South Whidbey Parks & Recreation
5495 Maxwelton Rd, Langley, WA 98260

South Whidbey Aquatic Recreation Center

Project Manual

August 8, 2025
Conformed

Prepared by:
ARC Architects
119 S Main St, STE 200
Seattle, WA 98104

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SECTION 00 00 10 - INVITATION TO BID

Notice is hereby given that the **South Whidbey Parks and Recreation District** will receive sealed bids at **5476 Maxwelton Rd. #C2, Langley WA 98260**, at or before 1:00 pm local time on July 15, 2025, for the project hereinafter referred to as:

South Whidbey Aquatic Recreation Center
(SWARC)

Anticipated $19,000,000 to $20,000,000 (plus WSST) Aquatic Recreation Center including but is not limited to site clearing and grading, building and natatorium construction, and LOSS and water systems on south Whidbey Island. See Builders Exchange for plans and details.

At said time all bids will be opened and publicly read aloud. Each bid shall be accompanied by a bid proposal deposit in the form of a cashier's check, certified check, or a bond issued on a form acceptable to your surety made payable to the **South Whidbey Parks and Recreation District** for a sum of not less than five percent (5%) of the total bid amount. No bid shall be considered unless accompanied by such bid proposal deposit. Incomplete proposals and proposals received after the time stated above will not be considered. Faxed or emailed responses are not acceptable.

The work to be performed under these specifications consists of furnishing all labor, tools, materials, and equipment necessary for construction of the **South Whidbey Aquatic Recreation Center** and all related work, all in accordance with the Drawings, Specifications, Project Manual, and Addenda (if any)**.**

Free-of-charge access to project bid documents (plans, specifications, addenda, and Bidders List) is provided to Prime Bidders, Subcontractors, and Vendors by going to www.bxwa.com and clicking on "Posted Projects", "Public Works", "South Whidbey Parks & Recreation", and "Projects Bidding". This online plan room provides Bidders with fully usable online documents with the ability to: download, view, print, order full/partial plan sets from numerous reprographic sources, and a free online digitizer/take-off tool. It is recommended that Bidders "Register" to receive automatic e-mail notification of future addenda and to place themselves on the "Self-Registered Bidders List". Bidders that do not register will not be automatically notified of addenda and will need to periodically check the on-line plan room for addenda issued on this project. Contact Builders Exchange of Washington at (425) 258-1303 should you require assistance with access or registration.

Questions regarding this project shall be submitted in writing to Marc Bloom via email at mbloom@bloomprojects.com. Bidders shall submit questions no later than 5:00 pm local time on June 27, 2025. Answers to questions received by this deadline shall be posted in an addendum no later than July 8, 2025.

This project is subject to the apprenticeship requirements of RCW 39.04.320. Bidders may contact the Department of Labor & Industries, Apprenticeship Section, to obtain information on available apprenticeship programs.

This is a prevailing wage project.

The South Whidbey Parks and Recreation District requires all contractors, vendors, suppliers, and providers of services to comply with all applicable laws and regulations prohibiting discrimination. The District is an equal opportunity employer and encourages participation by minority, veteran, and women-owned businesses.

South Whidbey Parks and Recreation District reserves the right to reject any and all bids, and to waive any informalities in the bidding, and to make the award to the lowest, responsive, responsible bidder as best serves its interests.

No bids may be withdrawn within sixty (60) calendar days after the actual date of the bid opening.

Project Summary

The new South Whidbey Aquatics Recreation Center is designed to include a natatorium with one 6-lane lap pool, one 2-lane teaching pool along with lazy river amenity, spa and sauna. The facilities will include locker rooms, aquatic business and support spaces, fitness room, and two multi-purpose rooms. The grounds will include a parking lot with infrastructure for EV chargers, multiple outdoor seating spaces, and landscaped grounds.

The single-story building will be approximately 24,027 square feet. The surface parking lot will include approximately 79 parking spaces, EV chargers to serve four EVs, and infrastructure for ten additional future EV chargers.

A LOSS (Large Onsite Sewage System) is included in the scope. The location is remote from the new building site and will require trenching. Electrical service will be from an existing panel located in the Park's adjacent Maintenance Building.

A new 100,000-gallon water tank is included in the scope. The location is remote from the new building site; however, it is adjacent to an existing water tank. This system will make use of the existing well. Upgrades will be required in the Pump House as well as the Water Treatment Building.

IT, AV and Security are included in the scope of work by the General Contractor.

The project is anticipated to be awarded soon after the bid date and construction is anticipated to take approximately 18 months.

Dated this 2nd day of June, 2025

END OF SECTION 00 00 10

SECTION 00 10 10 - BIDDER'S CHECKLIST FORM

The omission or deletion of any bid item may be considered non-responsive and may be cause for the rejection of the bid.

1. ☐ Has a bid bond or certified check been enclosed with your bid? Is the amount of the bid guaranty at least 5 percent of the total amount of the bid?

2. ☐ Has the proposal been properly completed and signed? Do written amounts on the proposal agree with the amounts shown in the figures?

3. ☐ Have you bid on all items including, if applicable, all alternates?

   Alternate #1

   Alternate #2

4. ☐ Have you acknowledged all addenda, if any, in the Bid Form (Section 00 41 00)

   Addenda #1

   Addenda #2

5. ☐ Do not submit any of the forms still attached to the Project Manual. Remove or copy the forms and submit in the sealed envelope as directed.

6. ☐ Are you and all your subcontractors familiar with the schedule of value requirements including but not limited to the required retention of five percent (5%) of the bid for work between substantial completion and final completion?

7. ☐ Have you reviewed the Bidder's Qualifications and Bidder Responsibility Criteria forms and understand these obligations if you are selected as the apparent low bidder?

8. The following items must be completed and included with the Bid Form within the sealed envelope:

   A. ☒ **Bid Form (00 41 00)** The bid price must be shown in the space provided. Show price in both words and figures. The bid form must be completed in full, signed, and dated.

   B. ☒ **Bidder's Qualifications Form (00 10 20):** This form must be filled in and signed. The owner reserves the right to check all statements and to judge the adequacy of the bidder's qualifications.

   C. ☒ **Bid Bond Security Form (00 43 30):** A surety issued bid bond must be executed by the bidder and its surety company. The amount of the bid bond shall be not less than five (5%) of the total bid and may be shown in dollars or on a percentage basis. A cashier's check payable to (South Whidbey Parks and Recreation District) and issued for an amount not less than 5% of the total bid may be submitted in lieu of a bid bond.

   D. ☒ **Non-Collusion, Bidder Responsibility, and Minimum Wage Certification Form (00 15 40):** This form must be filled in, signed, and notarized.

   E. ☒ **Subcontractor Listing (00 44 00):** This form must be filled in and signed if the estimated bid amount exceeds $1,000,000 as required by RCW 39.30.060. (One hour after published bid submittal time for HVAC and electrical subcontractors; 48 hours after published bid submittal time for structural steel installation and rebar installation subcontractors.)

9. The following forms are to be executed after the contract is awarded:

   A. ☐ **AGREEMENT FORM (00 52 00):** This agreement to be executed by the successful bidder.

   B. ☐ **PERFORMANCE BOND (00 61 40):** One hundred percent of the Contract Price to be executed by the successful bidder and his surety company. The surety on such bonds shall be

a duly authorized surety company satisfactory to the Owner.

C. ☐ **PAYMENT BOND (00 61 41):** One hundred percent of the Contract Price to be executed by the successful bidder and his surety company. The surety on such bonds shall be a duly authorized surety company satisfactory to the Owner.

D. ☐ **RETAINAGE INVESTMENT OPTION (00 45 80):** This agreement to be executed by the successful bidder.

J. ☐ **CERTIFICATES OF INSURANCE (00 60 00):** To be executed by the successful bidder and by an acceptable insurance company. South Whidbey Parks and Recreation District and Bloom Projects, LLC must be named as an additional insured.

K. ☐ **CONTRACTOR'S CERTIFICATION (00 83 00):** Concerning Labor Standards and Prevailing Wage Requirements. Submit Statement of Intent to Pay Prevailing Wages.

10. ☐ Special Note: Prior to commencing work, the Contractor and all subcontractors must have applied and paid for a City Business License, if required. Contractor to verify local licensing requirements, as the Park is located in unincorporated Island County.

END OF SECTION 00 10 10

SECTION 00 10 20 - BIDDER'S QUALIFICATIONS

Each bidder submitting a proposal for this Project shall submit, as part of its bid, the following information:

1. Name of Bidder:
_____

2. Business Address:
_____

3. Telephone Number:
_____

4. IRS Federal Employer's Identification Number:
_____

5. Current State Unified Business Identification Number: _____

6. Number of years engaged in the contraction business under the present firm:
_____

7. Total value of contracts in force: _____

8. To qualify for bidding for this project the General Contractor as the legal entity bidding the project:
    a. Shall have constructed one (1) aquatics or comparably complex project with construction value of $20M (in 2025 dollars) within the past 12 years;
    b. Shall have constructed a minimum of one (1) Large On-site Sewage System (LOSS) and one (1) on-site water system of similar size and complexity within the past five (5) years; and
    c. Shall have a superintendent with a minimum of 15 years of experience in new construction projects.

9. List below project(s) which meet items outlined in item 8 above:

    Project Name:
_____
    Project Value:
_____

    Reference/Contact Name: _____

    Reference Phone Number: _____

    Reference e-mail: _____

    Description of Scope of Work:_____

    Scheduled, Substantial Completion, and Final Completion Dates: _____

    Original vs actual/final contract amount: _____

    Project Name:
_____
    Project Value:
_____

Reference/Contact Name: _____

Reference Phone Number: _____

Reference e-mail: _____

Description of Scope of Work:_____

Scheduled, Substantial Completion, and Final Completion Dates: _____

Original vs actual/final contract amount: _____

Project Name:
_____

Project Value:
_____

Reference/Contact Name: _____

Reference Phone Number: _____

Reference e-mail: _____

Description of Scope of Work:_____

Scheduled, Substantial Completion, and Final Completion Dates: _____

Original vs actual/final contract amount: _____

10. Washington State Contractor Registration Number: _____
11. Bonding Reference:
_____
12. Bonding Capacity: _____

Bidder:

By: _____ Title: _____ Date: _____

This Form Must Be Submitted with the Bid.

END OF SECTION 00 10 20

SECTION 00 15 30 - BIDDER'S RESPONSIBILITY CRITERIA

Low Responsible Bidder

It is the intent of South Whidbey Parks and Recreation District, Owner, to award a contract to the low responsible bidder. The Bidder must meet the minimum project bidding requirements outlined in Section 00 10 20 Bidder's Qualifications Section, Item 8.

In addition, the Owner shall consider an overall accounting of the items listed below which the bidder must meet. The bidder must submit the Non-Collusion, Bidder Responsibility, and Minimum Wage Certification Form (00 15 40) demonstrating that they meet the following criteria:

Bid Procedures and Conditions

Qualifications of Bidder

A. Bidders must meet the minimum qualifications of RCW 39.04.350, as amended:
"Before award of a public works contract, a bidder must meet the following responsibility criteria to be considered a responsible bidder and qualified to be awarded a public works project. The bidder must:
   (a) At the time of bid submittal, have a certificate of registration in compliance with chapter 18.27 RCW;
   (b) Have a current State unified business identifier number;
   (c) If applicable, have industrial insurance coverage for the bidder's employees working in Washington as required in Title 51 RCW; an employment security department number as required in Title 50 RCW; and a State excise tax registration number as required in Title 82 RCW; and
   (d) Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3).
   (e) If bidding on a public works project subject to the apprenticeship utilization requirements in RCW 39.04.320, not have been found out of compliance by the Washington state apprenticeship and training council for working apprentices out of ratio, without appropriate supervision, or outside their approved work processes as outlined in their standards of apprenticeship under chapter 49.04 RCW for the one-year period immediately preceding the date of the bid solicitation; and
   (f) Have received training on the requirements related to public works and prevailing wage under this chapter and chapter 39.12 RCW. The bidder must designate a person or persons to be trained on these requirements. The training must be provided by the department of labor and industries or by a training provider whose curriculum is approved by the department. The department, in consultation with the prevailing wage advisory committee, must determine the length of the training. Bidders that have completed three or more public works projects and have had a valid business license in Washington for three or more years are exempt from this subsection. The department of labor and industries must keep records of entities that have satisfied the training requirement or are exempt and make the records available on its web site. Responsible parties may rely on the records made available by the department regarding satisfaction of the training requirement or exemption; and

B. In addition to the bidder responsibility criteria above, the bidder must also meet the following relevant supplemental bidder responsibility criteria applicable to the project:

   a. The Bidder shall not currently be debarred or suspended by the Federal government. The Bidder shall not be listed as a current debarred or suspended bidder on the U.S.

General Services Administration's "Excluded Parties List System" website. Bidder debarment or suspension status may be verified through this website: http://www.sam.gov/. The Owner may also use other sources of information that may be available to otherwise determine whether the Bidder is following these supplemental criteria.

b. The Bidder shall not owe delinquent taxes to the Washington State Department of Revenue. The Bidder shall not be listed on the Washington State Department of Revenue's "Delinquent Taxpayer List." The Owner may also use other sources of information that may be available to otherwise determine whether the Bidder is following these supplemental criteria.

c. The Bidder shall not have been convicted of a crime involving bidding on a public works contract within five (5) years prior to the bid submittal deadline. The Bidder shall provide a duly executed sworn statement (on the included form, or on a form otherwise determined to be acceptable by the Owner), that the Bidder has not been convicted of a crime involving bidding on a public works contract. The Owner may also use independent sources of information that may be available to otherwise determine whether the Bidder is following these supplemental.

d. The Bidder's standard subcontract form shall include the subcontractor responsibility language required by RCW 39.06.020, and the Bidder shall have an established written procedure which the Bidder uses to validate the responsibility of each of its subcontractors. The Bidder's subcontract form shall also include a requirement that each of its subcontractors shall have and document a similar procedure to determine whether the sub-tier subcontractors with whom it contracts are also "responsible" contractors as defined per RCW 39.06.020. The Owner may also use independent sources of information that may be available to otherwise determine whether the Bidder is following these supplemental criteria.

e. The Bidder shall not have a record of prevailing wage complaints filed against the Bidder within five (5) years prior to the bid submittal date that demonstrates a pattern of failing to pay workers prevailing wages, unless there are extenuating circumstances that are acceptable to the Owner. The Owner may also use independent sources of information that may be available to otherwise determine whether the Bidder is following these supplemental criteria.

f. The Bidder shall not have had any public works contract terminated for cause by a government agency during the five (5) year period immediately preceding the bid submittal deadline for the project unless there are extenuating circumstances acceptable to the Owner. The Bidder shall provide a duly executed sworn statement (on the included form, or in a form otherwise determined to be acceptable by the Owner), that the Bidder has not had any public works contract terminated for cause by a government agency during the five (5) year period immediately preceding the bid submittal deadline for the project. The Owner may also use independent sources of information that may be available to otherwise determine whether the Bidder is following these supplemental criteria.

g. The Bidder shall not have a record of excessive claims filed against the retainage or payment bonds for public works projects within three (3) years of the bid submittal date, that demonstrate a lack of effective management by the Bidder of making timely and appropriate payments to its subcontractors, suppliers, and workers, unless there are extenuating circumstances which are acceptable to the Owner. The Owner may also use independent sources of information that may be available to otherwise determine whether the Bidder is following these supplemental criteria.

h. Within two (2) years prior to the bid submittal date the Bidder shall not have had a project construction site shut down due to a safety violation (i.e., WISHA / OSHA written citations) from the Washington State Department Labor & Industries or analogous agency with jurisdiction in the location the work was performed, regardless of whether such willful and/or serious safety violations have been abated or not. The Bidder shall maintain compliance with all safety and health requirements (i.e., WISHA / OSHA) from the Washington State Department Labor & Industries (or analogous agency with jurisdiction in the location the work is performed). The Owner may verify such information provided with the Washington State Department Labor & Industries or analogous agency with jurisdiction in the location the work was performed. The Owner may also use other sources of information that may be available to otherwise determine whether the Bidder is following these supplemental criteria.

C. If a Bidder fails to supply the required bidder responsibility documentation, information, or materials, then Bidder may be determined by the Owner to be non-responsive, and the bid may be rejected on this basis. If the Owner determines the apparent successful bidder does not meet the bidder responsibility criteria above and is therefore not a responsible bidder, the Owner shall notify the bidder in writing with the reasons for its determination. If the bidder disagrees with this determination, it may appeal the determination within twenty-four (24) hours of receipt of the Owner's determination by presenting additional written information to the Owner. The Owner will consider the additional information before issuing its final determination. If the Owner's final determination affirms that the bidder is not responsible, the Owner will not execute a contract with any other bidder until two (2) business days after the bidder determined to be not responsible has received the final determination. Please note that the above-described information, materials, and documentation requested by the Owner for purposes of determining Bidder responsibility is not necessarily exclusive, and the Owner expressly reserves the right to request additional information, materials, and documentation as may be determined to be necessary or desirable by the Owner to evaluate and determine Bidder's compliance with the above-described bidder responsibility criteria. At all times, the Owner may also use other sources of information that may be available to otherwise determine whether the Bidder is following the forgoing bidder responsibility criteria.

END OF SECTION 00 15 30

SECTION 00 15 40 – NON-COLLUSION, BIDDER RESPONSIBILITY, AND MINIMUM WAGE CERTIFICATION FORM

In accordance with the Contract Documents and Instructions to Bidder, the Bidder must provide the following sworn statement and certification:

Name of Bidder: _____

Address: _____

Telephone No._____

E-Mail: _____

I, _____, the undersigned declarant, as the duly authorized representative on behalf of _____ _____ (herein the "Bidder") hereby make this declaration on the basis of facts within the scope of my firsthand knowledge and authority to which I am competent to testify:

1. I hereby certify, swear and affirm under penalty of perjury, that the Bidder, as of the date of this declaration (below) meets all of the minimum bidder responsibility qualifications of RCW 39.04.250, as amended.

2. I hereby certify, swear and affirm under penalty of perjury, that the Bidder, as of the date of this declaration (below) meets all of the minimum project bidding requirements outlined in the Bidder's Qualifications Form (Section 00 10 20) Item 8, if any.

3. I hereby certify, swear and affirm under penalty of perjury, that the Bidder, as of the date of this declaration (below) meets all of the supplemental bidder responsibility criteria as set forth in the Bidder's Responsibility Criteria (Section 00 15 30), Section B.

4. I hereby certify, swear and affirm under penalty of perjury, that the undersigned is the person that submitted the bid herewith, that such bid is genuine and not a sham or collusive, or made in the interest of any person not therein named; and he/she further says that said Bidder has not directly or indirectly induced or solicited any Bidder on the above work or supplies to put in a sham bid, or any other person or corporation to refrain from bidding; and that said Bidder has not in any manner sought by collusion to secure to himself or to any other person an advantage over any other Bidder or Bidders.

5. I hereby certify, swear and affirm under penalty of perjury, that in connection with the performance of the work of this Project, if awarded, I will pay each classification of laborer, workman, or mechanic employed in the performance of such work; not less than the prevailing rate of wage or not less than the minimum rate of wages as specified in the Contract Documents.

Signed under penalty of perjury under the laws of the State of Washington this ___ day of _____ 2025, at _____, Washington.

Name of Bidder/Contractor: _____

Signature: _____
Printed Name: _____
Title: _____

STATE OF WASHINGTON
} ss.
COUNTY OF _____

I certify that I know or have satisfactory evidence that _____ is the person who appeared before me, and said person acknowledged that they signed this instrument, on oath stated that they were duly authorized execute the instrument and acknowledged it as the _____of _____, 2025 to be the free and voluntary act of such party for the uses and purposes herein mentioned.

DATED this _____ day of _____, 2025.

(SEAL)

_____
Notary Public
Print name:_____
Residing at _____

My commission expires _____

END OF SECTION 00 15 40

SECTION 00 20 00 – INSTRUCTION TO BIDDERS

A. PRE-BID SITE VISIT

General Contractors will be required to visit the site on one of two dates – 9:00 am Wednesday June 11, 2025 or 9:00am Wednesday June 18, 2025, local time. It is critical that any respective general contractors visit the site prior to submitting a bid. A sign-in sheet(s) will be provided by the Owner and included by Addendum. It is mutually agreed that the submission of a bid shall be considered prima facie evidence that the bidder has made such examination and is satisfied as to the conditions to be encountered in performing the work, and as to the requirements of the plans, specifications, and provisions in the Contract Documents.

B. ADDENDA AND INTERPRETATIONS

Project Contact: Questions regarding this project shall be submitted in writing to Marc Bloom at mbloom@bloomprojects.com via e-mail with the subject line of “South Whidbey Aquatic Recreation Center: Bid Question”. Questions received via phone or any other method other than e-mail with the appropriate subject line will not be accepted.

Deadline for Questions and Substitution Request: Bidders requiring clarification or interpretation of the Project Manual, Drawings, and/or any Addenda shall provide a written request to the Owner no later than 5:00 P.M., local time, on June 23, 2025.

All such interpretations and any supplemental instructions will be in the form of written addenda to the Project Manual and Drawings. Any interpretation, correction or change of the Project Manual, Drawings, and any Addenda made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections, and changes.

Failure of any bidder to receive Addenda shall not relieve any such bidder from any obligation under its bid as submitted. All Addenda so issued shall become part of the Contract Documents. Bidders shall acknowledge receipt of all Addenda, if any, on the Bid Form. Failure to do so may result in the bid being declared non-responsive.

No oral statements by Owner, Architect, or other representative of the Owner shall, in any way, modify the Project Manual, Drawings, and any Addenda whether made before or after letting the Contract.

C. PRODUCT SUBSTITUTIONS:

1. Substitutions: Bids must be based upon the specific articles and materials named in the Project Manual, Drawings, and any Addenda. When the term “or approved equal” or similar is used, any item or material not specifically named by manufacturer’s name shall be subject to Owner’s approval. Substitutions may be made only under the following conditions:
    a. Prior to Bid Opening: Subject to the deadline for written requests noted in item B above, prime bidders may e-mail written requests for approval of articles or materials, accompanied by complete descriptions, technical data, record of performance, samples to the Project Contact, and any other additional information as the Owner may reasonably request. Approval or rejection of the proposed substitutions will be made by addenda issued to all bidders.
    b. After Award of Contract: As allowed per this Project Manual and the Contract Documents.

The Owner's decision of approval or disapproval of a requested substitution shall be final. The cost of any redesign caused by a substitutional shall be borne by the Contractor.

D. BID FORM (Section 00 41 00)

Bids must be submitted on and according to the Bid Form. Fill in all spaces, where required. The bid price for the work as specified in the Project Manual, Drawings, any Addenda and any Alternates must be the total price to cover all items required by the contract including all labor, materials, services, permits, and incidentals necessary to complete this project.

E. SUBMISSION OF BID

Enclose bid and bid bond in opaque sealed envelope, as indicated in the Invitation to Bid. Bids shall be delivered in person on or before 1:00pm July 15, 2025 to the South Whidbey Parks & Recreation District office at 5476 Maxwelton Rd. #C2, Langley, WA 98260. All submitted bid materials shall be provided in 8 ½" x 11" format. Bidders who fail to submit sealed bids may be deemed non-responsive. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligation of the contract and to complete the work contemplated therein. Conditional bids will not be accepted. No proposal or bid may be changed after the time set for receiving bids.

F. BID BOND

Each bidder agrees to furnish a certified check, bank cashier's check, or bid bond in the amount equal to five percent (5%) of the total base bid plus bid alternates (if applicable) within its bid proposal. Such checks and/or bonds shall be made payable to the South Whidbey Parks and Recreation District. Failure to provide this bid security when required shall render the bid non-responsive. The Owner will retain the bid security of the three lowest bidders until the award of the contract or for a period of sixty (60) days, whichever is the shorter time. Bid bonds of all unsuccessful bidders will be returned as soon as feasible after the bid opening.

G. WITHDRAWAL OF BIDS

Any Bidder may withdraw its bid either personally or by written request at any time prior to the hour set for the bid opening. All requests for withdrawals shall not reveal the amount of the bid. Withdrawn bids may be resubmitted up to the time designated for the receipt of bids. No bid may be withdrawn or modified after the time set for opening unless and until the award of the contract is delayed for period exceeding sixty (60) days.

H. TIME OF COMPLETION AND LIQUIDATED DAMAGES

The Owner can issue Notice to Proceed at any time after contract execution. Bidder must agree to commence work within twenty (20) calendar days of receipt of the Notice to Proceed, and Substantially Complete the Work within eighteen (18) consecutive calendar months of the date of the Notice to Proceed, and to Finally Complete the Work within thirty (30) consecutive calendar days thereafter. Bidder must agree to pay as liquidated damages the sum of $500 for each consecutive calendar day that Substantial Completion is delayed and the sum of $500 thereafter for each consecutive calendar day that Final Completion is delayed. Liquidated damages have been established based on the estimated cost that will be incurred by the Owner in the event the Contractor fails to complete the Work in the time stipulated.

I. SECURITY FOR FAITHFUL PERFORMANCE

Simultaneously with its delivery of the executed contract, the Contractor shall furnish a surety bond or bonds as security for faithful performance of the Contract and for payment of all persons performing labor under the Contract and furnishing material or services in connection with the Contract as described in the Contract Documents. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the Owner, registered in the State of Washington, Insurance Commissioner's Office. The Contractor shall provide the Owner with the name of the Bonding Agent, if any, and the address of same.

J. INSURANCE

The Contractor shall obtain such construction insurance as is set forth in Section 00 60 00 "Bonds and Certificates."

K. QUALIFICATIONS OF BIDDERS

Bidder must meet all criteria set forth in the Bidder's Qualifications (Section 00 10 20), Item 8 and the Bidder's responsibility Criteria in Section 00 15 30. The Owner may make such investigations as necessary to determine the ability of a Bidder to perform the work, and the Bidder shall furnish all such information and data as may be requested prior to bidding. The Owner reserves the right to reject any bid if the evidence submitted by, or if investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to perform the obligations of the Contract and to complete the work contemplated therein.

L. LAWS AND REGULATIONS

The bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they shall be deemed to be included in the Contract the same as though written out in full therein. Bidders are advised that if successful, they will be required to meet all applicable federal, state, and local laws pertaining to permits, licenses, fees and taxes, as well as laws pertaining to employment and wages. Bidders are responsible for determining the extent and applicability of such laws.

M. AWARD OF THE CONTRACT/REJECTION OF BIDS

1. The Contract will be awarded to the responsible bidder submitting the lowest proposal complying with the condition of the Invitation for Bid and these Contract Documents provided the bid is reasonable and in the best interest of the Owner. Items in this bid, approved for contract by the Owner, shall be awarded by the Owner.
2. The Owner reserves the right to select, or not select, all or individual alternate bid items whichever is determined to be in their best interest. The Owner has the right to determine the low bidder on the basis of the sum of the Base Bid and Alternates accepted.
3. The Owner reserves the right to reject any and all bids and to waive any informality in bids received whenever such rejection or waiver is in the interest of the Owner.
4. The bidder to whom the award is made will be notified at the earliest practicable date.

N. DISQUALIFICATION OF BIDDERS

Any one or more of the following causes may be considered sufficient for the disqualification of a Bidder and the rejection of its bid or bids:

a. Evidence of collusion among Bidders.
b. Lack of expertise as shown by past work and judged from the standpoint of workmanship and performance history.

c. Uncompleted work under other contracts which, in the judgment of the Owner, might hinder or prevent the prompt completion of additional work if awarded.
d. Being in arrears on existing contracts, in litigation with an Owner, or having defaulted on a previous contract.
e. Contractor's naming oneself as a Subcontractor for which they have no expertise and working knowledge directly within the firm.
f. Contractor's inability to meet the Bidder's Qualifications (Section 00 10 20) outlined in item 8.
g. Contractor's inability to meet the Bidder's Responsibility Criteria outlined in Section 00 15 30.
h. Failure to comply with any requirements of the Invitation for Bid or Instructions to Bidders.

END OF SECTION 00 20 00

SECTION 00 30 00 - INFORMATION AVAILABLE TO BIDDERS

The following documents are provided for the Contractor's reference. These documents are part of the Contract Documents and influence the bid proposal.

- Construction documents dated XX/XX/XX
- Specifications dated XX/XX/XX
- Soils report dated XX/XX/XX
- Water report dated XX/XX/XX
- Ferry info dated XX/XX/XX.

Contractor to verify all information is accurate.

END OF SECTION 00 30 00

SECTION 00 41 00 - BID FORM

Bidder's Firm Name: _____ Date: _____

Address: _____

Phone No.: _____

TO: South Whidbey Parks and Recreation District
Project: South Whidbey Aquatic Recreation Center
Mailing Address: 5495 Maxwelton Rd, Langley WA 98260
Physical Address: 5476 Maxwelton Rd, Room C2, Langley, WA 98260
Project Number: SWAC

GENERAL PROPOSAL

The undersigned, hereinafter called the Bidder, declares that the only persons or parties interested in this proposal are those named herein; that this proposal is in all respects fair and without fraud; that it is made without collusion with any official or employee of the Owner; and that the proposal is made without any connection or collusion with any person making another proposal on this contract.

The Bidder further declares that they have carefully examined the Contract Documents for the construction of the project; that they have personally inspected the site, if made available; that they have satisfied themselves as to the quantities involved, including materials and equipment and conditions of work involved, including the fact that the description of the quantities of work materials, as included herein, is brief and is intended only to indicate the general nature of the work and to identify the said quantities with the detailed requirements of the contract documents; and that this proposal is made according to the provisions and under the terms of the contract documents, which documents are hereby made a part of this proposal.

The Bidder further agrees that they have exercised their own judgment regarding the interpretation of subsurface information and have utilized all data which they believe is pertinent from the Architect, Owner, and other sources in arriving at their conclusions.

The Bidder agrees to hold their bid proposal open for sixty (60) calendar days after the actual date of bid opening and to accept the provisions of the Instructions to Bidders regarding disposition of bid bond.

The Bidder agrees that if this bid is accepted through Award of Contract, it will, within ten (10) calendar days after notification of acceptance, execute the contract with the Owner in the form of contract included in the contract documents, and will, at the time of execution of the Contract, deliver to the Owner the Performance and Payment Bonds and all Certificates of Insurance required therein, and will, to the extent of its proposals, furnish all machinery, tools, apparatus, and other means of construction and do the work in the manner, in the time, and according to the requirements as specified in the contract documents and required by the Architect or other project manager designated thereunder.

TIME OF COMPLETION:

The Owner can issue Notice to Proceed at any time after contract execution. The undersigned understands and agrees that Substantial Completion of the work shall be no later than eighteen (18) consecutive calendar months after the Notice to Proceed, and that Final Completion of the work shall be no later than thirty (30) consecutive calendar days after Substantial Completion.

PERMITS, FEES AND INSPECTIONS:

The Owner will apply for and pay for the general building permit. The contractor is required to meet the requirements and conditions of any owner-procured permits, to post the permits, and for the scheduling

and inspections related to these permits. The Contractor is responsible for all other required permits for the project in their entirety: including, but not limited to the plumbing, electrical, mechanical, right-of-way and utility permits. The Contractor will need to comply with requirements of working in the right of way, such as, but not limited to, having an approved traffic control plan. Utility connection fees, if incurred by the contractor to facilitate the work, shall be paid back to the Contractor by the Owner within the contact document change order process without markup of any kind. All other State of Washington or local agency permits and requirements are the financial and administrative responsibility of the Contractor at no cost to the Owner.

BASE BID:

The Bidder further proposes to accept as full payment for the work proposed herein the amounts computed under the provisions of the Contract Documents and based upon the bid price for fully completed work as included in the proposal and the Bid Price represents a true measure of the labor, equipment, and materials required to perform and complete the work, including all allowances for overhead and profit for each type of work called for in these Contract Documents, as well as all use taxes, overhead, profit, bond premiums, insurance premiums and all other miscellaneous and incidental expenses. The amounts shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.

The undersigned bids for complete construction of the Project as follows:

For the **Total for Base Bid,** which does not include Washington State sales tax, the sum of:

_____ DOLLARS
(Please print dollar amount in words in space above.)

$_____
(Please write dollar figure in numerals in space above.)

ALTERNATE BIDS

Alternate #1: per section 01 23 00. Bidder shall provide the differential amount to the Total Base Bid. Deductive amounts shall be shown enclosed in parentheses [ex: ($1,000)]. The bidder must bid on Alternate #1.

The undersigned bids for complete construction of Alternate #1 for a differential amount to the Total for Base Bid, which does not include Washington State sales tax, the sum of:

_____ DOLLARS
(Please print dollar amount in words in space above.)

$_____
(Please write dollar figure in numerals in space above.)

Alternate #2 per section 01 23 00. Bidder shall provide the differential amount to the Total Base Bid. Deductive amounts shall be shown enclosed in parentheses [ex: ($1,000)]. The bidder must bid on Alternate #2.

The undersigned bids for complete construction of Alternate #2 for a differential amount to the Total for Base Bid, which does not include Washington State sales tax, the sum of:

_____ DOLLARS
(Please print dollar amount in words in space above.)

$_____
(Please write dollar figure in numerals in space above.)

Alternate #3 per section 01 23 00. Bidder shall provide the differential amount to the Total Base Bid. Deductive amounts shall be shown enclosed in parentheses [ex: ($1,000)]. The bidder must bid on Alternate #3.

The undersigned bids for complete construction of Alternate #3 for a differential amount to the Total for Base Bid, which does not include Washington State sales tax, the sum of:

_____ DOLLARS
(Please print dollar amount in words in space above.)

$_____
(Please write dollar figure in numerals in space above.)

Alternate #4 per section 01 23 00. Bidder shall provide the differential amount to the Total Base Bid. Deductive amounts shall be shown enclosed in parentheses [ex: ($1,000)]. The bidder must bid on Alternate #4.

The undersigned bids for complete construction of Alternate #4 for a differential amount to the Total for Base Bid, which does not include Washington State sales tax, the sum of:

_____ DOLLARS
(Please print dollar amount in words in space above.)

$_____
(Please write dollar figure in numerals in space above.)

Alternate #5 per section 01 23 00. Bidder shall provide the differential amount to the Total Base Bid. Deductive amounts shall be shown enclosed in parentheses [ex: ($1,000)]. The bidder must bid on Alternate #5.

The undersigned bids for complete construction of Alternate #5 for a differential amount to the Total for Base Bid, which does not include Washington State sales tax, the sum of:

_____ DOLLARS
(Please print dollar amount in words in space above.)

$_____
(Please write dollar figure in numerals in space above.)

Alternate #6a and #6b per section 01 23 00. Bidder shall provide the differential amount to the Total Base Bid. Deductive amounts shall be shown enclosed in parentheses [ex: ($1,000)]. The bidder must bid on Alternates #6a and #6b.

The undersigned bids for complete construction of Alternate #6 for a differential amount to the Total for Base Bid, which does not include Washington State sales tax, the sum of:

_____ DOLLARS
(Please print dollar amount in words in space above for #6a.)

$_____
(Please write dollar figure in numerals in space above for #6a.)

_____ DOLLARS
(Please print dollar amount in words in space above for #6b.)

$_____
(Please write dollar figure in numerals in space above for #6b.)

Alternate #7 per section 01 23 00. Bidder shall provide the differential amount to the Total Base Bid. Deductive amounts shall be shown enclosed in parentheses [ex: ($1,000)]. The bidder must bid on

Alternate #7.

The undersigned bids for complete construction of Alternate #7 for a differential amount to the Total for Base Bid, which does not include Washington State sales tax, the sum of:

_____ DOLLARS
(Please print dollar amount in words in space above.)

$_____
(Please write dollar figure in numerals in space above.)

ADDENDA

Receipt of the following Addenda is hereby acknowledged.

Addendum No. _____ dated _____
Addendum No. _____ dated _____
Addendum No. _____ dated _____
Addendum No. _____ dated _____
Addendum No. _____ dated _____

BID REVIEW MEETING:

The Undersigned agrees that if they are the successful bidder, they will be available for a bid review meeting with the Architect and the Owner at the Owner's office, at a time to be agreed upon.

Within the three-year period immediately preceding the date of the bid solicitation for this Project, bidder has not been determined by a final and binding citation and notice of assessment issued by the department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, any provision of chapter 49.46, 49.48, or 49.52 RCW.

I certify (or declare) under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct:

_____
CONTRACTOR (Firm Name)

_____ _____
By (Signature) Printed Name/Title of Signatory

_____
(Indicate whether Contractor is Partnership)

_____ _____
Washington State Contractor's Registration Number
Contractor's Industrial Insurance Account Number

_____ _____
Contractor's Address: Telephone Number

BID FORM TO BE SUBMITTED IN A SEALED ENVELOPE

END OF SECTION 00 41 00

SECTINON 00 43 30 - BID BOND SECURITY FORM

DEPOSIT

Herewith find deposit in the form of a cashier's check or certified check in the amount of $_____which amount is not less than five percent (5%) of the total bid.

SIGN HERE_____

BID BOND

KNOW ALL INDIVIDUALS BY THESE PRESENTS:

That we, _____, as Principal, and _____, as Surety, are held and firmly bound unto the Owner, as Obligee, in the penal sum of _____ _____ dollars, for the payment of which the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by these presents.

The condition of this obligation is such that if the Obligee shall make any award to the Principal for

_____ _____
Project Name Project Number

according to the terms of the proposal or bid made by the Principal therefor, and the Principal shall duly make and enter into a contract with the Obligee in accordance with the terms of said proposal or bid and award and shall give bond for faithful performance thereof, with Surety or Sureties approved by the Obligee; or if the Principal shall, in case of failure to do so, pay and forfeit to the Obligee the penal amount of the deposit specified in the call for bids, then this obligation shall be null and void; otherwise it shall be and remain in full force and effect and the Surety shall forthwith pay and forfeit to the Obligee, as penalty and liquidated damages, the amount of this bond.

SIGNED, SEALED AND DATED THIS _____ DAY OF _____, 20_____.

PRINCIPAL: SURETY:

_____ _____

Note: If a Bid Bond is provided, it must be accompanied by a power of attorney which appoints the Surety's true and lawful attorney-in-fact to make, execute, seal and deliver this Bid Bond.

END OF SECTION 00 43 30

SECTION 00 44 00 - SUBCONTRACTOR IDENTIFICATION FORM*

*FOR CONTRACTS ESTIMATED TO BE IN EXCESS OF ONE MILLION DOLLARS ($1,000,000.00)

RCW 39.30.060 requires the following:

> "(1) Every invitation to bid on a prime contract that is expected to cost one million dollars or more for the construction, alteration, or repair of any public building or public work of the state or a state agency or municipality as defined under RCW 39.04.010 … shall require each prime contract bidder to submit:
>
> (a) **Within one hour after the published bid submittal time**, the names of the subcontractors with whom the bidder, if awarded the contract, will subcontract for performance of the work of: HVAC (heating, ventilation, and air conditioning); plumbing as described in chapter 18.106 RCW; and electrical as described in chapter 19.28 RCW, or to name itself for the work; or
>
> (b) **Within forty-eight hours after the published bid submittal time**, the names of the subcontractors with whom the bidder, if awarded the contract, will subcontract for performance of the work of structural steel installation, rebar installation, pool installation, LOSS installation, and water tank/system installation.
>
> The prime contract bidder shall not list more than one subcontractor for each category of work identified, unless subcontractors vary with bid alternates, in which case the prime contract bidder must indicate which subcontractor will be used for which alternate. Failure of the prime contract bidder to submit as part of the bid the names of such subcontractors or to name itself to perform such work or the naming of two or more subcontractors to perform the same work shall render the prime contract bidder's bid non-responsive and, therefore, void."

To turn in this Subcontractor Identification form, please deliver to the same bid submittal location identified in the Invitation to Bid (section 00 00 10). The Owner will accept, and date/time stamp the form.

Each bidder shall submit a list of:

1. HVAC, plumbing, electrical, structural steel installation, rebar installation subcontractors, pool installation, LOSS installation, and water tank/system installation; and

2. The specific items of work those subcontractors will perform on the contract; and

3. The specific items of work that will be performed by the bidder on the contract relating to work described in RCW 39.30.060.

SUBCONTRACTOR IDENTIFICATION LIST

*REQUIRED ONLY IF ESTIMATE AMOUNT EXCEEDS $1,000,000 (*Reference RCW 39.30.060 RCW*).
If any of the following category(s) do not apply, note as not applicable (N/A).

Proposed Subcontractors and items of work to be performed:

Subcontractor Name: _____

HVAC Work to be Performed: _____

_____

_____

_____

Subcontractor Name: _____

Plumbing Work to be Performed: _____

_____

_____

_____

Subcontractor Name: _____

Electrical Work to be Performed: _____

_____

_____

_____

Subcontractor Name: _____

Structural Steel Installation Work to be Performed: _____

_____

_____

_____

Subcontractor Name: _____

Rebar Installation Work to be Performed: _____

_____

_____

_____

Subcontractor Name: _____

Pool Installation Work to be Performed: _____

_____

_____

_____

Subcontractor Name: _____

LOSS Installation Work to be Performed: _____

_____

_____

_____

Subcontractor Name: _____

Water tank/system Installation Work to be Performed: _____

_____

_____

_____

Work to be performed by Prime Contractor:

Work to be Performed: _____

_____

_____

_____

- make additional pages if necessary -

END OF SECTION 00 44 00

SECTION 00 45 80 - RETAINAGE INVESTMENT FORM

CONTRACTOR:

PROJECT NAME: South Whidbey Aquatic Recreation Center

DATE:

Pursuant to RCW 60.28.010, as amended, you may choose how your retainage under this contract will be held and invested. Please complete and sign this form indicating your preference. If you fail to do so, the Owner will hold your retainage as described in "Current Expense" option 1 below.

____1. Current Expense: The Owner will retain your money in its Current Expense Fund Account until thirty days following final acceptance of the improvement or work as completed. You will not receive interest earned on this money.

____2. Interest Bearing Account: The Owner will deposit retainage checks in an interest-bearing account in a bank, mutual savings bank, or savings and loan association, not subject to withdrawal until after the final acceptance of the improvement or work as completed or until agreed to by both parties. Interest on the account will be paid to you. Any fees incurred shall be the responsibility of the contractor.

____3. Escrow/Investments: The Owner will place the retainage checks in escrow with a bank or trust company until thirty days following the final acceptance of the improvement or work as completed. When the moneys reserved are to be placed in escrow, the Owner will issue a check representing the sum of the moneys reserve payable to the bank or trust company and you jointly. This check will be converted into bonds and securities chosen by you and approved by the Owner and these bonds and securities will be held in escrow. Interest on these bonds and securities will be paid to you as interest accrues.

The Contractor in choosing option (3) agrees to assume full responsibility to pay all costs which may accrue from escrow services, brokerage charges or both, and further agrees to assume all risks in connection with the investment of the retained percentages in securities.

____4. Bond-in-Lieu: With the consent of the Owner, the contractor may submit a bond for all or any portion of the amount of funds retained by the Owner in a form and from an authorized surety insurer acceptable to the Owner. Such bond and any proceeds therefrom shall be made subject to all claims and liens and in the same manner and priority as set forth for retained percentages in this chapter. The Owner shall release the bonded portion of the retained funds to the contractor within thirty days of accepting the bond from the contractor. Whenever an Owner accepts a bond in lieu of retained funds from a contractor, the contractor shall accept like bonds from any subcontractors or suppliers from which the contractor has retained funds. The contractor shall then release the funds retained from the subcontractor or supplier to the subcontractor or supplier within thirty days of accepting the bond from the subcontractor or supplier.

Retainage is normally released thirty (30) days after Final Acceptance of the work or following receipt of Labor and Industries/Department of Revenue clearance, whichever date is the later. Retainage on landscaping work may be retained longer, due to its seasonal nature. State law allows for limited early release in certain circumstances.

CONTRACTOR:

Signature: _____

Print or Type Name: _____

Title: _____

Date: _____

THIS FORM TO BE EXECUTED AFTER CONTRACT IS AWARDED

END OF SECTION 00 45 80

SECTION 00 52 00 - AGREEMENT FORM

Standard form of agreement for this project will be the enclosed and Owner-amended American Institute of Architects (AIA) A101®-2017.*

*AIA A101®–2017 is a standard form of agreement between owner and contractor for use where the basis of payment is a stipulated sum or fixed price. A101 adopts by reference, and is designed for use with the enclosed, AIA Document A201®–2017, General Conditions of the Contract for Construction.

END OF SECTION 00 52 00

AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

South Whidbey Parks and Recreation District
5495 Maxwelton Road
Langley, Washington 98260

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

South Whidbey Aquatic Recreation Center
The Architect:
(Name, legal status, address and other information)

ARC Architects
119 South Main Street, Suite 200
Seattle, Washington 98104

The Owner and Contractor agree as follows:

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and may be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

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ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be: a date set forth in a notice to proceed issued by the Owner.

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work by the following date: 2/9/27 or no later than 18 months from Start of Work.

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

Owner will assess, and the Contractor shall pay, liquidated damages in the amount of $500.00 per day for each calendar day beyond the Contract Time that Substantial Completion is not timely achieved, and an additional $500.00 per day for each calendar day beyond forty-five (45) days after Substantial Completion of the Work that Final Completion is not achieved. Moreover, and without limiting any right or remedy under this Agreement or under law, the Owner may take over and complete the Work, or any portion of the Work, at any time more than forty-five (45) days following Substantial Completion of the Work if Final Completion has not been achieved, and charge all direct and indirect costs of completion against the Contractor. Contractor and Owner agree that these liquidated damages are not penalties and are a reasonable estimation of actual damages to the Owner, as of the date of this Agreement, based on the inherent uncertainty and difficulty in calculating and quantifying damages caused by delays in construction.

§ 4.6 Other: Apprenticeship Utilization Goals

The Contract Sum will be increased by $1,000 if Contractor achieves the apprenticeship utilization goals stated in the Contract Documents, and the Contract Sum will be decreased by $1,000 if Contractor fails to achieve said apprenticeship utilization goals. The Owner is not in a position within existing resources to identify an expected cost value associated with meeting the apprenticeship utilization goals.

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the 25th day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the 30th day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than « » (« ») days after the Architect receives the Application for Payment.

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due: Five percent (5%)

§ 5.1.8 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- **.1** the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and
- **.2** a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than thirty (30) days after the issuance of the Architect's final Certificate for Payment, and satisfaction of all requirements listed in the revised A201 General Conditions. Retainage shall be paid in accordance with RCW 60.28.011.

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

One percent (1%) per month.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[« X »] Owner and Contractor shall participate, in good faith, in a meeting to resolve the Dispute.

[« X »] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:

Bloom Projects, LLC
117 East Louisa Street, Box 700
Seattle, WA 98102
mbloom@bloomprojects.com

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

« »
« »
« »
« »
« »
« »

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten (10) days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 Contractor shall purchase and maintain insurance and provide bonds as set forth in in the revised A201 General Conditions

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
.2 AIA Document A201™–2017, General Conditions of the Contract for Construction
.3 All Drawings

Number	Title	Date

.4 **All** Specifications

Section	Title	Date	Pages

.5 Addenda, if any:

Number	Date	Pages

.6 Other Exhibits, if any listed below:

.7 Other documents, if any, listed below:

- Request for Proposals
- Contractor's Proposal

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

SECTION 00 60 00 - BONDS AND CERTIFICATES

The bond and insurance requirements set forth on the following pages are required of the successful bidder.

1.01 GENERAL: In addition to the Bid Security, the Owner requires the Contractor to furnish the following bonds and insurance. The insurance coverage shall be maintained during the life of the Contract and for such other periods required by the Contract Documents.

1.02 EVIDENCE OF COMPLIANCE:

A. Performance Bond: Submitted at time of execution of the Contract and attached thereto. The bond shall cover the faithful performance of the obligations arising under the Contract Documents, in the full amount of the Contract Sum.

B. Payment Bond: Submitted at time of execution of the Contract and attached thereto. The bond shall cover the payment obligations arising from the Contract, and shall be in the full amount of the Contract Sum.

B. Insurance: Certificate(s) of Insurance shall be provided to Owner. This Certificate shall be reflective of all Insurance Coverage required by the Contract Documents. Any Certificate filed found to be incomplete or not according to Form, will be returned as not satisfactory. Rejected Certificates shall be corrected as necessary and resubmitted.

Certificates of Insurance shall indicate the following to be Additional Named Insureds:

- Owner; It's officers, elected officials, employees, agents, and volunteers
- Consultants hired by the Owner to administer the construction
- ARC Architects
- Bloom Projects, LLC

In addition to the foregoing, the Certificate of Insurance must include a Cancellation Notification of not less than thirty (30) days. The Certificate should also contain the Contract Number and a "concise verbal definition" of the Contract to which the Certificate applies.

1.03 INSURANCE GENERALLY: The Contractor shall not commence work under this contract until they have obtained the insurance required hereunder and such insurance has been approved by the Owner. In like manner, the General Contractor shall not allow any subcontractor to commence work on any subcontract until the subcontractor has submitted to the General Contractor a Certificate of Insurance reflective of the coverage required by the Owner. The Owner's approval of insurance shall not relieve or decrease the Contractor's liability hereunder. Each policy shall contain an endorsement stating that the insurance company will not, prior to the completion of the Work or any expiration date shown on the policy and certificate, whichever occurs first, terminate the policy or change any coverage therein without first mailing, by registered mail, written notice of such action at least thirty (30) days prior to the termination or change, to the Owner. Certificate shall be issued on an ACORD Form, or a form that meets with the Owner's approval. The Insuring Company shall have a Best Rating of A or meet with the Owner's approval.

The "Cancellation" Block shall be altered to include the wording "Should any of the above described policies be canceled or materially reduced before expiration date thereof, the issuing company will mail thirty (30) days written notice to the certificate holder named to the left."

1.04 CONTRACTOR'S LIABILITY INSURANCE: The insurance required by the Owner is as specified below and in the amounts indicated:

A. Worker's Compensation and Employer's Liability Insurance: All employees of the Contractor and subcontractors shall be insured under Washington State Industrial Insurance. Employees not subject to the State Act shall be insured under Employer's Liability with a $2,000,000.00 limit of liability. A separate Certificate of Insurance shall be furnished to the Owner if any of the Contractor' payroll is not reported to the Washington State Industrial Insurance. The contractor shall be responsible for confirming compliance of all subcontractors with the above requirements.

B. Comprehensive General Liability and Comprehensive Automobile Liability Insurance: The Contractor shall obtain and retain Bodily Injury and Property Damage Liability Insurance providing the following:

1. Additional Insured: Owner, Bloom Projects, LLC, and the Architect/Engineer of Record shall be named as additional insured for liability arising out of the work of this Contract as a result of the negligence, real or alleged, on the part of the contractor and his subcontractors.
2. Limits of Liability: The minimum acceptable General Liability Limit shall be $5,000,000per occurrence for bodily injury/$5,000,000 aggregate; $5,000,000 property damage liability per occurrence/aggregate. Coverage shall include owners & Contractors Protective Liability and Employers Liability (Stop-Gap) Coverage. The minimum acceptable Automobile Liability Limit shall be $5,000,000. The Owner does not represent that the minimum required insurance coverage or limits are adequate to protect Contractor from all liabilities.
3. Coverage: Coverage shall be written on an "Occurrence" Basis. Coverage shall be as is usual to the practice of the Insurance Industry; included but not limited to the following coverages:
    a. Premises and Operations including Explosion, Collapse and Underground Liability;
    b. Products and completed Operations;
    c. Owners and Contractors Protective Liability;
    d. Broad form Property Damage Liability;
    e. Blanket Contractual Liability;
    f. Personal Injury Liability, including coverage's A, B, and C;
    g. Employers "Stop-Gap" Liability;
    h. Automobile Liability for All Owned, Non-Owned, Hired Leased or Borrowed Vehicles. Automobile Coverage shall include "Any Auto" or "Scheduled Autos" and shall include Hired and Non-Owned Auto Liability;
    i. Un-insured and Under-insured Motorist Coverage should also be in effect.
4. Products and Completed Operations Insurance: The minimum acceptable Annual Aggregate for Products and Completed Operations Liability shall be $5,000,000. This coverage must be maintained for a period of not less than three (3) years after the final acceptance of the work performed.
5. Umbrella insurance providing excess limits in an amount of not less than $10,000,000.
6. Additional insurance requirements can be found in the A201 General Conditions. To the extent there is a conflict between the insurance provisions provided in these specifications and those in the General Conditions, the General Conditions control.

1.05 PROPERTY INSURANCE: The Contractor shall purchase and maintain property insurance upon the entire Work at the site to 115 percent of the full value thereof. This insurance shall include the interests the Owner, the Contractor, and all subcontractors in the Work being performed. The coverage shall be written on a "Builder's Risk" basis. All materials which are to be made part of the construction project are to be so insured while being stored at or off the job site(s) and/or

while being transported to and from the job site(s). Builders Risk insurance shall be on a special perils policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including flood, earthquake, theft, vandalism, malicious mischief, and collapse. The Builders Risk insurance shall include coverage for temporary buildings, debris removal, and damage to materials in transit or stored off-site. This Builders Risk insurance covering the work will have a deductible of $5,000 for each occurrence, which will be the responsibility of the Contractor. Higher deductibles for flood and earthquake perils may be accepted by the Owner upon written request by the Contractor and written acceptance by the Owner. Any increased deductibles accepted by the Owner will remain the responsibility of the Contractor. The Builders Risk insurance shall be maintained until the Owner has granted substantial completion of the project. Insurance against loss of tools, equipment, construction, or otherwise not to be incorporated into the Work is the responsibility of the Contractor and the cost of such insurance shall not be included in the cost of insurance required herein before.

A. Waiver: Owner and the Contractor waive all rights against (1) each other and the subcontractors, sub-subcontractors, agents and employees each of the other, and (2) the Owner for damages caused by fire or other perils to the extent covered by insurance obtained pursuant to this Article or any other property insurance applicable to the Work, except such rights as they may have to the proceeds of such insurance held by the Owner, as trustee.

1.06 BONDS

A. Performance and Payment Bond: Furnish Performance and Payment Surety Bonds (Section 00 61 40) in an amount equal to 100 percent of the Contract Sum covering faithful performance of the work and payment of labor and materials. Furnish bonds issued by a bonding company licensed to transact business in the locality of the Work and approved by the Owner. The bonds must state that it is provided pursuant to Ch. 39.08 RCW.

1.07 Builders Risk Insurance (BRI)

A. BRI is to be provided by the General Contractor (GC). As supporting backup, the GC shall include their broker's quote.

END OF SECTION 00 60 00

SECTION 00 61 40 - PERFORMANCE BOND

SURETY TO HAVE AN A.M. BEST RATING OF A:VII OR BETTER.

Bond No. _____

KNOW ALL PERSONS BY THESE PRESENTS, that _____ **(Contractor)**, as Principal, and _____, (insert name of surety), as Surety, a corporation duly organized under the laws of the State of _____, (insert Surety's state of incorporation), and authorized to do business as a surety in the State of Washington, are held and firmly bound unto the South Whidbey Parks and Recreation District (Owner) in the sum of _____ dollars **($_____)**, lawful money of the United States of America, plus the total amount of extra orders issued by the Owner to the Principal pursuant to the terms of the Contract referred to in the next succeeding paragraph hereof, for the payment whereof Principal and Surety bind ourselves, and our heirs, executors, administrators, representatives, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has been awarded, and is about to enter into, a written Contract with the Owner for **PROJECT NAME:** South Whidbey Aquatic Recreation Center, which is hereby made a part of this bond as if fully set forth herein;

NOW, THEREFORE, the condition of this bond is such that:

1. If the Principal shall completely and faithfully perform all of its obligations under the Contract, including any warranties required thereunder, and all modifications, amendments, additions, and alterations thereto, including modifications which increase the contract price or time for completion, with or without notice to the surety;
2. If the Principal shall indemnify and hold the Owner harmless from any and all losses, liability, damages, claims, judgments, liens, costs, and fees of any type that the Owner may be subject to because of the failure or default of the Principal (a) in performance of any of the terms, conditions, or obligations of the Contract, including all modifications, amendments, additions, and alterations thereto, and any warranties required thereunder, and/or (b) in the payment for labor, equipment, and materials by satisfying all claims and demands incurred under the Contract, and reimbursing and paying Owner all expenses that Owner may incur in making good any default by the Principal; and
3. If the Principal shall indemnify and hold the Owner harmless from all claims, liabilities, causes of action, damages and costs, including property damages and personal injuries, resulting from any defect appearing or developing in the material provided or workmanship performed under the Contract;

THEN THIS obligation shall be null and void; otherwise to remain in full force and effect. If the Owner shall declare Principal to be in default of the Contract, and shall so notify Surety, Surety shall, within a reasonable time which shall not exceed 14 days, except for good cause shown, notify the Owner in writing of the manner in which surety will satisfy its obligations under this Bond.

Nonpayment of the Bond premium will not invalidate this Bond nor shall the Owner be obligated for the payment thereof. The Surety hereby waives notice of any modification of the Contract or extension of time made by the Owner.

Signed this _____ day of _____, 20__.

Principal:	_____	Surety:	_____
By:	_____	By:	_____
Title:	_____	Title:	_____
Address:	_____	Address:	_____
City/Zip:	_____	City/Zip:	_____
Telephone: ( )	_____	Telephone: ( )	_____

Note: A power of attorney must be provided which appoints the Surety's true and lawful attorney-in-fact to make, execute, seal and deliver this performance bond.

END OF SECTION 00 61 40

SECTION 00 61 41 - LABOR, MATERIAL, AND TAXES BOND (PAYMENT) BOND

SURETY TO HAVE AN A.M. BEST RATING OF A:VII OR BETTER.

Bond No. _____

KNOW ALL PERSONS BY THESE PRESENTS, that, _____ **(Contractor)**, as Principal, and _____, (insert name of surety), as Surety, a corporation duly organized under the laws of the State of _____ (insert Surety's state of incorporation), and authorized to do business as a surety in the State of Washington, are held and firmly bound unto the South Whidbey Parks and Recreation District (Owner) for the use and benefit of claimants as hereinafter defined, in the sum of _____ **Dollars ($_____),** lawful money of the United States of America, plus the total amount of any extra orders issued by the Owner, for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, representatives, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has been awarded, and is about to enter into, a Contract with the Owner for **PROJECT NAME: South Whidbey Aquatic Recreation Center,** which contract is by this reference made a part hereof;

WHEREAS, the contract is a public works contract, subject to the provisions of RCW Titles 39 and 60;

NOW, THEREFORE, the conditions of this obligation are such that, if the Principal shall promptly make payment to all claimants as hereinafter defined, for (a) all labor and material used or reasonably required for use in the performance of the contract and (b) all taxes, increases, and penalties incurred on the above-referenced contract under Titles 50, 51, and 82 RCW which may be due, then this obligation shall be void; otherwise, it shall remain in full force and effect, subject, however, to the following conditions: A claimant is defined as and includes (a) a person claiming to have supplied labor or materials for the prosecution of the work provided for in the contract, including any person having direct contractual relationship with the contractor furnishing the bond or direct contractual relationship with any subcontractor, or an assignee of such person, (b) the state with respect to taxes incurred on the above-referenced contract under Titles 50, 51, and 82 RCW which may be due and (c) any other person or entity as allowed or required by law.

1. The Principal and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full prior to Final Acceptance of the project, or materials were furnished by such claimant, has an action on this bond for such sum or sums as may be justly due claimant, and may have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit or action.

(Form continues on next page)

2. No suit or action shall be commenced hereunder by any claimant (except the state with respect to taxes, increases, and penalties incurred on the above-referenced contract under Titles 50, 51, and 82 RCW which may be due) unless the claimant has sent the written notice required under RCW Title 39 to the Principal and to the Owner's Purchasing Agent by registered or certified mail, or by hand delivery, no later than 30 days after Final Acceptance of the Project.

The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens which may be filed of record against the improvement, whether or not claim for the amount of such lien be presented under and against this bond.

The Surety hereby waives notice of any modification of the contract or extension of time made by the Owner.

Signed this _____ day of _____, 20__.

Principal:	_____	Surety:	_____
By:	_____	By:	_____
Title:	_____	Title:	_____
Address:	_____	Address:	_____
City/Zip:	_____	City/Zip:	_____
Telephone: ( )	_____	Telephone: ( )	_____

Note: A power of attorney must be provided which appoints the Surety's true and lawful attorney-in-fact to make, execute, seal and deliver this performance bond.

END OF SECTION 00 61 41

SECTION 00 63 00 – CLARFICATION, MODIFICATION, AND CLOSEOUT FORMS

1.1 ADMINISTRATIVE FORMS

A. Sample copies of administrative forms are provided in this section. Originals may be obtained from the American Institute of Architects; https://www.aiacontractdocs.org; (800) 942-7732, or requested from Architect.

B. Information and Modification Forms:

1. Change Order Form: AIA Document G701-2001 "Change Order."
2. Form of Request for Proposal: AIA Document G709-2001 "Work Changes Proposal Request."
3. Form of Architect's Memorandum for Minor Changes in the Work: AIA Document G710-1992 "Architect's Supplemental Instructions."
4. Form of Change Directive: AIA Document G714-2007 "Construction Change Directive."
5. Form of Requests for Information (RFIs): AIA Document G716-2004 "Request for Information (RFI)."
6. Substitution Request Form: CSI Form 1.5C
7. Change Order Request Proposal: CSI Form 13.6A
8. Change Order Request Proposal Worksheet Summary: CSI Form 13.6C
9. Change Order Request Proposal Worksheet Detail: CSI Form 13.6D

C. Payment Formatting and Closeout Forms:

1. Payment Application: AIA Document G702~~S~~-1992~~2017~~ "Application and Certificate for Payment and Continuation Sheet."
2. Schedule of Values Form: AIA Document G703~~S~~-1992~~2017~~ "Continuation Sheet."
3. Certificate of Substantial Completion: AIA Document G704-2017 “Substantial Completion Certificate.”

END OF SECTION 00 63 00

AIA® Document G701™ – 2017

Change Order

PROJECT: *(name and address)*	**CONTRACT INFORMATION:** Contract For: Date:	**CHANGE ORDER INFORMATION:** Change Order Number: Date:
OWNER: *(name and address)*	**ARCHITECT:** *(name and address)*	**CONTRACTOR:** *(name and address)*

THE CONTRACT IS CHANGED AS FOLLOWS:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

Lump Sum

The original (Contract Sum) (Guaranteed Maximum Price) was	$ _____
The net change by previously authorized Change Orders	$ _____
The (Contract Sum) (Guaranteed Maximum Price) prior to this Change Order was	$ _____
The (Contract Sum) (Guaranteed Maximum Price) will be (increased) (decreased) (unchanged) by this Change Order in the amount of	$ _____
The new (Contract Sum) (Guaranteed Maximum Price), including this Change Order, will be	$ _____
The Contract Time will be (increased) (decreased) (unchanged) by	( ) days.
The new date of Substantial Completion will be	

NOTE: This Change Order does not include adjustments to the Contract Sum or Guaranteed Maximum Price, or the Contract Time, that have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

ARCHITECT *(Firm name)*	**CONTRACTOR** *(Firm name)*	**OWNER** *(Firm name)*
SIGNATURE	**SIGNATURE**	**SIGNATURE**
PRINTED NAME AND TITLE	**PRINTED NAME AND TITLE**	**PRINTED NAME AND TITLE**
DATE	**DATE**	**DATE**

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AIA® Document G704™ – 2017

Certificate of Substantial Completion

PROJECT: *(name and address)*	CONTRACT INFORMATION: Contract For: Date:	CERTIFICATE INFORMATION: Certificate Number: Date:
OWNER: *(name and address)*	ARCHITECT: *(name and address)*	CONTRACTOR: *(name and address)*

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.
(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT *(Firm Name)*	SIGNATURE	PRINTED NAME AND TITLE	DATE OF SUBSTANTIAL COMPLETION

WARRANTIES
The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:
(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED
A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:
(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within ( ) days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: $

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:
(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR *(Firm Name)*	SIGNATURE	PRINTED NAME AND TITLE	DATE
OWNER *(Firm Name)*	SIGNATURE	PRINTED NAME AND TITLE	DATE

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AIA® Document G709™ – 2018

Proposal Request

PROJECT: *(name and address)*:	**CONTRACT INFORMATION:** Contract For: Date:	Architect's Project number: Proposal Request Number: Proposal Request Date:
OWNER: *(name and address)*:	**ARCHITECT:** *(name and address)*:	**CONTRACTOR:** *(name and address)*:

The Owner requests an itemized proposal for changes to the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. The Contractor shall submit this proposal within _____ (___) days or notify the Architect in writing of the anticipated date of submission.

(Insert a detailed description of the proposed modifications to the Contract Documents and, if applicable, attach or reference specific exhibits.)

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE, OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.

REQUESTED BY THE ARCHITECT:

_____

PRINTED NAME AND TITLE

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Sample

AIA® Document G710™ – 2017

Architect's Supplemental Instructions

PROJECT: *(name and address)*	CONTRACT INFORMATION: Contract For: Date:	ASI INFORMATION: ASI Number: Date:
OWNER: *(name and address)*	ARCHITECT: *(name and address)*	CONTRACTOR: *(name and address)*

The Contractor shall carry out the Work in accordance with the following supplemental instructions without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.
(Insert a detailed description of the Architect's supplemental instructions and, if applicable, attach or reference specific exhibits.)

ISSUED BY THE ARCHITECT:

ARCHITECT *(Firm name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE

Sample

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AIA® Document G714™ – 2017

Construction Change Directive

PROJECT: *(name and address)*	CONTRACT INFORMATION: Contract For: Date:	CCD INFORMATION: Directive Number: Date:
OWNER: *(name and address)*	ARCHITECT: *(name and address)*	CONTRACTOR: *(name and address)*

The Contractor is hereby directed to make the following change(s) in this Contract:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits.)

PROPOSED ADJUSTMENTS

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price:

   ☐ Lump Sum (increase) (decrease) of $

   ☐ Unit Price of $ per

   ☐ Cost, as defined below, plus the following fee:
   (Insert a definition of, or method for determining, cost)

   ☐ As follows:

2. The Contract Time is proposed to (be adjusted) (remain unchanged). The proposed adjustment, if any, is (an increase of days) (a decrease of days).

NOTE: The Owner, Architect and Contractor should execute a Change Order to supersede this Construction Change Directive to the extent they agree upon adjustments to the Contract Sum, Contract Time, or Guaranteed Maximum price for the change(s) described herein.

When signed by the Owner and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Contractor signature indicates agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this CCD.

ARCHITECT *(Firm name)*	OWNER *(Firm name)*	CONTRACTOR *(Firm name)*
SIGNATURE	SIGNATURE	SIGNATURE
PRINTED NAME AND TITLE	PRINTED NAME AND TITLE	PRINTED NAME AND TITLE
DATE	DATE	DATE

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Sample

AIA® Document G716™ – 2004

Request for Information (RFI)

TO: **FROM:**

PROJECT: **ISSUE DATE:** **RFI No.:**

REQUESTED REPLY DATE:

PROJECT NUMBERS: **COPIES TO:**

RFI DESCRIPTION: *(Fully describe the question or type of information requested.)*

REFERENCES/ATTACHMENTS: *(List specific documents researched when seeking the information requested.)*

SPECIFICATIONS **DRAWINGS** **OTHER**

SENDER'S RECOMMENDATION: *(If RFI concerns a site or construction condition, the sender may provide a recommended solution, including cost and/or schedule considerations.)*

RECEIVER'S REPLY: *(Provide answer to RFI, including cost and/or schedule considerations.)*

By:_____ **Date:**_____ **Copies to:**_____

NOTE: This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.

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020711ACD44

Sample

CSI Form 1.5C

SUBSTITUTION REQUEST
(During the Bid Period)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

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110 South Union Street, Suite 100, Alexandria, VA 22314

Form Version: June 2004
CSI Form 1.5C

This is not an official CSI Construction Contract Administration (CCA) Form. Please use CSI's official CCA Forms if required by your project needs.

Knowledge for Creating and Sustaining the Built Environment

CHANGE ORDER REQUEST (PROPOSAL)

Project: _____ Change Order Request Number: _____

_____ From (Contractor): _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

This Change Order Request (C.O.R.) contains an itemized quotation for changes in the Contract Sum or Contract Time in response to proposed modifications to the Contract Documents based on Proposal Request No. _____ .

Description of Proposed Change:

Attached supporting information from: ☐ Subcontractor ☐ Supplier ☐ _____ ☐ _____

Reason For Change:

Does Proposed Change involve a change in Contract Sum? ☐ No ☐ Yes [Increase] [Decrease] $_____

Does Proposed Change involve a change in Contract Time? ☐ No ☐ Yes [Increase] [Decrease] _____ days.

Attached pages: ☐ Proposal Worksheet Summary: _____

☐ Proposal Worksheet Detail(s): _____

Signed by: Date:

Copies: ☐ Owner ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ File

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Form Version: July 1994
CSI Form 13.6A

PROPOSAL
WORKSHEET DETAIL

Project: _____ Change Order Request Number:

To: _____ From: _____ Contact: _____

Re: _____ Date: _____

Proposal Request Number: _____ A/E Project Number: _____

SHADED AREAS FOR A/E USE

ADDITIONS

	Ref. No.	Item Description	Quantity		UNIT PRICES Materials		UNIT PRICES Labor		SUBTOTALS Materials		SUBTOTALS Labor		TOTAL	
1														
2														
3														
4														
		Subtotal (Enter this number on Worksheet Summary.)												

DEDUCTIONS

	Ref. No.	Item Description	Quantity		UNIT PRICES Materials		UNIT PRICES Labor		SUBTOTALS Materials		SUBTOTALS Labor		TOTAL	
1														
2														
3														
4														
		Subtotal (Enter this number on Worksheet Summary.)												

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PROPOSAL
WORKSHEET SUMMARY

Project: _____ Change Order Request Number: _____

To: _____ From: _____

Re: _____ Date: _____

Proposal Request Number: _____ A/E Project Number: _____

Complete and attach Proposal Worksheet Detail for each element of Work. Enter Worksheet Information below.

ADDITIONS:

	Sheet	Description	Material	Labor	Subtotal
1					
2					
3					
4					
5					
6					
7					
		Subtotal:			

DEDUCTIONS:

	Sheet	Description	Material	Labor	Subtotal
1					
2					
3					
4					
5					
6					
7					
		Subtotal:			

Subcontractor's Net:	
Subcontractor's OH&P:	
Subcontractor's Bond:	
Subcontractor's Total:	$ -
Contractor's OH&P:	
Contractor's Bond:	
Insurance:	
Tax:	
WORKSHEET TOTAL:	$ -

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Form Version: January 2013
110 South Union St., Suite 100, Alexandria, VA 22314
CSI Form 13.6D

SECTION 00 70 00 - GENERAL CONDITIONS

The General Conditions for this project will be the enclosed and Owner-amended, where applicable, American Institute of Architects (AIA) Document A201®–2017*, General Conditions of the Contract for Construction.

*AIA A201®–2017 is considered the keystone document of the Conventional family of documents because it provides the terms and conditions under which the Owner, Contractor, and Architect will work together during the building construction process. A201 adopts by reference, and is designed for use with the enclosed, AIA Document A101®–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum.

END OF SECTION 00 70 00

AIA® Document A201™ – 201

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

South Whidbey Aquatic Recreation Center

THE OWNER:
(Name, legal status and address)

South Whidbey Parks and Recreation District
5495 Maxwelton Road
Langley, Washington 98260

THE ARCHITECT:
(Name, legal status and address)

ARC Architects
119 South Main Street, Suite 200
Seattle, Washington 98104

TABLE OF ARTICLES

1 GENERAL PROVISIONS

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10 PROTECTION OF PERSONS AND PROPERTY

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14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

In the event of a conflict or discrepancy among or in the Contract Documents that cannot be resolved by interpreting the Contract Documents as a single, integrated document and giving effect to each provision therein, interpretation shall be governed in the following priority, with an Addendum or a revision to a Contract Document having precedence over the original document and later Addenda having precedence over earlier:

.1 Agreement (revised A101-2017, including exhibits) (written amendments having precedence)
.2 These revised General Conditions (A201-2017)
.3 Supplementary Conditions, if any
.4 Specifications
.5 Drawings (large-scale having precedence over small-scale, and written or computed dimensions having precedence over scaled dimensions)
.6 Request for Proposals and Contractor's Bid Proposal

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials through which the Work to be executed by the Contractor is described

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§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade, nor shall it remove the Contractor's obligation to complete all of the Work when coordination between the Specifications and the Drawings or coordination between subcontracts is required.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 If the Contractor discovers that the Specifications or Drawings fail to particularly describe the material or kind of goods to be used in any place or discovers an inconsistency or ambiguity between the Specifications or Drawings, or an inconsistency or ambiguity arises internally within the Specifications or Drawings, then the Contractor shall make inquiry of the Architect as to what is best suited. If the Contractor discovers such an inconsistency or ambiguity and fails to notify the Architect, there shall be no adjustment to the Contract Time or Contract Sum.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, (3) the titles of other documents published by the American Institute of Architects, or (4) published codes, statutes, and standards.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement. Reference in the singular to an article, device, item or piece of equipment shall include the larger of the number of such articles indicated in the Contract Documents or the number required to complete the installation.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain, subject to the rights of the Owner, all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work under the Contract documents for the Project. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

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§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties may agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.2 Information and Services Required of the Owner

§ 2.2.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities. Except for as expressly provided herein, the Contractor is responsible for securing and paying for licenses and all other permits.

§ 2.2.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.2.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.2.4 The Owner may furnish surveys describing physical characteristics, legal limitations, utility locations for the site of the Project, and a legal description of the site. Contractor shall not be entitled to rely upon the accuracy of the information furnished by Owner, but shall exercise proper precautions relating to the investigation and safe performance of the Work. The Contractor should assume that the locations of any underground or hidden utilities, active or abandoned underground tanks, plumbing or electrical runs indicated in the survey or Contract Documents are shown in approximate locations. The Contractor is responsible for performing all utilities investigation and location work to determine the precise locations thereof. The Contractor shall not damage or interrupt utilities or utilities services of any kind. The Contractor shall bear the risk of loss arising out of its Work which directly or indirectly damages or interrupts any utilities or utilities services, or causes or contributes to damages of any nature.

§ 2.2.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

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§ 2.4 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten (10)day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. If this occurs, an appropriate Change Order will be issued deducting from payments then or thereafter due to the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15. The Owner's exercise of its rights under this Section shall not adversely affect any warranties applicable to the Project.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.1.4 The Contractor shall be and operate as an independent contractor in the performance of the Work, and shall have completed control over and responsibility for all personnel performing the Work. The Contractor is not authorized to enter into any agreements or undertakings for or on behalf of the Owner or to act as or be an agent or employee of the Owner.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents. By executing the Agreement, the Contractor represents and acknowledges that the Contract Sum is reasonable compensation for all the Work, that the Contract Time is adequate for the performance of the Work, and that it has carefully examined the Contract Documents and the Project site, including any existing structures and access thereto, and any drawings of the existing conditions available from the Owner, and that it has satisfied itself as to the nature, location, character, quality and quantity of the Work, the labor, materials, equipment, goods, products, supplies, work, services and other items to be furnished and all other requirements of the Contract Documents, as well as the surface conditions and other foreseeable matters that may be encountered at the Project site or affect performance of the Work or the cost or difficulty thereof, including but not limited to those conditions and matters affecting: transportation, access, local regulations, disposal, handling and storage of materials, equipment and other items; availability and quality of labor, water, electric power, utilities, drainage; availability and condition of roads; normal climatic conditions and season; physical conditions at the Project site and the surrounding locality; topography and ground surface conditions; and equipment and facilities needed preliminary to and at all times during the performance of the Work. The failure of the Contractor to fully acquaint itself with any such condition or matter shall not in any way relieve the Contractor from the responsibility for performing the Work in accordance with the Contract Documents and for the Contract Sum and within the Contract Time, and shall not be the basis of a Claim.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it and shall carefully compare and verify such field measurements and conditions and other information known to the Contractor and within the Contract Documents before commencing such activities. These obligations are for the purpose of

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facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require. The Contractor shall comply with all federal, state, county, and City laws, ordinances, rules, and regulations.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of any design errors or omissions or inconsistencies noted by the Contractor, or clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.6, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, unless the Contractor recognized or reasonably should have recognized such error, inconsistency, omission or difference and failed to report it to the Owner and the Architect. If the Contractor performs any construction activity it knows or reasonably should have known involves an error, inconsistency or omission in the Contract Documents or reports referenced therein without such notice to the Owner and the Architect, the Contractor shall be responsible for such performance and shall bear the attributable costs for correction.

§ 3.2.5 The Contractor shall do no work, except work related to means and methods and temporary controls, without applicable Drawings, Specifications, or written modifications or, where required, Shop Drawings, Product Data, or Samples, unless instructed to do so in writing by the Architect and the Owner.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. The Contractor shall review any such specific instructions concerning construction means, methods, techniques, sequences, or procedures, shall evaluate the jobsite safety thereof, and shall advise the Owner and Architect (a) if the specified instruction or procedure deviates from what the Contractor considers to be good construction practice or jeopardizes job safety; (b) if following the instruction or procedure will negatively affect warranties; or (c) if the Contractor objects to the instruction or procedure. Contractor may propose alternative means, methods, techniques, sequences, or procedures, for which no increase to the Contract Sum or Contract Time shall be made. The Contractor shall not proceed with any alternative instructions or procedures without the written acceptance and consent of the Owner and the Architect. Contractor shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's principals, agents, employees, and Subcontractors of any tier, and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors of any tier.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work. Responsibility for timely installation of all materials and equipment rests solely with the Contractor, who shall maintain coordination control at all times. The Contractor shall require its Subcontractors of any tier to be familiar with all aspects of the Contract Documents related to their Work. The Contractor shall ensure that the responsible Subcontractor has carefully examined all preparatory work that has been executed to receive its Work and has notified the Contractor (who shall notify the Owner and Architect in writing) of any defects or imperfections in preparatory work that will, in any way, affect

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satisfactory completion of the Work. The lack of such notification, or the failure of the Contractor to inspect such portions of the Work, shall constitute an acceptance of preparatory work and a waiver of any later claim of defect therein.

§ 3.3.4 The Contractor shall perform such detailed examination, inspection and quality control and surveillance of the Work as will ensure that the Work is progressing and is being completed in strict accordance with the Contract Documents, including the then current issue of the Drawings, Specifications, and accepted Shop Drawings. The Contractor shall be responsible for examination, inspection, and quality control and surveillance of all Work performed by any Subcontractor of any tier. The Contractor shall determine when it is necessary to perform, and shall perform, tests to verify its inspections or to ensure that the Work is being completed in strict accordance with the Contract Documents. The Contractor shall report known errors, omissions, or inconsistencies to the Architect and the Owner before commencing Work. Inspections by or on behalf of the Owner shall not constitute approval of the Work.

§ 3.3.5 The Contractor shall plan and lay out all Work in advance of installation so as to coordinate all Work without delay or revision. The Contractor is responsible for coordination of all the Drawings related to specific locations. The Contractor shall establish and maintain existing lot lines, restrictions, existing survey markers of any kind, and bench marks. The Contractor shall establish and maintain all other lines, levels and bench marks necessary for the execution of the Work and take necessary steps to prevent their dislocation or destruction. The Contractor may employ a professional land surveyor registered in the State of Washington to initially lay out and be responsible for the accuracy of the Work and to create and submit to the Owner an as-built survey and accurate utility as-builts for use by the Owner. The Contractor shall provide an as-built surveyed site plan noting all site improvements, including but not limited to building corners, storm, sewer, drains, grade and invert elevations, edge of pavement, signs, markings, back of curb, and sidewalks.

§ 3.3.6 The Contractor's superintendent shall provide a Daily Report to the Owner for each work day during the Contract Time, whether or not any Work is performed, and for each non-work day in which Work is performed on the site. The Daily Report shall be submitted to the Owner and the Architect on the work day following the day covered in the Report.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive. The written request for a substitution must include the specifications for the material or product at issue. By requesting a substitution, the Contractor represents that it has personally investigated the proposed material or product and determined that it is equal or better in all respects to that specified (or if not equal or better in all respects, the Contractor shall identify such deficiencies), that the same or better warranty will be provided for the substitution, that complete cost data, including all direct and indirect costs of any kind, has been presented, that it waives any other known or unknown Claim for an increase in the Contract Sum or Contract Time, that it has coordinated with affected Subcontractors, that the substitution will not impact other parts of the Work, and that it will coordinate the installation of the substitution if accepted and make all associated changes in the Work.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them. Upon the Owner's request and for any employee working on the Project, the Contractor shall provide the Owner with background checks on each of its employees and of the employees of all Subcontractors of any tier.

§ 3.4.4 Prevailing Wages

§ 3.4.4.1 Pursuant to RCW 39.12, "Prevailing Wages on Public Works," no worker, laborer, or mechanic employed in the performance of any part of the Work shall be paid less than the "prevailing rate of wage" (in effect as of the date that bids are due) as determined by the Industrial Statistician of the Department of Labor and Industries. The

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prevailing rate of wage shall be the rate of hourly wage, usual benefits, and overtime paid in the locality to the majority of workers, laborers, or mechanics, in the same trade or occupation. The locality for the purposes of the prevailing rate of wage shall be the largest city in the county wherein the physical work is being performed. See RCW 39.12.010. The schedule of the prevailing wage rates for the locality or localities where this contract will be performed is attached to the executed contract and made a part of the Contract Documents by reference as though fully set forth herein; if not attached, then the applicable prevailing wages are determined as of the Bid Date for the county in which the Project is located. A copy is available for viewing at the Owner's office, and a hard copy will be mailed upon request. To the extent that there is any discrepancy between the attached or provided schedule of prevailing wage rates and the published rates applicable under WAC 296-127-011, or if no schedule is attached, the applicable published rates shall apply with no increase to the Contract Sum. It is the Contractor's responsibility to ensure that the correct prevailing wage rates are paid. The Contractor shall provide the respective Subcontractors with a schedule of the applicable prevailing wage rates. Questions relating to prevailing wage data should be addressed to the Industrial Statistician upon request.

Mailing Address:	Department of Labor and Industries Prevailing Wage Office PO Box 44540 Olympia, WA 98504-4540
Telephone:	(360) 902-5335
Facsimile:	(360) 902-5300
Website:	www.lni.wa.gov/TradesLicensing/PrevWage/WageRates/defauilt.asp

§ 3.4.4.2 Pursuant to RCW 39.12.060, in case any dispute arises as to what are the prevailing rates of wages for work of a similar nature, and such dispute cannot be adjusted by the parties in interest, including labor and management representatives, the matter shall be referred for arbitration to the Director of the Washington State Department of Labor and Industries, and his or her decision therein shall be final and conclusive and binding on all parties involved in the dispute.

§ 3.4.4.3 The Contractor must have received training on the requirements related to public works in prevailing wage under Chapters 39.04 and 39.12 RCW. The Contractor must designate a person or persons to be trained on these requirements. The training must be provided by the Department of Labor and Industries or by a training provider whose curriculum is approved by the Department. Contractors that have completed three or more public works projects and have had a valid business license in Washington for three or more years are exempt from this requirement. The Department of Labor and Industries maintains records of entities that have satisfied the training requirement or are exempt and makes the records available on its website. The Owner may rely on the records made available by the Department regarding satisfaction of the training requirements or exemption.

§ 3.4.4.4 The Contractor shall defend, indemnify and hold the Owner harmless, including attorneys' fees, from any violation or alleged violation by the Contractor or any Subcontractor of any tier of Chapter 39.12 RCW ("Prevailing Wages on Public Works") and Title 51 RCW ("Industrial Insurance"), including without limitation RCW 51.12.050.

§ 3.4.5 The Contractor shall comply with all applicable provisions of Chapter 49.28 RCW ("Hours of Labor").

§ 3.4.6 Pursuant to Chapter 49.70 RCW ("Worker and Community Right to Know Act") and WAC 296-901 *et seq.*, the Contractor shall provide the Owner copies of and have available at the Project site a workplace survey or material safety data sheets for all "hazardous" chemicals under the control or use of Contractor or any Subcontractor of any tier at the Project site. Contractor shall not be entitled to any additional Contract Time or compensation arising from its failure or alleged failure to comply with this statute or regulation.

§ 3.4.7 All products and materials incorporated into the Project as part of the Work shall be certified as "asbestos-free" and "lead-free" by United States standards. At the completion of the Project, the Contractor shall submit Certificates of Asbestos-Free and of Lead-Free Materials, certifying that all materials and products incorporated into the Work meet the requirements of this section.

§ 3.4.8 The Contractor shall be responsible for labor peace on the Project and shall at all times use its best efforts and exercise its best judgment as an experienced contractor to adopt and implement policies and practices designed to avoid work stoppages, slowdowns, disputes or strikes where reasonably possible and practical under the circumstances, and shall at all times maintain Project-wide labor harmony.

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§ 3.4.9 Materials shall conform to the manufacturer's standards in effect at the date of execution of the Contract Documents and shall be installed in strict accordance with the manufacturer's instructions, specifications and directions. The Contractor shall, if required in writing by the Owner or Architect, furnish satisfactory evidence regarding the kind and quality of any materials identifying thereon the source, and warranting their quality and compliance with the Contract Documents.

§ 3.4.10 Apprenticeship Utilization Requirements

§ 3.4.10.1 Pursuant to RCW 39.04.320, no less than fifteen percent (15%) of the Labor Hours shall be performed by apprentices, unless a different amount is permitted or otherwise required by law.

§ 3.4.10.2 Apprenticeship hours shall be performed by participants in training programs approved by the Washington State Apprenticeship Council.

§ 3.4.10.3 "Labor Hours" means the total hours of workers receiving an hourly wage who are directly employed on the site of the public works project. "Labor Hours" includes hours performed by workers employed by the Contractor and all Subcontractors working on the Project. "Labor Hours" does not include hours worked by foremen, superintendents, owners, and workers who are not subject to prevailing wage requirements of Chapter 39.12 RCW.

§ 3.4.10.4 During the term of this Contract, the Owner may adjust the apprenticeship labor hour requirement upon its finding or determination that includes:

- **.1** A demonstration of lack of availability of apprentices in the geographic area of the Project;
- **.2** A disproportionately high ratio of material costs to labor hours that do not make feasible the required minimum levels of apprenticeship participation;
- **.3** Demonstration by participating contractors of a good faith effort to comply with the requirements of RCW 39.04.300, 39.04.310 and 39.04.320;
- **.4** Small contractors or subcontractors (e.g., small or emerging businesses) would be forced to displace regularly employed members of their workforce;
- **.5** The reasonable and necessary requirements of the Contract render apprentice utilization infeasible at the required level (e.g., the number of skilled workers required and/or limitations on the time available to perform the Work preclude utilization of apprentices); or
- **.6** Other criteria the Owner deems appropriate, which are subject to review by the Office of the Governor.

§ 3.4.10.5 The Contractor shall report apprentice participation to the Owner at least quarterly, on forms provided or approved by the Owner. In addition, copies of quarterly certified payroll records may be requested to document the goal, including copies with any birthdates and social security numbers (and any other sensitive personal information) redacted so as such copies may be used to respond to any public records requests. The reports will include:

- **.1** The name of the Project;
- **.2** The dollar value of the Project;
- **.3** The date of the Contractor's Notice to Proceed;
- **.4** The name of each apprentice and apprentice registration number;
- **.5** The number of apprentices and labor hours worked by them, categorized by trade or craft;
- **.6** The number of journey level workers and labor hours worked by them, categorized by trade or craft; and
- **.7** The number, type, and rationale for the exceptions granted.

§ 3.4.10.6 The Contractor shall be entitled to a monetary incentive of $1,000 for meeting the goals identified in this Section 3.4.10. The Contractor shall be subject to a monetary penalty of $1,000 for failure to meet the goals identified in this Section 3.4.10. The Owner cannot within existing resources identify an expected cost value to be included in the bid associated with meeting these goals.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be

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free from defects, except for those inherent in the quality of the Work the Contract Documents require. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. The Contractor is not relieved of its general warranty obligations by the specification of a particular product or procedure in the Contract Documents. Warranties in the Contract Documents shall survive completion, acceptance, final payment, and the correction period identified in Section 12.2. The Contractor shall collect, assign, and deliver to the Owner any specific written warranties given by others. Warranty language shall comply with the Contract Documents and shall be submitted to the Owner and Architect at least thirty (30) days prior to ordering the warranted material or equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Owner will pay Washington State sales tax. Washington State sales tax shall not be included in the bid amount. The Contractor shall pay sales, consumer, use, B&O, income, and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for all permits, which include, without limitation, all fees, licenses, application fees, Department of Labor & Industries fees, renewals and penalties, reinspection fees, government fees, permit fees, and inspection fees assessed by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work. The Contractor shall coordinate and schedule all Work with entities having jurisdiction over the site, permitting agencies, utility companies, and other such agencies determined to have jurisdictional authority necessary for completion of the Work. The Contractor shall keep the Owner informed of communications from these authorities and utilities. The Owner will assist the Contractor with such coordination and scheduling, but the Owner is not responsible for any delays caused by such permitting agencies, utility companies, and other such agencies determined to have jurisdictional authority. The Contractor shall be responsible for providing all information and documents to the permitting agencies, utility companies, and other such agencies determined to have jurisdictional authority within thirty (30) days after issuance of the Notice to Proceed as necessary to obtain and coordinate permits, utility and other such connections. The Contractor shall obtain all permit renewals during the course of the Work. The Contractor is responsible for providing requested information to the Department of Labor and Industries.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction. If the Contractor observes that portions of the Contract Documents are at variance with applicable laws, statutes, ordinances, building codes, rules and regulations, or lawful orders of public authorities, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than seven (7) days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially

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different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15. If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall immediately notify the Owner and Architect. Upon receipt of such written notice, the Owner and Contractor shall promptly cooperate with each other and take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations that may affect the human remains, burial markers, archaeological sites or wetlands until otherwise instructed by the Owner, but shall continue with all other operations that do not affect those remains or features.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2, except where the allowance is based upon a unit price specified in the Agreement.

Allowances, if any, are defined in the Contract Documents due to the uncertainty in the scope, price and quantity of the Allowance items at the time the Agreement was executed. Whenever actual costs are more or less than the Allowance, the Contract Sum will be adjusted accordingly by Change Order. The Contractor must provide the Owner with written notice of its intent to exceed an Allowance amount, with estimates and justification (providing the Owner with the opportunity to approve or reject the excess costs) before exceeding an Allowance amount.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent, computer literate, and experienced project manager, superintendent, and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of the proposed project manager and superintendent. Within a reasonable time, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed project manager or superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within a reasonable time shall constitute notice of no reasonable objection. Upon request of Owner, the Contractor shall also furnish to the Owner and Architect:

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.1 A chain-of-command organizational chart which includes all supervisory personnel, including the project manager and the superintendent, assistant superintendent and lead foreman, that the Contractor intends to use on the Work. The chart shall specify any limits of authority for each person, including any limitation on his or her ability to speak for and bind the Contractor, as well as any limits on decision-making authority with respect to specific dollar values, Contract Time, and issues affecting quality of the Work.

.2 Complete resumes, including all past and current projects, for the project manager and superintendent. The Owner reserves the right to verify references and reserves the right to reject personnel reasonably believed to be unsuitable or incompatible for the Project. The Contractor shall replace any rejected personnel with an agreeable replacement at no increase in the Contract Sum or Contract Time.

.3 A list of telephone numbers for all key personnel of the Contractor and its principal subcontractors for purposes of contacting personnel after hours in the event of an emergency. The list shall be periodically updated as necessary to ensure the Owner has the most current information.

§ 3.9.3 The Contractor shall not employ a proposed project manager or superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the project manager or superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed. The Contractor shall have available for work on site experienced, skilled workers, such as carpenters, laborers, and erection specialists, to perform work as needed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.1.1 The Contractor shall promptly notify the Owner and Architect in writing of any proposed change in the Project Schedule or the Contract Time or of any event which could delay performance of any item of the Work, stating the cause of the delay, expected duration of the delay, the anticipated effect of the delay on the Project Schedule, and the action being taken to correct the delay. Notification of potential delay does not constitute a change in the Contract Time; only a Change Order signed by the Owner can amend the Contract Time. The Contractor shall comply with Article 15 with regard to any delays that it believes are the responsibility of the Owner or are otherwise the subject of a Claim for additional Contract Time.

§ 3.10.1.2 If any Project Schedule submitted sets forth a date for Substantial Completion for the Work or any phase of the Work beyond the Dates of Substantial Completion established in the Contract Documents (as the same may be extended as provided in the Contract Documents), the Contractor shall submit to the Architect and the Owner for their review and approval a narrative description of the means and methods which the Contractor proposes to use to expedite the progress of the Work to ensure timely completion of the various phases of the Work and the Work as a whole. Regardless of the cause of any delay, the Contractor shall exercise reasonable efforts to bring the Project back into compliance with the Project Schedule.

§ 3.10.1.3 To the extent that the Contractor or any Subcontractor or material supplier of any tier is responsible for the delay, the Contractor shall take all necessary action to bring the Project back into compliance with the Project Schedule, including without limitation increasing the number of personnel on the Project and implementing overtime and double shifts.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

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§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect and shall promptly notify the Owner of any substantial deviations from those schedules. The Contractor's Construction Schedule shall be based upon a critical path method ("CPM") analysis of construction activities and sequence of operations needed for the orderly performance and completion of all separable parts of the Work, in the form of a precedence diagram and activity listing and time-scaled, all in accordance with the Contract Documents and within the Contract Time.

§ 3.10.4 The Contractor shall not be entitled to any adjustment in the Contract Sum or Contract Time, or to any additional payment of any sort by reason of the loss or use of any float time, including time between the Contractor's anticipated completion date and end of the Contract Time, whether or not the float time is described as such on the Contractor's Construction Schedule. To ensure that the Owner is substantively aware and effectively able to mitigate any Project delays, the Contractor shall not be entitled to any extension of time, compensable or otherwise, for any delay that occurred during any time the Contractor has not timely submitted an updated Construction Schedule as required by the Contract Documents.

§ 3.10.5 The Contractor shall attend and participate in and ensure applicable Subcontractors of any tier attend and participate in:

- **.1** A preconstruction meeting;
- **.2** Regular weekly on-site Project status meetings to review progress of the Work, to discuss the Contractor's progress reports, to obtain necessary Owner's or Architect's approvals, and generally to keep the Owner and Architect informed and involved in the progress of the Project; and
- **.3** Other meetings scheduled from time to time by the Owner or by the Architect to review progress of the Work and other pertinent matters.

§ 3.10.6 Should the Contractor fail to meet any scheduled date as shown, the Contractor shall, upon request, be required at its own expense to submit within ten (10) days of the request a revised Progress Schedule and at its own expense to increase its work force and working hours (*e.g.*, through weekends, overtime and additional shifts) to bring the actual completion dates of the activities into conformance with the Progress Schedule. The Contractor shall also submit a revised Progress Schedule at its own expense (a) with each of its applications for payment and (b) within ten (10) days of notice from the Construction Project Manager or Architect that the sequence of work varies significantly from that shown on the Progress Schedule. The revised Progress Schedule will be reviewed at the construction site one (1) week prior to the due date of the Contractor's monthly application for payment. If requested by the Owner or Construction Project Manager, the Contractor shall provide copies of two (2) tabular reports: (a) a total float report clearly indicating the current critical path through project completion, and (b) a report of activity sorted by early start dates commencing with the previous update and including all undated activities during the previous month. Actual progress of the previous month will be recorded and incorporated into the update. The Owner may withhold any progress payment until such time as the Contractor has provided an approved revised Progress Schedule in a form satisfactory to the Construction Manager and Architect.

§ 3.10.7 The activities defined in the Contractor's Progress Schedule shall represent the planned durations in anticipation of normal manpower and equipment utilization and durations of whole working days. No activity duration for non-construction activities shall exceed fifteen (15) working days unless approved by the Owner. All durations shall be determined based upon resource planning under contractually defined onsite work conditions. All durations shall be of whole working days. In calculating activity durations, normal inclement weather shall be considered. The Contractor shall schedule the Work to minimize the effect of weather. The Contractor shall also protect the Work site from the effects of weather or take other necessary measures such that the Work can be completed within the time established in the Contract Documents and include these provisions in the Project Schedule as appropriate.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed. The location of all existing or new hidden piping, valves, conduit, cabling and utilities, as located during the course of construction, shall be appropriately marked until the actual field location dimensions and coordinates are incorporated on the as-built drawings, and mechanical and electrical deviations and changes shall be

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included. Upon Final Completion of the Work, the Contractor shall transfer all as-built information in a clear and legible manner as described in the Contract Documents and in compliance with all requirements of local governmental entities, shall certify in writing that these documents reflect complete and accurate "as-built" conditions and shall deliver the following in a clear, clean and legible manner and in compliance with all requirements of local governmental authorities: (i) complete, integrated copies of the documents in both paper form in good condition and in electronic form in the same format as originally created by the Architect; (ii) the approved permit set of plans; and (iii) the full-size record documents, Shop Drawings, Specifications, Addenda, maintenance manuals and warranties to the Architect for submittal to the Owner in accordance with the provisions of the Contract Documents. Satisfactory maintenance of up-to-date as-built drawings on a monthly basis will be a requirement for approval of progress payments.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors. The Contractor shall notify the Owner and Architect of any expedited review required. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect without action, which will not constitute an Owner-caused delay to the Contractor.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof. Any corrections or modifications to Shop Drawings made by the Architect shall be deemed accepted by the Contractor, without change in Contract Sum or Contract Time, unless the Contractor provides the Architect with written notice at least seven (7) working days before commencing any Work from such Shop Drawings and complies with the change procedures in

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the Contract Documents. The Contractor shall make all corrections requested by the Architect and, when requested by the Architect, provide a corrected submittal without change in the Contract Sum or Contract Time.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. Materials and equipment on site shall be used directly in the Work and not stored on site after their use is complete.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations for the Project. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

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§ 3.16 Access to Work
The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights
The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification
§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, its officials, Board members, agents, representatives, and employees from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 The Contractor shall fully defend, indemnify, and hold harmless the Indemnified Parties for the sole negligence of the Contractor. The indemnification obligations provided in this Section 3.18 do not extend to claims, damages, losses, and expenses arising from the sole negligence of the Indemnified Parties.

§ 3.18.3 The Contractor shall defend, indemnify, and hold harmless the Indemnified Parties for the concurrent negligence of the Contractor. The Contractor agrees to being added by the Owner as a party to any arbitration or litigation with third parties in which the Owner alleges indemnification or contribution from the Contractor, any of its Subcontractors of any tier, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable. The Contractor agrees that all of its Subcontractors of any tier shall, in their subcontracts, similarly stipulate; in the event any does not, the Contractor shall be liable in place of such Subcontractor(s) of any tier. To the extent any portion of this Section 3.18 is stricken by a court or arbitrator for any reason, all remaining provisions shall retain their vitality and effect.

§ 3.18.4 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor of any tier, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor of any tier under workers' compensation acts, disability benefit acts, or other employee benefit acts. After mutual negotiation of the parties, the Contractor waives immunity as to the Owner, the Architect and their respective consultants only under Title 51 RCW, "Industrial Insurance."

ARTICLE 4 ARCHITECT
§ 4.1 General
§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.2.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

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§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment and from time to time in the one (1) year period of the correction of Work. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Agreement. Neither the Architect nor the Owner's Project Manager is the agent of the Owner and neither is authorized to agree on behalf of the Owner to changes in the Contract Sum or Contract Time, nor to waive provisions of the Contract Documents, nor to direct the Contractor to take actions that change the Contract Sum or Contract Time except that the Owner's representative may issue Construction Change Directives in accordance with Section 7.3.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents. The presence of the Architect or the Owner at the site shall not in any manner be construed as assurance that the Work is being completed in compliance with the Contract Documents, nor as evidence that any requirement of the Contract Documents of any kind, including notice, has been met or waived. The Contractor shall reimburse the Owner for any amounts paid to the Architect for site visits made necessary by the fault of the Contractor or by defects and deficiencies in the Work.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work. Neither the Architect nor the Owner will be responsible for defining the extent of any subcontract or dealing with disputes between the Contractor and third parties.

§ 4.2.4 Communications

Except as otherwise provided in the Contract Documents or when direct communication have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect and Owner's Project Manager in all communications that relate to or affect the Architect's services or professional responsibilities or matters arising out of or relating to the Contract. The Contractor shall simultaneously provide the Owner with a direct copy of all written communications to the Architect, including all notices, requests, transmittals, substitutions, RFIs, Claims, and potential changes in the Contract Sum or Contract Time, but not including Shop Drawings, Product Data or Samples The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Work and the Contractor's Applications for Payment, the Architect will make recommendations to and otherwise assist the Owner to determine the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component. The Contractor shall clearly note, and the Architect shall not be required to search out, any deviations from the Contract Documents not clearly identified by the Contractor, nor shall the Architect be required to review partial submissions of those for which submission for correlated items have not been received. Regardless of how a submittal is marked, the Contractor should not presume that the Architect has reviewed a submittal in every aspect.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections and make observations to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.2.11, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until fifteen (15) days after written request is made for them.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents and agreeable to the Owner.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

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§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.1.3 A Subcontractor of any tier is a Subcontractor or a Sub-subcontractor.

§ 5.1.4 The designation of terms in this Article 5 is not meant to change or alter the definitions contained in Chapter 60.28 RCW ("Lien for Labor, Materials, Taxes on Public Works"), Chapter 39.12 RCW ("Prevailing Wages on Public Works"), or other statutory definitions of a subcontractor for the purposes of such statutes.

§ 5.1.5 A responsible Subcontractor is a person or entity who is qualified and can document training, experience, license, and special certification to perform work, supply materials, or provide equipment required and specified by the Contract Documents, and meets the requirements outlined in RCW 39.04.350.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within fourteen (14) days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection. Reasonable objection" shall include without limitation lack of "responsibility" of the proposed Subcontractor, as defined in RCW 39.26.160(2). Failure of the Architect to reply promptly shall constitute notice of no reasonable objection. If the Owner makes a reasonable objection, the Contractor shall replace the Subcontractor with no increase to the Contract Sum or Contract Time. Such a replacement shall not relieve the Contractor of its responsibility for the performance of the Work and compliance with all of the requirements of the Agreement within the Contract Sum and Contract Time.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was Responsible (as defined herein) and reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work; provided that, no increase in the Contract Sum or Contract Time shall be permitted for such change unless the Contractor acts promptly and responsively in submitted qualified names as required, and no increase shall be permitted if the Owner reasonably concludes that the proposed Subcontractor materially failed to perform satisfactorily on one or more projects for the Owner within three (3) years of the bidding date, or is otherwise not Responsible as defined herein.. Such replacement shall not relieve the Contractor of its responsibility for the performance of the Work or compliance with all of the requirements of the Agreement for the Contract Sum and within the Contract Time.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution. If the Owner reasonably concludes that any portion of the Work subcontracted by the Contractor is not being performed in accordance with the Contract Documents, the Contractor shall, upon request of the Owner, remove the Subcontractor performing such work. This removal shall not relieve the Contractor of its responsibility for the performance of the Work or complying with all of the requirements of the Agreement for the Contract Sum and within the Contract Time, nor shall the Owner be obligated to so request.

§ 5.2.5 The Contractor shall verify responsibility criteria for each first-tier Subcontractor. A Subcontractor of any tier that engages other Subcontractors must verify responsibility criteria for each of its lower-tier Subcontractors. Verification shall include that each Subcontractor of any tier, at the time of subcontract execution, meets the responsibility criteria listed herein and in the bidding documents for the bid package.

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§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors. The Contractor shall provide to the Owner copies of the written agreements between the Contractor and any Subcontractor, and a Subcontractor and any sub-tier Subcontractor, upon request.

§ 5.3.1 The Contractor agrees to diligently, and using its best efforts, cause each Subcontractor of any tier to correct, at that Subcontractor's own expense, all Work performed by the Subcontractor of any tier that is defective in material or workmanship or otherwise fails to conform to the Contract Documents, including all necessary removal, replacement and/or repair of any other portion of the Project which may be damaged in removing, replacing or repairing any portion of the Project. If any Subcontractor of any tier defaults in its obligations to promptly correct any such deficiency, the Contractor shall be responsible for correcting the deficiency.

§ 5.3.2 The Contractor shall provide, and shall cause its Subcontractors of any tier to provide, all required notices and comply with all applicable health and safety laws, rules, regulations, codes and lawful orders of public authorities and of quasi-governmental authorities relating to the Work, and the Contractor shall, and shall cause applicable Subcontractors of any tier to, indemnify, defend and hold harmless the Owner from and against any and all claims, liabilities, fines and attorneys' fees arising from any failure of the Contractor or a Subcontractor of any tier to have complied with any such requirements in any respect.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract, but only for events and payment obligations arising after the date of assignment

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

§ 5.5 Subcontractor Responsibility

§ 5.5.1 The Contractor shall include the language of this Section 5.5 in each of its first tier subcontracts, and shall require each of its Subcontractors to include the same language of this Section 5.5 in each of their subcontracts, adjusting only as necessary the terms used for the contracting parties. Upon request of the Owner, the Contractor shall promptly provide documentation to the Owner demonstrating that each Subcontractor meets the Subcontractor

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responsibility criteria in Section 5.5.2 below. The requirements of this Section apply to all Subcontractors regardless of tier.

§ 5.5.2 At the time of subcontract execution, the Contractor shall verify that each of its first tier Subcontractors meets the following bidder responsibility criteria:

.1 Have a current certificate of registration in compliance with Chapter 18.27 RCW, which must have been in effect at the time of subcontract bid submittal;

.2 Have a current state unified business identifier (UBI) number;

.3 If applicable, have:

(a) industrial insurance (workers' compensation) coverage for the Subcontractor's employees working in Washington, as required by Title 51 RCW;

(b) a Washington Employment Security Department number, as required by Title 50 RCW;

(c) a Washington Department of Revenue state excise tax registration number, as required by Title 82 RCW;

(d) an electrical contractor license, if required by Chapter 19.28 RCW;

(e) an elevator contractor license, if required by Chapter 70.87 RCW.

.4 Not be disqualified from bidding on any public works contract under RCW 39.06.010 or 39.12.065(3).

§ 5.6 Liens

§ 5.6.1 The Contractor shall promptly pay (and secure the discharge of any liens asserted by) all persons properly furnishing labor, equipment, materials or other items in connection with the performance of the Work (including, but not limited to, any Subcontractors of any tier) to the extent that the Owner has paid the Contractor for such. The Contractor shall furnish to the Owner such releases of liens and Claims and other documents monthly with its payment application to evidence such payment (and discharge). The Owner may, at its option, withhold payment, in whole or in part, to the Contractor until such documents are furnished. The Contractor may provide other security acceptable to the Owner, such as a bond, in lieu of paying disputed liens or Claims.

§ 5.6.2 The Contractor shall defend, indemnify, and hold harmless the Owner from any liens, including all expenses and the Architect's and attorneys' fees, except to the extent a lien has been filed because of the failure of the Owner to make a contractually required payment.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under conditions of the Agreement substantially similar to those, including those provisions of the conditions of the Agreement related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15, except that the Contractor shall have no Claim for such construction or operations to the extent disclosed in the Bidding Documents or Contract Documents or known to the Contractor prior to execution of the Agreement. The Contractor is also responsible to coordinate its Work with any other entities performing work on or adjacent to the site, such as work in the right of way and work by utility companies, and the Contractor shall incorporate such work into its project schedule.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

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§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents. If the Contractor receives items from a Separate Contractor or from the Owner for storage, erection or installation, the Contractor shall acknowledge receipt for items delivered, and thereafter will be held responsible for the care, storage and any necessary replacement of items received.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction. If such a Separate Contractor sues or initiates any proceeding against the Owner on account of any damages or delays alleged to have been caused by the Contractor, the Owner shall notify the Contractor and the Contractor shall defend all such proceedings at its own expense, and shall defend, indemnify, and hold the Owner harmless from any damages awarded on such claims, including all attorneys' fees and other costs incurred by the Owner.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.2.6 Should the Contractor or any of its Subcontractors of any tier cause damage of any kind, including but not limited to delay, to any other contractor or Subcontractor on the Project, the Contractor shall, upon due notice, promptly attempt to settle with such other contractor or Subcontractor by agreement or otherwise to resolve the dispute.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Agreement, and without invalidating the Agreement, by Change Order, Construction Change Directive, or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

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§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.1.4 A "minor change in the Work" referenced above is a change which has no direct or indirect effect upon the Contract Sum or Contract Time and includes, but is not limited to, a supplemental instruction.

§ 7.1.5 The Owner may request the Contractor via a Change Proposal Request to propose the amount of change to the Contract Sum, if any, and the extent of change in the Contract Time, if any, arising from the proposed change in the Work. The Contractor shall submit its responsive proposal as soon as possible and within ten (10) days, and shall in good faith specify the components and amount by which the Contract Sum and/or Contract Time would change. If the Contractor fails to respond within this time, the Owner may withhold some or all of a progress payment otherwise due until the tardy proposal is received. If the Owner explicitly accepts the proposal in writing, the Owner and the Contractor will be immediately bound to the terms of the proposal, the change will be included promptly in a future Change Order, and the change in the Work described in the proposal shall commence expeditiously. The Owner may reject the proposal, in which case the Owner may either not effectuate the change in the Work or may order the change through a Construction Change Directive or supplemental instruction or an order for a minor change in the Work. The Architect and the Owner may confer directly with Subcontractors of any tier concerning any item proposed to the Owner under this Article.

§ 7.1.6 If the Contractor adds a reservation of rights that has not been initialed by the Owner to any Change Order, Construction Change Directive, Change Order proposal, Application for Payment or any other document, all amounts therein shall be considered disputed and not due or payable unless and until costs are re-negotiated or the reservation is withdrawn or changed in a manner satisfactory to and, in all cases, initialed by the Owner. If the Owner makes payment for a Change Order or an Application for Payment that contains a reservation of rights not initialed by the Owner to indicate agreement with the reservation, and if the Contractor negotiates the check for such payment, then the reservation or rights shall be deemed waived, withdrawn and of no effect.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly. The Owner's use of a Construction Change Directive does not constitute agreement that the directive constitutes a change in the Work, the Contract Sum, or the Contract Time. For any change in the Work, whether initiated by a Construction Change Directive or a Change Order Proposal, the Contractor must submit its proposed price and any proposed extension of the Contract Time to the Owner within ten (10) days of the date of the Construction Change Directive or Change Order Proposal. If the Contractor fails to submit a proposed price and time within this time period, the Owner may establish what it believes to be the fair price of the changed work, and any additional Contract Time, and this price and time submitted by the Owner shall be final and binding upon the parties, as if they had signed a Change Order in this amount, without recourse to submitting any claims or litigation. Payment for any Changes to the Work shall not exceed the labor and equipment indicated on the daily work logs.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

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.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect and the Owner shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed, based on the quantity and cost of additional materials reasonable and necessary to perform the Change in the Work. The unit cost shall be based upon the net cost after all discounts or rebates, freight costs, express charges, or special delivery costs, when applicable. No lump sum costs will be allowed except when approved in advance by the Owner. If the Contractor is offered discounts and/or rebates based upon prompt payment, the Contractor shall offer the Owner the opportunity to take advantage of such discount and/or rebate, and if the Owner makes such a prompt payment then the Owner shall only be charged the price as reduced by the discount and/or rebate. If the Owner declines the opportunity the Contractor may keep any such discounts and/or rebates it achieves through its own prompt payment. If the Contractor does not provide the Owner the opportunity to participate then the Contractor may only charge the net costs after consideration of discounts and rebates;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others appropriate for the Work will be used solely on the Change in the Work at the site times the applicable rental cost as established by the lower of the local prevailing rate published in The Rental Rate Blue Book by Data Quest, San Jose, California, as modified by the AGC/WSDOT agreement or the actual, reasonable rate paid to unrelated third parties as evidenced by rental receipts. Rates and quantities of equipment rented that exceed the local fair market rental costs shall be subject to the Owner's prior approval. Total rental charges for equipment or tools shall not exceed 75% of the fair market purchase value of the equipment or the tool. Actual, reasonable mobilization costs are permitted if the equipment is brought to the site solely for the Change in the Work. If more than one rate is applicable, the best available rate will be utilized. The rates in effect at the time of the performance of the changed Work are the maximum rates allowable for equipment of modern design and in good working condition and include full compensation for furnishing all fuel, oil, lubrication, repairs, maintenance, and insurance to the same extent as the comparable Blue Book or fair market rate. Equipment not of modern design and/or not in good working condition will have lower rates. Hourly, weekly, and/or monthly rates, as appropriate, will be applied to yield the lowest total cost. When rental rates payable do not include fuel, lubrication, maintenance, and servicing, as defined as operating costs in the Blue Book, such operating costs shall be reimbursed based on actual costs. The rate for equipment necessarily standing by for future use on the changed work shall be no more than 50% of the rate established above. If equipment is required for which a rental rate is not established by Blue Book, an agreed rental rate shall be established for that equipment, which rate and use must be approved by the Owner prior to performing the Work.

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved. As soon as possible, but no later than seven (7) days of receipt, the Contractor shall advise the Architect in writing of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time. The

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Contractor's response shall reasonably specify the reasons for its disagreement and the adjustment or other terms that it proposes. Without such timely written response, the Contractor shall conclusively be deemed to have accepted the Owner's adjustment. The Contractor's disagreement shall not relieve the Contractor of its obligation to comply promptly with any written notice issued by the Owner or the Architect. The adjustment shall then be determined in accordance with the provisions of the Contract Documents.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be the greater of (i) the reasonable and prevailing value of the deletion or change, or (ii) the actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, and provided that any reservations of rights regarding the Construction Change Directive have been initialed by the Owner, amounts not in dispute for such changes in the Work may be included in Applications for Payment, accompanied by a Change Order indicating the parties' agreement with part or all of such costs.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 The Owner's final determination, in consultation with the Architect and the Owner's Project Manager, concerning the adjustments to the Contract Sum and/or Contract Time resulting from a Construction Change Directive constitute an "Event" for the purposes of submitting a Claim under Section 15.2.

§ 7.3.12 Within ten (10) days of Contractor's receipt of a Change Order, Contractor must issue a Change Order(s) to lower tier subcontractors impacted by the change. If Contractor does not issue a Change Order to any such subcontractor(s) within ten (10) days after its receipt of a Change Order, Contractor shall be solely responsible for any interest that accrues on the balance of the Change Order pursuant to RCW 39.04.360.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

§ 7.5 The cost of any changed Work or of any other increase or decrease in the Contract Sum, including a Claim, shall not include, among other things, consultant costs, attorneys' fees, or Claim preparation expenses.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

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§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 Timely completion of this Project is essential to the Owner. The Contractor shall proceed expeditiously with adequate forces and equipment, and shall work such hours, conduct overtime operations and weekend and holiday work as may be necessary to achieve Substantial Completion within the Contract Time. If the Contractor fails to perform in a timely manner in accordance with the Contract Documents and, through the fault of the Contractor or Subcontractors of any tier fails to meet the Construction Schedule, the Contractor shall take such steps as may be necessary to immediately improve its progress by increasing the number of workers, shifts, overtime operations or days of work, or other means and methods, all without additional cost to the Owner.

§ 8.2.4 It is the Contractor's option, but not its right, to attempt to complete the Project earlier than the dates specified in the Contract Documents. Thus, any Claim based upon delay shall be evaluated based upon the dates specified in the Contract Documents, not an earlier projected completion that the Contractor may propose.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work only to the extent reflected in approved Change Orders providing for specific extensions of the Contract Time; (3) by unanticipated abnormal weather; (4) by unexpected industry-wide labor disputes, fire, seismic event, unusual delay in deliveries, governmental delays (including unanticipated permit delays not caused by the Contractor), unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.5.2, or other causes beyond the Contractor's control; (5) by delay authorized by the Owner pending mediation and binding dispute resolution; or (6) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine, limited to the change in the critical path of the Construction Schedule directly caused thereby, as the Owner may determine consistent with the Contract Documents. In no event, however, shall the Contractor be entitled to any extension of time absent proof of (1) delay to an activity on the critical path of the Contract schedule, so as to actually delay the Project completion beyond the date of Substantial Completion, or (2) delay transforming an activity into the critical path of the Contract Schedule, so as to actually delay the Project completion beyond the date of Substantial Completion.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15 and shall include any proposed changes in the Contractor's Construction Schedule or the Contract Time, a description of any event that could delay performance or supplying of any item of the Work, the expected duration of the delay, the anticipated effect of the delay on the Contractor's Construction Schedule, and the action being taken to correct the delay situation. That the Owner or the Architect may be aware of the occurrence or existence of a delay through means other than the Contractor's written notification shall not constitute a waiver of a timely or written notice or Claim. The Contractor has an obligation to minimize and mitigate schedule impacts.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents; provided:

.1 If the delay was not caused by the Owner, the Contractor, a Subcontractor of any tier, or the Architect, or anyone acting on behalf of any of them, the Contractor is entitled only to an increase in the Contract Time in accordance with the Contract Documents but not an increase in the Contract Sum. If the delay was caused by the Contractor, a Subcontractor of any tier, or anyone acting on behalf of any of them, the Contractor is not entitled to an increase in the Contract Sum or Contract Time. The Contractor shall be entitled to a change in the Contract Sum only if the delay was caused by the Owner or the Architect, or anyone acting on behalf of them. The Contractor shall not recover damages, an equitable adjustment or an increase to the Contract Sum or Contract Time from the Owner where the Contractor could have reasonably avoided the delay by the exercise of due diligence. The Contractor shall be able to recover an increase to the Contract Sum, provided it is consistent with the terms of the Contract Documents, only if the delay was in the critical path, could not have reasonably been avoided, was unreasonable and was caused by the Owner or anyone acting

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on its behalf as permitted under the Contract Documents. The Owner is not obligated directly or indirectly for damages, an equitable adjustment, or an increase to the Contract Sum for any delay suffered by a Subcontractor of any tier that does not increase the Contract Time.

.2 The Contractor shall not in any event be entitled to damages arising out of actual or alleged loss of efficiency; morale, fatigue, attitude, or labor rhythm; constructive acceleration; home office overhead; expectant underrun; trade stacking; reassignment of workers; rescheduling of work, schedule compression; concurrent operations; dilution of supervision; learning curve; beneficial or joint occupancy; logistics; ripple; season change; extended or expanded overhead or general conditions; profit upon damages for delay; impact damages; cumulative impacts; or similar damages.

.3 The Contractor shall not be entitled to any adjustment to the Contract Sum or Contract Time, or to any additional payment of any sort, by reason of the loss or the use of any float time, including time not on the critical path or time between the Contractor's anticipated completion date and the end of the Contract Time, whether or not the float time is described as such on the Contractor's Construction Schedule.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

At least fourteen (14) days before the submission of the first Application for Payment, the Contractor shall submit a schedule of values to the Architect allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten (10) days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier because of a dispute or any other reason, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for

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Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.3.4 Retainage

§ 9.3.4.1 In accordance with RCW 60.28, a sum equal to five percent (5%) of each approved Application for Payment shall be retained. After award of a Contract for public improvements, or work for which retained percentages are required to be reserved under the provision of RCW 60.28, the Owner shall require the Contractor to exercise, in writing, one of the options listed below:

.1 Retained percentages will be retained in a fund by the Owner not subject to release until sixty (60) days following the Final Acceptance of the Work as completed and as provided in Section 9.10.4; or

.2 Deposited by the Owner in an interest-bearing account in a bank, mutual savings bank or savings and loan association and not subject to release until sixty (60) days following Final Acceptance of the Work as completed and as provided in Section 9.10.4; or

.3 Placed in escrow with a bank or trust company and not subject to release until sixty (60) days following the Final Acceptance of the Work as completed and as provided in Section 9.10.4.

§ 9.3.4.2 The Contractor or a Subcontractor may withhold payment of not more than five percent (5%) as retainage from the monies earned by any Subcontractor or Sub-subcontractor, per RCW 60.28, provided that the Contractor pays interest to the Subcontractor at the same interest rate it receives from its reserved funds. If requested by the Owner, the Contractor shall specify the amount of retainage and interest due a Subcontractor.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven (7) days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

.1 defective Work not remedied;

.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;

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.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

.7 unsatisfactory prosecution of the Work by the Contractor, including but not limited to failure to carry out the Work in accordance with the Contract Documents;
.8 delay by the Contractor and/or its Subcontractor(s) of any tier, or failure to comply with the Contractor's Construction Schedule requirements;
.9 failure to submit affidavits pertaining to wages paid as required by statute;
.10 failure to submit a properly updated Construction Schedule;
.11 failure to comply with a requirement of the Contract Documents in which the Owner has reserved the right to withhold payment;
.12 incurring liquidated damages;
.13 failure to properly maintain as-builts;
.14 failure to properly submit daily construction records;
.15 failure to properly submit certified payrolls; or
.16 failure to properly submit any other documents required of the Contractor under the Contract Documents.

§ 9.5.2 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 The Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.5.4 Pursuant to Chapter 39.12 RCW ("Prevailing Wages on Public Works"), the Contractor will not receive any payment until the Contractor and all Subcontractors of any tier for whom payment is sought have submitted state-approved "Statements of Intent to Pay Prevailing Wage" to the Owner. The statement must have the approval of the Industrial Statistician of the Department of Labor and Industries before it is submitted to the Owner. The statement must include the Contractor's registration number, the number of workers in each trade classification, and the applicable wage rate for each trade listed. The Contractor agrees to provide each Subcontractor of any tier with a schedule of applicable prevailing wage rates. The Contractor and the respective Subcontractors of any tier shall pay all fees required by the Department of Labor and Industries, including fees for the approval of the "Statement of Intent to Pay Prevailing Wages." Approved copies of the "Statement of Intent to Pay Prevailing Wages" must be posted where workers can easily read them.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents. The Owner will make a progress payment within thirty (30) days of its receipt and approval of the Architect's Certificate for Payment. The Owner shall be entitled to withhold payment to the extent provided by the Contract Documents, notwithstanding the issuance of a Certificate for Payment.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven (7) days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner. If the Contractor does not receive payment for any cause which is not the fault of a particular Subcontractor but does receive payment for materials supplied or work performed by that Subcontractor, the Contractor shall pay that Subcontractor in accordance with its subcontract for its satisfactorily completed work, less the retained percentage

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§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven (7) days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven (7) days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven (7) additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. All Work other than incidental corrective or punch list work and final cleaning shall be completed, including but not limited to the following:

.1 Obtaining applicable occupancy permits, including fire/life safety systems and health department approval, pressure vessel permits, elevator permits, and similar approvals or certificate by governing authorities and franchised services, assuring the Owner's full access and use of completed Work;

.2 Submitting the Contractor's punch list of items to be completed or corrected and written request for inspection;

.3 Completing final start-up, testing, and commence instruction and training sessions on all major building systems including HVAC and controls, intercom, data communications, fire alarm, telephone, fire sprinkler, security and clocks;

.4 Completing final start-up, testing, and commence instruction and training sessions of all pool systems, LOSS systems, and water systems;

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.5 Making a final changeover of locks and transmit new keys to the Owner, and advise the Owner of the changeover in security provisions;

.6 Removing unnecessary temporary facilities and services from the project site;

.7 Advising the Owner on coordination of shifting insurance coverages, including proof of extended coverages as required; and

.8 Completing final cleaning.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. . The Contractor shall proceed promptly to complete and correct items on the list and shall immediately clean up any dust or debris created through punch list work activities. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, and upon verification by the Architect that all permits, approvals, testing, training, and other submittals and administrative actions required under the Contract Documents for obtaining Substantial Completion have been satisfied, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the, and at its option, the Owner, will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion. If the Owner or Architect determines that the Work or designated portion is not substantially complete, the Contractor shall expeditiously complete the Work or designated portion, and again request an inspection. The Contractor shall pay the costs associated with this third and any further re-inspections.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion that, upon approval of the Owner, shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Contractor shall attach and submit with the executed Certificate of Substantial Completion the Certificate of Occupancy as well as a written list of each outstanding and unresolved Claim; any Claim not so submitted and identified, other than retainage and the undisputed balance of the Contract Sum, shall be deemed waived and abandoned. If the Owner or Architect determines that the Work or designated portion is not Substantially Complete, the Contractor shall expeditiously complete the Work or designated portion, again request an inspection, and pay the costs associated with the re-inspection, including Architect and consultant fees.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Any items not included by the Architect but required or necessary for Final Completion shall be supplied and installed by the Contractor as a part of the Contract Sum, notwithstanding if the items were not recorded by the Architect. Upon such acceptance of the Certificate of Substantial Completion by the Owner and the Contractor, and upon Contractor's Application for Payment and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof as provided in the Contract Documents. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents. No further payment shall become due or owing until the payment following Final Completion.

§ 9.8.6 The Contractor shall prepare, continue to monitor with the Architect, and cause to be completed, all punch lists with respect to the activity of each Subcontractor and report weekly to the Owner on all outstanding punch list items. Beginning thirty (30) days before the scheduled date of Substantial Completion, the Contractor shall prepare reports weekly, identifying items to be completed in order to obtain required certificates of occupancy and make recommendations to the Owner with respect to effectuating the earliest possible completion.

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§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may, upon written notice to the Contractor, take possession of, operate, occupy or use any completed or partially completed portion of the Work at any stage. Unless otherwise agreed in writing, such possession, use or operation shall not be deemed acceptance of any portion of the Work, nor accelerate the time for any payment to the Contractor under the Agreement, nor prejudice any rights of the Owner under the Agreement or under any insurance, bond, guaranty, or other requirement of the Agreement, nor relieve the Contractor of the risk of loss or any of its obligation under the Agreement, nor establish a Date of Substantial or Final Completion, nor establish a date for termination or partial termination of the running of liquidated damages, nor constitute a waiver of any Owner Claims. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Final Completion

§ 9.10.1.1 The Contractor shall cause punch list items to be completed within thirty (30) days of Substantial Completion of each phase (or such other period of time as is specified in the Contract Documents) or within such reasonable period as may be required to correct the item (in the event that the punch list items are, because of their nature, incapable of correction during that period), provided that the Contractor commences to correct the item within that period and thereafter diligently and in good faith pursues the corrective action to completion. If, at fifteen (15) days after the Date of Substantial Completion, the Owner considers that the punch list items are unlikely to be completed within thirty (30) days of the date of Substantial Completion of each phase (or such other period of time as is specified in the Contract Documents), the Owner may, upon seven (7) days' written notice to the Contractor, take over and perform some or all of the punch list items. If the Contractor fails to correct the deficiencies within this seven (7) day period, the Owner may back-charge the actual cost of performing this punch list work, including any design costs, plus 15% to account for the Owner's transaction costs.

§ 9.10.1.2 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance, the Architect will promptly make such inspection accompanied by the Contractor (if requested by the Architect or Owner). If the Architect or Owner determines that some or all of the punch list items are not accomplished, the Contractor shall be responsible to the Owner for all costs, including re-inspection fees, for any subsequent Architect inspection to determine compliance with the punch list. . When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly notify the Owner and the Contractor in writing that, to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.1.3 The Contractor is liable for, and the Owner may deduct from any amounts due the Contractor, all Architect, engineer or other design consultant fees and all Commissioning Agent and Construction Manager fees incurred by the Owner for services performed more than thirty (30) days after Substantial Completion of all the Work (or such other period of time as is specified in the Contract Documents), whether or not those services would have been performed prior to that date had Final Completion been achieved in a timely manner.

§ 9.10.1.4 When the Architect finds that the Work has been concluded, a final occupancy permit has been issued, any commissioning process and validation process have been successfully concluded, and the Contractor has submitted all the items identified in Section 9.10.1.5 to the Architect, the Contractor may submit a final Application for Payment. The Architect will then promptly issue a final Certificate for Payment stating that the entire balance found to be due the Contractor and noted in said final Certificate is due and payable. The Architect's final Certificate for Payment shall establish the date of Final Completion upon its execution by the Owner.

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§ 9.10.1.5 "Final Completion" will be attained when the Contractor has accomplished the following:

.1 Completed all requirements listed in Section 9.8 for Substantial Completion;

.2 Completed all remaining punch list items and remaining Work, and obtain approval by Architect and Owner that all Work is complete;

.3 Obtained permanent occupancy permits (if only a temporary occupancy permit was issued at Substantial Completion);

.4 Submitted final change order and final Application for Payment;

.5 Submitted record documents, any final property survey, and operation and maintenance manuals required by the Contract Documents;

.6 Delivered tools, spare parts, extra stock of material and similar physical items to the Owner as required by the Contract Documents;

.7 Completed final cleaning after punch list work (in addition to the final cleaning that was required to obtain Substantial Completion;

.8 Completed instruction and training sessions on all major building systems including HVAC, intercom, data communications, fire alarm, telephone, fire sprinkler, emergency power, security and clocks;

.9 Submitted executed warranties;

.10 Made final changeover of locks and transmit new keys to the Owner, and advise the Owner of the changeover in security provisions;

.11 Discontinued or changed over and removed temporary facilities and services from the project site; and

.12 Advised the Owner on coordination of shifting insurance coverages, including proof of extended coverages as required.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Owner has formally accepted the Project ("Final Acceptance"). To achieve Final Acceptance, the Architect must have issued a final Certificate for Payment, an occupancy permit must have been issued, Final Completion must have occurred, and the Contractor has submitted the following to the Architect and the Owner:

.1 an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied;

.2 a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to the Owner;

.3 a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents;

.4 consent of surety, if any, to final payment;

.5 other data establishing payment or satisfaction of or protection against obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner (Contractor's Affidavit of Release of Liens,). If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees;

.6 subcontractors of any tier certified by the Industrial Statistician of the Washington State Department of Labor and Industries, with the fees paid by the Contractor or Subcontractor;

.7 all warranties, guarantees, training, manuals, operation instructions, certificates, spare parts, maintenance manuals and stock, specified excess material, as-built drawings and other documents, training or items required by the Contract Documents or local governmental entities; and

.8 all submittals and information sufficient for the Owner to submit apprenticeship utilization data as required by RCW 39.04.320(5)(a).

§ 9.10.3 The retainage will be held and applied by the Owner as a trust fund in a manner required by Chapter 60.28 RCW. Release of the retainage will be processed in ordinary course of business upon the expiration of sixty (60) days following Final Acceptance of the Work by the Owner provided that no notice of lien shall have been given as provided in Chapter 60.28RCW, that no Claims have been brought to the attention of the Owner and that the Owner has no claims under this Contract. The following items must also be obtained prior to release of retainage; pursuant to Chapter 60.28 RCW, a certificate from the Department of Revenue; pursuant to Chapter 50.24 RCW, a certificate

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from the Department of Employment Security; and appropriate information from the Department of Labor and Industries.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

.1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;

.2 failure of the Work to comply with the requirements of the Contract Documents; or

.3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

§ 9.10.6 The execution of a Change Order shall constitute a waiver of Claims by the Contractor arising out of the Work to be performed or deleted pursuant to the Change Order, except as specifically described in the Change Order. Reservations of rights will be deemed waived and are void unless the reserved rights are specifically described in detail to the satisfaction of the Owner and are initialed by the Owner.

§ 9.10.7 The Contractor and all Subcontractors of any tier shall maintain books, ledgers, records, documents, estimates, bids, correspondence, logs, schedules, emails, facsimiles, and other tangible and electronic data and other evidence relating or pertaining to the costs and/or performance of the Contract ("Records") to such extent and in such detail as will properly reflect and fully support compliance with the requirements of the Contract Documents and with all costs, charges and other amounts of whatever nature. The Contractor shall preserve such Records for a period of six (6) years following the date of Final Acceptance under the Agreement and for such longer period as may be required by any other provision of the Agreement. Within seven (7) days of the Owner's request, the Contractor agrees to make available at the office of the Contractor during normal business hours all Records for inspection, audit and reproduction (including electronic reproduction) by the Owner or its representatives. These requirements shall also be applicable to each Subcontractor of any tier and included in each Subcontract and purchase order issued with respect to the Work, except fixed-price Subcontracts where the price is $25,000 or less. The Contractor agrees, on behalf of itself and Subcontractors of any tier, that any rights under RCW 42.56 will commence at Final Acceptance, and that the invocation of such rights at any time by the Contractor or a Subcontractor of any tier, or their respective representatives, shall initiate an equivalent right to disclosures from the Contractor and Subcontractors of any tier for the benefit of the Owner. Failure to fully comply with any requirements of this Section shall constitute a material breach of contract and shall constitute a waiver of all claims by the Contractor and any Subcontractor that does not fully comply.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

§ 10.1.1 The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall have the right to control and shall be solely and completely responsible for conditions of the work site, including safety of all persons and property, during performance of the Work. The Contractor shall maintain the Work site and perform the Work in a manner that meets statutory and common-law requirements for the provision of a safe place to work. This requirement shall apply continuously and not be limited to working hours. Any review by the Owner or the Architect of the Contractor's performance shall not be construed to include a review of the adequacy of the Contractor's safety measures in, on or near the site of the Work.

§ 10.1.2 No action or inaction of the Owner or the Architect relating to safety or property protection or a violation thereof shall in any way: (1) relieve the Contractor of sole and complete responsibility for the violation and the correction thereof, or of sole liability for the consequences of said violation; (2) impose any obligation upon the Owner or Architect to inspect or review the Contractor's safety program or precautions or to enforce the Contractor's compliance with the requirements of this Article 10; (3) impose any continuing obligation upon the Owner or Architect to ensure the Contractor performs the Work safely or to provide such notice to the Contractor or any other person or entity; (4) affect the Contractor's sole and complete responsibility for performing the Work safely or the Contractor's responsibility for the safety and welfare of its employees and the employees of Subcontractors of any tier; or (5) affect the Contractor's responsibility for the protection of property, staff and the general public.

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§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to:

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss. The Contractor shall comply with all notices and comply with all requests from the Owner regarding the safety and protection of the Owner's patients, visitors, and staff. The Contractor shall comply with the safety regulations set forth in "Safety Standards for Construction" and "General Safety Standards" and any other requirements published by the Washington State Department of Labor and Industries. The Contractor shall comply with the Federal Occupational Safety and Health Act of 1970 ("OSHA"), including all revisions, amendments and regulations issued thereunder, and the provisions of the Washington Industrial Safety and Health Act of 1973 (WISHA), including all revisions, amendments and regulations issued thereunder by the Washington State Department of Labor and Industries. The WISHA regulations shall apply to all excavation, trenching and ditching operations. In case of conflict between any such requirements, the more stringent applicable regulation or requirement shall apply.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards. The Contractor shall maintain at the work site office or other well-known place at the work site all materials (e.g., a first aid kit) necessary for giving first aid to the injured, and shall establish, publish and make known to all employees procedures for ensuring immediate removal to a hospital or a doctor's care, persons, including employees, who may have been injured on the site. Employees shall not be permitted to work on the site before the Contractor has established and made known procedures for removal of injured persons to a hospital or a doctor's care. The Contractor and/or any Subcontractors shall ensure that at least one of such employees has a valid, effective first aid card.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 At all times until the Owner's occupancy of the Work or a designated portion of the Work, the Contractor shall protect from damage, weather, deterioration, theft, vandalism and malicious mischief, and shall bear the risk of any uninsured loss or destruction of, or injury to damage to, all materials, equipment, tools, and other items

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incorporated or to be incorporated in the Work or designated portion, or consumed or used in the performance of the Work or designated portion and all Work in process and completed Work or designated portion. Protection of the Work shall include but not be limited to protection of soils, subgrade preparation, exterior concrete, masonry, sealant, gypsum sheathing, roofing and interior finishes. The Contractor is responsible for any delays or costs resulting from the Contractor's failure to protect the Work from weather damage, weather, deterioration, theft, vandalism and malicious mischief. Contractor is further responsible for any deductible amounts related to any insurance coverage.

§ 10.2.9 Any notice given to the Contractor by the Owner or the Architect of a safety or property protection violation will not: (1) relieve the Contractor of sole and complete responsibility for the violation and the correction thereof, or for sole liability for the consequences of said violation; (2) impose any obligation upon the Owner or Architect to inspect or review the Contractor's safety program or precautions or to enforce the Contractor's compliance with the requirements of this Article 10; or (3) impose any continuing obligation upon the Owner or Architect to provide such notice to the Contractor or any other persons or entity.

§ 10.2.10 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding twenty-one (21) days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter. This Section does not apply to Claims, damages for additional costs or time, acceleration, or delay.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition. The Contractor shall proceed with the Work in areas not affected.

§ 10.3.2 Upon receipt of the Contractor's notice, and with the Owner's agreement, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection, but the Owner shall not be responsible for any delay resulting from the Contractor's unreasonable objection to such person or entity. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity or if the removal of such material or substance was a part of the Contractor's Work.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the

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extent of the Contractor's fault or negligence in the use and handling of such materials or substances. The Contractor shall store all hazardous materials safely, whether or not required by Contract Documents. The Contractor shall not install hazardous materials, including without limitation asbestos, lead, mercury, or polychlorinated biphenyl (PCB), in the Work.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

§ 10.5 Public Safety and Convenience

The Contractor shall conduct its Work so as to ensure the least possible obstruction to vehicular traffic and inconvenience to the general public and others in the vicinity of the Work and to ensure the protection of persons, property and natural resources. No road or street shall be closed to the public except with the permission of the Owner and the proper governmental authority. Fire hydrants on or adjacent to the Work shall be accessible to firefighting equipment at all times. Temporary provisions shall be made by the Contractor to ensure the use of sidewalks, fire lanes, private and public driveways and proper functioning of gutters, sewer inlets, drainage ditches and culverts, irrigation ditches and natural water courses, if any, on the Work site.

ARTICLE 11 INSURANCE, BONDS, INDEMNITY

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located possessing an A.M. Best's policyholder's rating of A or better and a financial rating of no less than VII and reasonably acceptable to the Owner, an occurrence-based Commercial General Liability Insurance Policy, which shall provide personal injury, bodily injury and property damage liability to cover the Contractor's operations, including Subcontractors and suppliers of any tier; owned, non-owned and hired vehicles; on work the Contractor may subcontract or sublet to others; and on the indemnity provisions of this Contract, including but not limited to premises, products/completed operations, personal injury, blanket contractual liability, pollution, environmental hazards, explosion, collapse or underground, employment related practices coverage, and stopgap employer's liability. This insurance will name the Owner, Architect, and Owner's Project Manager as additional insureds for all coverages required by Section 11.1 and will include a severability of interest (cross liability clause) for Work performed under this Contract. The Contractor's policy shall be designated primary coverage for both defense and indemnity, and any Owner's policies excess. Such limits of liability insurance shall have per project general aggregate provisions and shall not be less than the following:

.1 $5,000,000 per occurrence for bodily injury liability including sickness, disease or death and $5,000,000 bodily injury liability for all occurrences (other than automobiles);

.2 $5,000,000 for property damage liability (other than automobiles) because of damage to or destruction of property of others including loss of the use thereof caused by one occurrence and $5,000,000 property damage liability for all occurrences;

.3 As an alternate to subsections .1 and .2 above, the Contractor may insure for $10,000,000 Combined Single Limit protection for both bodily injury and property damage liability per occurrence and $10,000,000 general aggregate stop loss;

.4 $5,000,000 per accident for bodily injury liability including sickness, disease or death and property damage liability because of damage to or destruction of property of others including loss of use thereof arising out of the operation of automobiles;

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.5 $5,000,000 for claims for damages insured by personal injury liability coverage (included and defined in the Commercial General Liability Insurance Policy) which are sustained (1) by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor, or (2) by another person;

.6 $5,000,000 for claims involving damages to a person as a result of an offense directly or indirectly related to employment of such person by the Contractor or another employee;

.7 $5,000,000 for claims involving blanket contractual liability insurance (included and defined in the Commercial General Liability Insurance Policy) applicable to the Contractor's obligations under Section 3.18;

.8 In addition, the Contractor shall maintain a true umbrella policy that provides excess limits over the primary layer, in an amount not less than $10,000,000;

.9 Builder's Risk or equivalent policy in the amount of the Contract Sum, plus all Modifications, comprising the total value for the Project on a replacement cost basis without optional deductibles. This insurance shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings, and debris removal including demolition occasioned by enforcement of any applicable legal requirements. This insurance shall cover portions of the Work stored off site, and portions of the Work in transit, and shall name Owner as a loss payee; and

.10 Workers' Compensation insurance at statutory limits.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, shall be written on an occurrence basis, shall be maintained without interruption from the date of commencement of the Work until the date of Final Acceptance and termination of any coverage required to be maintained after final payment. Completed operations coverage shall remain in force for three (3) years after Final Acceptance. All policies and certificates shall contain a provision that written notice must be provided to the Owner thirty (30) days before the policies are canceled; Contractor must provide the Owner and Architect forty-five (45) days' written notice before the policies expire or any coverages afforded under the policy are reduced, limits decreased, or the additional insureds removed. Upon receipt of a notice of cancellation or expiration from Contractor before Final Acceptance, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor.

§ 11.1.3 The Contractor shall furnish to the Owner and Architect copies of any subsequently issued endorsements amending, modifying, altering or restricting coverage or limits. Losses up to the deductible amount or otherwise not covered by insurance shall be the responsibility of the Contractor. The Contractor shall furnish to the Owner Copies of Certificates of Insurance evidencing all insurance required by the Contract Documents. No progress payment shall be made until all such Certificates are furnished.

§ 11.1.4 The Owner's specification or approval of the insurance in this Contract or of its coverage or amount shall not relieve or decrease the liability of the Contractor under the Contract Documents or otherwise. Coverages are the minimum to be provided and are not limitations of liability under the Contract, indemnification, or applicable law provisions. The Contractor may, at its expense, purchase larger coverage amounts. Notwithstanding anything herein to the contrary, the Contractor shall provide all bonding, insurance, and permit documentation as required by governmental entities for all portions of the Project.

§ 11.1.5 The Contractor shall ensure and require that Subcontractors of any tier have insurance coverage to cover bodily injury and property damage on all operations and all vehicles owned or operated by Subcontractors of all tiers in the amount of $3,000,000 per occurrence with a $3,000,000 aggregate limit. Also, the Subcontractors shall name both the Contractor and the Owner as an additional insured giving at least thirty (30) days' notice of cancellation.

§ 11.1.6 If the Owner is damaged by the failure of the Contractor to maintain any of the insurance in this Article 11 or to so notify the Owner, then the Contractor shall bear all costs attributable thereto.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain until Final Acceptance, in a company or companies lawfully authorized to do business in the State of Washington, property insurance for the entire Work at the site to the full

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insurable value thereof less costs of clearing, preparation and excavation of the site under this Contract. This insurance shall insure against the perils of fire and extended coverage and physical loss or damage.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner does not waive the subrogation rights to the extent of its property insurance on structures or portions of structures that do not comprise the Work. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this Section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§11.4 Adjustment and Settlement of Insured Loss

§ 11.4.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.4.2. The Owner shall distribute the proceeds so received in accordance with such agreement as the parties in interest may reach. If no agreement is reached, any damaged Work shall first be repaired or replaced, and payment therefor made from the separate account by Change Order or by payment to a separate contractor, at Owner's option; further disbursements will then be determined pursuant to the Contract Documents. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner. Any inconsistent policy provisions will supersede the provisions of this Section.

§ 11.4.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have fourteen (14) days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

§ 11.5 Performance Bond and Payment Bond

§ 11.5.1 Contractor's Bonds

The Contractor shall secure and pay for, from a surety company acceptable to the Owner and admitted and licensed in the State of Washington and possessing an A.M. Best's policyholder's rating of A or better and a financial rating of no less than VIII, separate bonds covering the faithful performance of the Agreement and payment of obligations arising under the Contract Documents, each in the full amount of the Contract Sum, pursuant to Chapter 39.08 RCW ("Contractor's Bond"). Within ten (10) days of executing the Agreement, the Contractor shall deliver two copies of the bonds to the Owner and one copy to the Architect. THE OWNER MAY WITHHOLD PAYMENT TO THE CONTRACTOR UNTIL SUCH SURETY BONDS ARE RECEIVED AND MAY TERMINATE THE CONTRACT FOR CAUSE if the Contractor fails to submit such bonds within the time provided herein. The Contractor shall be responsible for any delay in the Contract Time because of failure to submit acceptable bonds.

§ 11.5.2 Subcontractors' Performance and Payment Bonds

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Each Subcontractor so required by a bidding package or RCW 39.10.380 shall secure and pay for, from a surety company acceptable to the Owner and the Contractor and admitted and licensed in the State of Washington, bonds covering the faithful performance of the subcontract and payment of obligations arising under the Contract Documents related to the subcontract, each in the full amount of the subcontract sum, pursuant to Chapter 39.10 RCW and Chapter 39.08 RCW. Within ten (10) days of entering into the subcontract, and before any payment is due, the Subcontractor shall deliver copies of the bonds to the Owner and to the Architect.

§ 11.6 If the Owner is damaged by the failure of the Contractor to maintain any of the bonds or insurance in this Article 11 or to so notify the Owner, then the Contractor shall bear all costs attributable thereto. The Owner may withhold payment pending receipt of all certificates of insurance and bonds. Failure to withhold payment shall not constitute a waiver.

§ 11.7 Indemnification

The Contractor shall defend, indemnify, and hold harmless the Owner and the Architect and their agents, employees, and consultants, successors and assigns from and against all claims, damages, losses and expenses of third parties, direct and indirect, or consequential, including costs, design professional fees, and attorneys' fees incurred by the Owner related to such claims and in proving the right to indemnification ("Claims"), only to the extent caused by the negligent acts and/or omissions of the Contractor and/or its subcontractors of any tier. In the event of the concurrent negligence of the Owner, the Contractor's obligation to indemnify and hold harmless the Owner only extends to the extent said damages are caused by the negligence of the Contractor and/or its subcontractors of any tier.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, Owner, or governmental authority, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect, Owner, or governmental authority has not specifically requested to examine prior to its being covered, the Architect, Owner, or governmental authority may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense unless the condition was caused by the Owner or a Separate Contractor employed by the Owner, and in that event the Owner or the Separate Contractor shall be responsible for payment of such costs.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or Owner or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one (1) year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under this Section, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. If the Contractor does not promptly in accordance with the provisions of this Section 12.2.2 initiate work to correct the Work designated in the notice, the Owner may proceed to correct the Work and may, without further notice, dispose of materials and equipment as it sees fit, and the Contractor will be liable for all costs.

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§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced by the greater of the (1) cost of correction, or (2) diminution of value of the Work that is not in accordance with the requirements of the Contract Documents.. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the State of Washington. Venue for any litigation shall be in the Superior Court for Island County, Washington.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Written Notice

Notice required hereunder shall be deemed to have been duly served if delivered in person to the individual, to the designated representative as identified in the Agreement, or to an officer of the corporation for which it was intended; or if delivered at, via reliable overnight delivery courier service providing proof of delivery to, the last business address known to the party giving notice. The date of written notice shall be the earlier of the date of personal delivery, or three (3) calendar days after the date of postmark.

§ 13.4 Rights and Remedies

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

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§ 13.4.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4.3 If any portion of this Contract is held to be void or unenforceable, the remainder of the Contract shall be enforceable without such portion.

§ 13.5 Tests and Inspections

§ 13.5.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals; except that the Contractor will be responsible for any costs of re-testing and any extra costs incurred as a result of the Contractor. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The independent testing agency shall prepare the test reports, logs and certificates applicable to the specific inspections and tests and promptly and simultaneously deliver the specified number of copies of them to the designated parties. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.5.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If procedures for testing, inspection, or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Owner and Architect.

§ 13.5.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 Statutes and Other Requirements

The Contractor shall abide by the provisions of all applicable Washington statutes and regulations. Although a number of statutes are referenced in the Contract Documents, these references are not meant to be a complete list and should not be relied upon as such.

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§ 13.7.1 Contractor Registration and Related Requirements

Pursuant to Chapter 39.06 RCW ("Public Works – Registration, Licensing of Contractors") the Contractor shall be registered and licensed as required by the laws of the State of Washington, including but not limited to Chapter 18.27 RCW ("Registration of Contractors"). The Contractor shall: have a current state unified business identifier number; have industrial insurance coverage for the Contractor's employees working in Washington as required in Title 51 RCW; have an employment security department number as required in Title 50 RCW; have a state excise tax registration number as required in Title 82 RCW; and not be disqualified from bidding on any public works contract under RCW 39.06.010 (unregistered or unlicensed contractors) or RCW 39.12.065(3) (prevailing wage violations).

§ 13.7.2 Law Against Discrimination

The Contractor shall comply with pertinent statutory provisions relating to public works of Chapter 49.60 RCW ("Discrimination").

§ 13.7.3 Provisions for Aged and Handicapped Persons

The Contractor shall comply with pertinent statutory provisions relating to public works under Chapter 70.92 RCW ("Provisions in Buildings for Aged and Handicapped Persons") and the Americans With Disabilities Act.

§ 13.7.4 Safety Standards

The Contractor shall comply with pertinent provisions of Chapter 49.17 RCW ("Washington Industrial Safety and Health Act") and Chapter 296-155 WAC ("Safety Standards for Construction Work").

§ 13.7.5 Drug-Free Workplace

The Contractor and all Subcontractors of any tier shall fully comply with all applicable federal, state, and local laws and regulations regarding drug-free workplace, including the Drug-Free Workplace Act of 1988. Any person not fit for duty for any reason, including the use of alcohol, controlled substances, or drugs, shall immediately be removed from the Work.

§ 13.7.6 Asbestos Removal

To the extent this Project involves asbestos removal, the Contractor shall comply with Chapter 49.26 RCW ("Health and Safety – Asbestos") and any provisions of the Washington Administrative Code promulgated thereunder, and the applicable section of the Specifications should be viewed for possible insurance required for the applicable Subcontractor.

§ 13.7.7 Lead, Copper, and Cadmium in Drinking Water

No materials or products may be installed or otherwise incorporated into the Work that contain lead, copper, or cadmium that exceed the actionable limits of the Environmental Protection Agency and the Safe Drinking Water Act. Neither the Architect nor the Owner will approve any substitution of material or product that may contain harmful levels of lead, copper, or cadmium, whether in plumbing, water fixtures, or any other fixture, equipment or incorporated building material. At the time of Final Acceptance, Contractor shall submit a letter to the Owner that no lead contamination or lead products have been installed in the building or anywhere throughout the Project in violation of this contractual provision and applicable laws.

§ 13.7.8 Pursuant to Chapter 49.70 RCW ("Worker and Community Right to Know Act") and WAC 296-901 et seq., the Contractor shall provide the Owner copies of and have available at the Project Site a workplace survey or material safety data sheets for all "hazardous" chemicals under the control or use of Contractor or any Subcontractor of any tier at the Project Site. Contractor shall not be entitled to any additional Contract Time or compensation arising from its failure or alleged failure to comply with this statute or regulation.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped; or

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.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent (100%) of the total number of days scheduled for completion, or one hundred twenty (120) days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven (7) days' notice to the Owner and Architect, during which period the Owner may cure, terminate the Contract and recover from the Owner payment for Work properly executed, as well as reasonable overhead and profit on Work executed, and costs incurred by reason of such termination. The total recovery of the Contractor shall not exceed the unpaid balance of the Contract Sum.

§ 14.1.4 If the Work is stopped for a period of sixty (60) consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven (7) additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3. The total recovery of the Contractor shall not exceed the unpaid balance of the Contract Sum.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor:

.1 refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 fails to comply with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 fails to prosecute the Work or any portion thereof with sufficient diligence to ensure the Substantial Completion of the Work within the Contract Time;

.5 is adjudged bankrupt, makes a general assignment for the benefit of its creditors, or if a receiver is appointed on account of its insolvency; or

.6 is otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven (7) days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4;

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work; and

.4 Take or direct any or all of the actions in Section 14.5.1.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

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§ 14.2.5 If the Owner terminates a portion of the Work, the Contractor shall continue the performance of the remainder of the Work in accordance with the Contract Documents to the extent not terminated.

§ 14.2.6 If, after the Contractor has been terminated pursuant to this Section 14.2 or otherwise for cause, it is determined that none of the circumstances set forth in Section 14.2.1 exists, then such termination shall be considered a termination for convenience pursuant to Section 14.4.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and reasonable profit, not to exceed the Contract Sum, as reduced by payments otherwise made.

§ 14.5 Effects of Termination by Owner

§ 14.5.1 Unless the Owner directs otherwise, after receipt of a Notice of Termination from the Owner pursuant to Section 14.2 or 14.4, the Contractor shall promptly:

.1 stop Work under the Contract on the date and as specified in the Notice of Termination;

.2 place no further orders or subcontracts for materials, equipment, services or facilities, except as may be necessary for completion of any portion of the Work that is not terminated;

.3 procure cancellation of all orders and subcontracts, upon terms acceptable to the Owner, to the extent that they relate to the performance of Work terminated;

.4 assign to the Owner all of the right, title and interest of the Contractor under all orders and subcontracts, as directed by the Owner, in which case the Owner shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

.5 with the Owner's approval, settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts not assigned to the Owner;

.6 transfer title and deliver to the entity or entities designated by the Owner the fabricated or unfabricated parts, Work in process, partially completed supplies and equipment, materials, parts, tools, dies, jigs and other fixtures, completed Work, supplies and other material produced as part of, or acquired in connection with the performance of, the Work terminated, and the completed or partially completed plans, drawings, information and other property related to the Work;

.7 use commercially reasonable efforts to sell any property of the types referred to in Section 14.5.1.6. The Contractor shall not be required to extend credit to any buyer, and may acquire any such property under the conditions prescribed by and at a price or prices approved by the Owner, and the proceeds of any such transfer or disposition may be applied in reduction of any payments to be made by the Owner to the Contractor;

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.8 take such action as may be necessary or as directed by the Owner to preserve and protect the Work and property related to this Project in the possession of the Contractor in which the Owner has an interest; and

.9 continue performance only to the extent not terminated.

§ 14.5.2 In arriving at any amount due the Contractor after termination, the following deductions shall be made:

.1 all unliquidated advance or other prior payments on account made to the Contractor applicable to the terminated portion of the Contract;

.2 any claim the Owner may have against the Contractor;

.3 an amount necessary to protect the Owner against outstanding or potential liens or Claims; and

.4 the agreed price for or the proceeds of sale of any materials, suppliers or other things acquired by the Contractor or sold, pursuant to the provisions of Section 14.5.1.7, and not otherwise recovered by or credited to the Owner.

§ 14.5.3 The damages and relief from termination by the Owner specifically provided in this Article 14 shall be the Contractor's sole entitlement in the event of termination.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of the terms of the Agreement, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Agreement. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Continuing Contract Performance

§ 15.1.3.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Agreement and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. A written Claim must be made in accordance with this Article 15, or it will be waived. If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension, or (7) other reasonable grounds, a Claim shall be filed in accordance with this Article 15. The Contractor shall not be entitled to an increase in the Contract Sum or Contract Time arising out of an error or conflict in or among the Contract Documents where the Contractor failed adequately to review the Contract Documents or failed to report the error or conflict to the Architect and the Owner in a timely manner consistent with the requirements of the Contract Documents. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 Claims for Additional Time

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. A written Claim must be made in accordance with this Article 15, or it will be waived. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary. Any adjustment in the Contract Time arising from a

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Change or a Claim shall be limited to the change in the actual critical path of the Project directly caused thereby. If the delay was not caused by the Owner, the Contractor, a Subcontractor of any tier, or the Architect, or anyone acting on behalf of any of them, the Contractor is entitled only to an increase in the Contract Time in accordance with the Contract Documents but not a change in the Contract Sum. If the delay was caused by the Contractor, a Subcontractor of any tier, or anyone acting on behalf of any of them, the Contractor is not entitled to an increase in the Contract Time or in the Contract Sum.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction, and that the Work was on schedule (or not behind schedule through the fault of the Contractor) at the time the adverse weather conditions occurred. Neither the Contract Sum nor the Contract Time will be adjusted for normal inclement weather. The Contractor shall be entitled to a change in the Contract Time only (but not a change in the Contract Sum) if the Contractor can substantiate to the reasonable satisfaction of the Owner and Architect that there was materially greater than normal inclement weather considering the full term of the Contract Time and using a ten-year average of accumulated record mean values from climatological data compiled by the U.S. Department of Commerce National Oceanic and Atmospheric Administration for the locale closest to the Project, and that the alleged abnormal inclement weather actually extended the critical path of the Work. The change in Contract Time shall be provisional until Substantial Completion has been achieved, at which time the change in the Contract Time shall be the extent to which the total net accumulated number of calendar days lost due to inclement weather from commencement of the Work until Substantial Completion exceeds the total net accumulated number to be expected for the same period from the aforesaid data.

§ 15.1.6 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes:

- **.1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- **.2** damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents, or to preclude an obligation of the Contractor to indemnity the Owner for direct, indirect or consequential damages alleged by a third party.

§ 15.2 Claim Procedure

§ 15.2.1 In an effort to reduce the incidence and costs to all parties of extended disputes, all Claims, direct or indirect, arising out of, or relating to, the Contract Documents or the breach thereof, except Claims which have been waived under the terms of the Contract Documents, shall be decided exclusively by the following alternative dispute resolution procedure unless the parties mutually agree in writing otherwise. To the extent that the Owner and Contractor agree to any partnering process to help resolve disputes, such processes shall be in addition to, and not in place of, the mandatory dispute resolution procedures in the Contract Documents.

§ 15.2.2 Except for Claims requiring notice before proceeding with the affected Work as otherwise described in the Contract Documents, the Contractor shall submit a written notice of any Claim to the Owner and the Architect within fourteen (14) days of the occurrence of the event giving rise to such Claim and shall include a clear description of the event leading to or causing the Claim. For all Claims, the Contractor shall submit a written Claim as provided herein within thirty (30) days of submitting the notice. Claims shall include a clear description of the Claim and any proposed change to the Contract Sum (showing all components and calculations) and/or Contract Time (showing cause and analysis of the resultant delay in the critical path and other information referenced in Section 8.3.2) and shall provide data fully supporting the Claim, including without limitation a complete explanation as to why the relief sought is not within the scope of the Contract Documents. The Contractor may delay submitting data by an additional fourteen (14) days if it notifies the Owner in its Claim that substantial data must be assembled. Failure to properly submit the notice or Claim shall constitute a waiver of the Claim. The Claim shall be deemed to

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include all changes, direct and indirect, in cost and in time to which the Contractor (and Subcontractors of any tier) is entitled and may not contain reservations of rights without the Owner's written approval; any such unapproved reservations of rights shall be without effect. Any Claim of a Subcontractor of any tier may be brought only through, and after review by, the Contractor. For the purposes of calculating such time periods, an "event giving rise to a Claim" is not a Request for Information but rather is a response that the Contractor believes would change the Contract Sum and/or Contract Time. The fact that the Owner and the Contractor may consider, discuss or negotiate an untimely or waived Claim shall in no way be deemed to constitute a waiver of any notice or other provisions of the Contract Documents.

§ 15.2.3 Notice and Claims

All notices and Claims shall be made in writing as required by the Contract Documents and shall be addressed to the Owner's Designated Representative identified in the Agreement. Any notice of a Claim of the Contractor against the Owner and any Claim of the Contractor, whether under the Contract or otherwise, must be made pursuant to and in strict accordance with the applicable provisions of the Agreement. No act, omission, or knowledge, actual or constructive, of the Owner or the Architect shall in any way be deemed to be a waiver of the requirement for timely written notice and a timely written Claim unless the Owner and the Contractor sign an explicit, unequivocal written waiver. The fact that the Owner and the Contractor may consider, discuss, or negotiate a Claim that has or may have been defective or untimely under the Contract shall not constitute a waiver. The Contractor expressly acknowledges and agrees that the Contractor's failure to timely submit required notices and/or timely submit Claims has a substantial impact upon and prejudices the Owner, including but not limited to the inability to fully investigate or verify the claim, mitigate damages, choose alternative options, adjust the budget, delete or modify the impacted Work, and/or monitor time, cost and quantities. For these and other reasons, the parties stipulate that the Owner is prejudiced by the Contractor's failure to timely submit notices and/or Claims as required by the Contract Documents, and that the Owner shall not be required to establish any actual prejudice in order to enforce the notice and Claim provisions of the Contract Documents.

§ 15.2.4 At any time following the Owner's receipt of the written claim, the Owner may require that an officer of the Contractor, a principal of the Architect, and the Owner's Project Manager (all with authority to settle) meet, confer, and attempt to resolve the Claim. If the Claim is not resolved, the Contractor may bring no litigation against the Owner unless the Claim is first subject to nonbinding mediation as described in this Article 15. This mediation requirement cannot be waived except by an explicit written waiver by both parties.

§ 15.2.5 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.6 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines prior to resolution of the Claim by the Architect or the Owner, by mediation or by litigation.

§ 15.3 Mediation

§ 15.3.1 If a Claim is not resolved in the dispute resolution procedure of Section 15.2, neither the Contractor nor any Subcontractor or supplier of any tier may bring a claim or action against the Owner in litigation unless all unresolved claims are first subject to nonbinding mediation before a single mediator. This requirement cannot be waived except by an explicit written waiver signed by the Owner and the Contractor.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation. A request for mediation shall be made in writing, delivered to the other party, and the parties shall promptly attempt to mutually agree upon a mediator. If the parties have not reached agreement on a mediator within thirty (30) days of the request, either party may submit the unresolved Claims to Judicial Dispute Resolution, LLC ("JDR"), Seattle, Washington, or such other alternative dispute resolution service to which the parties mutually agree, for appointment of a single mediator according to its procedures.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

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§ 15.4 Litigation

§ 15.4.1 The Contractor may bring no litigation on Claims unless such Claims have been properly raised and considered in the procedures of this Article 15. The Contractor shall have the burden to demonstrate in any litigation that it has complied with all requirements of this Article 15. All unresolved Claims of the Contractor shall be waived and released unless the Contractor has complied with the time limits of the Contract Documents, and litigation is served and filed within the earlier of (a) 120 days after the Date of Substantial Completion approved in writing by the Owner, or (b) ninety (90) days after Final Acceptance. This requirement cannot be waived except by an explicit written waiver signed by the Owner and the Contractor. The pendency of a mediation (the time period between the written mediation request and the date of mediation) shall toll these deadlines until the earlier of the mediator providing written notice to the parties of impasse or thirty (30) days after the date of the mediation session. In the event of any dispute arising from this Agreement, including but not limited to any litigation to enforce this Agreement, any prevailing or non-breaching party shall be entitled to recover its attorney's fees and costs from any non-prevailing or breaching party, including any fees and costs incurred in enforcing any judgment obtained or on appeal.

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SECTION 00 73 00 - SUPPLEMENTAL CONDITIONS

UNLESS EXPRESSLY OTHERWISE INDICATED, THE FOLLOWING REQUIREMENTS SUPPLEMENT THE REFERENCED ARTICLES OF THE "GENERAL CONDITIONS" SECTION 00 70 00 AND SUPERCEDE THEM WHERE THEY CONTRADICT THE SAME.

AIA A201-2017 General Conditions of the Contract for Construction, Article 7 "Changes in the Work."

A. Methods for Calculating Change Order Pricing: The value of any Work covered by a Change Order or any adjustment to the Contract Sum shall be determined by fixed price, unless otherwise agreed to by Owner. The following procedures shall apply with respect to pricing:

a. Breakdown and itemization of details on COP: Contractor's COP shall be accompanied by a complete itemization of the costs, including labor, material, subcontractor costs, and overhead and profit. The costs shall be itemized in the manner set forth below, and shall be submitted on breakdown sheets in a form approved by Owner. If the total cost of the change in the Work does not exceed $2,000, Contractor shall not be required to submit a breakdown if the description of the change in the Work is sufficiently definitive for Owner to determine fair value.

b. Use of industry standards in calculating costs: All costs shall be calculated based upon appropriate industry standard methods of calculating labor, material quantities, and equipment costs acceptable to the Owner and Contractor.

c. Markups on additive and deductive Work: The cost of any additive or deductive changes in the Work shall be calculated as set forth below. Where a change in the Work involves additive and deductive work by the same Contractor or Subcontractor, small tools, overhead, profit, bond and insurance markups will apply to the net difference.

d. Components of Increased Costs: Any request for an adjustment of the Contract Sum shall include only the following

i. Craft labor costs: These are the labor costs determined by multiplying the estimated or actual additional number of craft hours needed to perform the change in the Work by the hourly labor costs. Craft hours should cover direct labor, as well as indirect labor due to trade inefficiencies. The hourly costs shall be based on the following:

1. Basic wages and benefits: Hourly rates and benefits as stated on the Department of Labor and Industries approved "statement of intent to pay prevailing wages" or a higher amount if approved by the Owner. Direct supervision shall be a reasonable percentage not to exceed 15% of the cost of direct labor. No supervision markup shall be allowed for a working supervisor's hours.
2. Federal insurance: Direct contributions required by the Federal Insurance Compensation Act; Federal Unemployment Tax Act; and the State Unemployment Compensation.
3. Travel allowance: Travel allowance and/or subsistence, if applicable, not exceeding those allowances established by regional labor union agreements, which are itemized and identified separately.

4. Safety: Cost incurred due to the Washington Industrial Safety and Health Act, which shall be a reasonable percentage not to exceed 2% of the sum of the amounts calculated in (1), (2), and (3) above.

ii. Material costs: This is an itemization of the quantity and cost of materials needed to perform the change in the Work. Material costs shall be developed first from actual known costs, second from supplier quotations or if these are not available, from standard industry pricing guides. Material costs shall consider all available discounts. Freight costs, express charges, or special delivery charges shall be itemized.

iii. Equipment costs: This is an itemization of the type of equipment and the estimated or actual length of time the construction equipment appropriate for the Work is or will be used on the change in the Work. Costs will be allowed for construction equipment only if used solely for the changed Work, or for additional rental costs actually incurred by the Contractor. Equipment charges shall be computed based on actual invoice costs or if owned, from the current edition of one of the following sources:

1. The Equipment Watch Fleet Manager Estimator Package (digital). The maximum rate for standby equipment shall not exceed that shown in the Associated General Contractors Washington State Department of Transportation (AGC WSDOT) Equipment Rental Agreement, current edition on the Contract execution date.
2. The National Electrical Contractors Association for equipment used on electrical work.
3. The Mechanical Contractors Association of America for equipment used on mechanical work.

The Equipment Watch Rental Rate Blue Book shall be used as a basis for establishing rental rates of equipment not listed in the above sources. The maximum rate for standby equipment shall not exceed that shown in the AGC WSDOT Equipment Rental Agreement, current edition on the Contract execution date.

iv. Allowance for small tools, expendables & consumable supplies: Small tools consist of tools which cost $250 or less and are normally furnished by the performing contractor. The maximum rate for small tools shall not exceed the following:

1. 3% for Contractor: For Contractor, 3% of direct labor costs.
2. 5% for Subcontractors: For Subcontractors, 5% of direct labor costs.

Expendables and consumables supplies directly associated with the change in Work must be itemized.

v. Allowance for overhead and profit: This is defined as costs of any kind attributable to direct and indirect delay, acceleration, or impact, added to the total cost to Owner of any change in the Contract Sum. This allowance shall compensate Contractor for all non-craft labor, temporary construction facilities, field engineering, schedule updating, as-built drawings, home office cost, B&O taxes, office engineering, estimating costs, additional overhead because of extended time, profit, and any other cost incidental to the change in the Work. It shall be strictly limited in all cases not to exceed the rates below:

1. Additive or Deductive Change Orders Performed by Contractor: Seven percent (7%) overhead and profit
2. Additive or Deductive Change Order for Work performed by Subcontractor(s): Five percent (5%) overhead and profit for Contractor and Ten (10%) percent overhead and profit for Subcontractor(s).

vi. Insurance and bond premiums: Cost of change in insurance or bond premium, which shall be added after overhead and profit are calculated in accordance with paragraph (v) above: This is defined as:

1. Contractor's liability insurance: The cost of any changes in Contractor's liability insurance arising directly from execution of the Change Order; and
2. Payment and Performance Bond: The cost of the additional premium for Contractor's bond arising directly from the changed Work.

B. Deductive Change or Credit: The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Owner. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

END OF SECTION 00 73 00

SECTION 00 73 56 – APPRENTICE UTILIZATION REQUIREMENTS

1. APPRENTICESHIP REQUIREMENTS

1.1. Contractor and its Subcontractors shall require no less than fifteen percent (15%) of the Project's total labor hours to be performed by apprentices. Labor hours are calculated by the total hours of work completed by workers receiving an hourly wage who are directly employed on the site of the Project. Hours of work include hours performed by workers directly employed by Contractor and all of its Subcontractors of any tier working on the Project, but do not include hours worked by foremen, superintendents, owners, and workers who are not subject to prevailing wage requirements.

1.2 Contractor and its Subcontractors shall monitor Project compliance with the apprenticeship utilization requirements, and provide copies to the Owner when and as requested, the following documentation concerning the requirements of this Section:

1.2.1. Records of its efforts to comply in good faith with the apprentice utilization requirement, including without limitation, documentation of its outreach efforts to encourage participation by apprentices in the Project;

1.2.2 The name and registration number of each apprentice who works on the Project site;

1.2.3 The number of apprentices and the number of labor hours worked by them on the Project site, categorized by trade or craft; and

1.2.4 The number of journey level workers and the number of labor hours worked by them on the Project site, categorized by trade or craft.

1.3 Contractor and its Subcontractors are not required to exceed the apprenticeship utilization requirements established by this Section.

2. ADJUSTMENTS TO THE APPRENTICE UTILIZATION REQUIREMENT

2.1 If the Contractor or its Subcontractors determine it will be unable to meet the apprentice utilization requirement, it must request, in writing, that the Owner modify the requirement. The Owner may adjust the requirements for the utilization of apprentices imposed by this Section if the Contractor establishes, to the satisfaction of the Owner, the existence of one or more of the following:

2.1.1 The demonstrated lack of availability of apprentices in specified geographic areas;

2.1.2 A disproportionately high ratio of material costs to labor hours, which does not make feasible the required minimum levels of apprentice participation;

2.1.3 Contractor demonstrated a good faith effort to comply with the requirements of RCW 39.04.320; or

2.1.4 Other criteria the Owner deems appropriate, which are subject to review by the office of the Governor.

2.2 The Owner shall evaluate the request, and if appropriate, authorize the modification of the apprentice utilization requirement. If the Owner determines that a modification is not justified, the Owner shall communicate the decision in writing to the Contractor.

3. APPRENTICE UTILIZATION INCENTIVES, PENALTIES, MONITORING AND ENFORCEMENT

3.1 The Owner shall provide the monetary incentive amounts for meeting the apprentice utilization requirements, and the monetary penalty amounts for failing to meet the apprentice utilization requirements on the Project. The amount of the expected cost value for meeting the apprentice utilization requirements shall be provided by each prime bidder on the appropriate Bid Form.

3.1.1 The monetary incentive for meeting the apprentice utilization requirement on this Project is $1,000.

3.1.2 The monetary penalty for failing to meet the apprentice utilization requirement on this Project is $1,000.

3.2 The Owner will report the apprentice utilization by the Contractor and any Subcontractors to the supervisor of apprenticeship at the Department of Labor and Industries by final acceptance.

3.3 The Owner or its designee will monitor the apprentice utilization data provided by the Contractor and its Subcontractors. Progress payments may be withheld if the Contractor fails to comply with this Section and evidences a lack of good faith in so doing.

3.4 The Owner may make routine visits to the Project site for the purpose of confirming the use of apprentices. The Contractor should be aware that various third parties might make visits to the Project site for the purpose of confirming the use of apprentices. Said third party visitors will be required to abide by the Contractor’s work rules and safety plan.

4. APPRENTICE UTILIZATION REPORTING

4.1 Upon the Owner’s request, Contractor and Subcontractor shall report apprentice utilization data, including without limitation, through the Department of Labor & Industries’ Prevailing Wage & Intent Affidavit System. The Owner may collect data on a monthly basis, beginning with the first day of work for each apprentice. Submittals are due at the end of the first month after the Contract start date specified in the Notice to Proceed, and at monthly intervals thereafter as specified above.

4.2 The Contractor and its Subcontractors shall submit such other information as may be requested by the Owner to verify compliance with the apprentice utilization requirement outlined in this Section, including but not limited to, apprentice utilization plans and/or reports as promulgated by the Department of Enterprise Services, the Department of Labor & Industries, or the Owner. The Owner reserves the right to add, delete, or change, as necessary, information it requires from Contractor and its Subcontractors.

END OF SECTION 00 73 56

SECTION 00 83 00 - DEPARTMENT OF LABOR WAGE RATES

PART 1 - GENERAL

1.1 SUMMARY

A. Prevailing wage rates for the locality or localities of the Work, as described by the Industrial Statistician of the Department of Labor and Industries, are required for this contract. Contractor remains solely responsible for verifying that the rates are accurate, current, and inclusive for all parts of this Work. Any off-site prefabrication may also require prevailing wages and the Contractor should contact the Department of Labor and Industries to ascertain those rates.

B. Contractor to provide the “Notice of Intent to Pay Prevailing Wage Rates”, as required by RCW 39.04, 39.12, 43.19, and 49.28 as amended. All paperwork regarding “Notice of Intent to Pay Prevailing Wage Rates” shall be sent directly to the Owner. The rules and regulations of the Department of Labor and Industries and the schedule of prevailing wage rates for the locality or localities where this Contract will be performed as determined by the Industrial Statistician of the Department of Labor and Industries, are by reference made a part of this Contract as though fully set forth herein.

Current prevailing wage rates for the County in which the project is located will apply to this project.

Current prevailing wage data are available online or at the following:

ADDRESS: Department of Labor and Industries
Prevailing Wage Section
P.O. Box 44540
Olympia, Washington 98504-4540

WEBSITE: https://secure.lni.wa.gov/wagelookup/

The General Contractor and its sub-contractors are to pay for all filing fees for Statements of Intent to Pay Prevailing Wages and Affidavits, and for any change in rate during the course of construction.

Submit forms to: Department of Labor and Industries
Prevailing Wage Section
P.O. Box 44540
Olympia, Washington 98504-4540

END OF SECTION 00 83 00

PROTEST PROCEDURES

1. **Protest of Contents of RFP.** The protest of any specification, term, requirement, condition, or any other item or process in connection with the RFP must follow the following process:

    a. Protests must be submitted no later than **ten** (**10) business days** prior to the deadline for submission of Proposals.
    b. Protests must be submitted to Marc Bloom and Colby Ray at mbloom@bloomprojects.com and cray@bloomprojects.com.
    c. If the protest decision results in a change to the RFP, the Owner shall issue an addendum identifying the new or revised RFP provisions.
    d. Proposers waive the right to challenge or protest any specification, term, requirement, condition, or any other item or process in connection with the RFP by failing to strictly comply with this requirement.

2. **Protest of Owner Selection.** The Owner will provide all Proposers notification of its selection of a Proposer with whom it intends to award the contract. After notification, Proposers may only protest that selection decision under the following process:

    a. Proposers may request a debriefing within **three (3) business days** after selection notification.
    b. Proposers are required to participate in a debriefing as a pre-requisite for submitting a protest.
    c. Proposers must submit a written protest within **five (5) business days** after the debriefing to \ Marc Bloom and Colby Ray at mbloom@bloomprojects.com and cray@bloomprojects.com.
    d. The grounds upon which a protest may be based are as follows:
        i. A matter of bias, discrimination, or conflict of interest on the Owner;
        ii. Substantial and material non-compliance with procedures described in the solicitation document.
    e. Protests shall not be based on the Owner's subjective determination that an individual Proposal is most advantageous to the Owner.
    f. The protest shall identify with particularity the nature and grounds of the protest.
    g. The Owner will issue a response within ten (10) business days from the receipt of the protest, unless additional time is needed. The protesting Proposer shall be notified if additional time is required.
    h. The decision of the Owner on any given protest is final.
    i. Proposers waive the right to challenge or protest any selection decision or related process in connection with the RFP by failing to strictly comply with these requirements.

END OF SECTION 00 91 23

01 10 00 – SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work performed by Owner.
3. Multiple Work Packages.
4. Work under Owner's separate contracts.
5. Future work not part of this Project.
6. Owner's product purchase contracts.
7. Owner-furnished/Contractor-installed (OFCI) products.
8. Owner-furnished/Owner-installed (OFOI) products.
9. Contractor-furnished/Owner-installed (CFOI) products.
10. Contractor's use of site and premises.
11. Coordination with occupants.
12. Work restrictions.
13. Specification and Drawing conventions.
14. Miscellaneous provisions.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 01 73 00 "Execution" for coordination of Owner-installed products.

1.3 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

A. -Based Project Software: Contractor-provided project software will be used for purposes of managing communication and documents during the construction stage.

1. See Section 01 31 00 "Project Management and Coordination" for requirements for using web-based project software.

1.5 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Preceding Work: Owner will perform the following construction operations at Project site. These operations are scheduled to be substantially complete before Work under this Contract begins.

1. N/A

C. Concurrent Work: Owner will perform the following construction operations at Project site. These operations will be conducted simultaneously with work under this Contract.

1. N/A

1.6 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
2. Provide for delivery of Owner-furnished products to Project site.
3. Upon delivery, inspect, with Contractor present, delivered items.
   a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
4. Obtain manufacturer's inspections, service, and warranties.
5. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products, where indicated on contract drawings and/or noted below:

1. N/A

1.7 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

A. The Owner will furnish and install products indicated.

B. Owner-Furnished/Owner-Installed (OFOI) Products, where indicated on drawings and/or noted below:

1. Furnishing and Equipment otherwise not noted in the Contract Documents.

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated by requirements of this Section.

B. Limits on Use of Site: Limit use of Project site to areas within the Contract limits. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits on Use of Site: Confine construction operations to areas identified on the contract drawings.
2. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, the Public, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.
    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations. See section 01 32 33 “Photographic Documentation” for contractor-provided photography of existing conditions requirements prior to commencing work.

1.9 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner and public activities will occupy the surrounding park during entire construction period, except for areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing, unaffected exits and provide approved signage for reroute of existing, affected exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, roads, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours’ notice to Owner of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.

2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.10 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 5 a.m. to 8 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: 7 days prior notification and approval by the Owner.
2. Early Morning Hours: 7 days prior notification and approval by the Owner
3. Hours for Utility Shutdowns: 7 days prior notification and approval by the Owner
4. Hours for Core Drilling: 7 days prior notification and approval by the Owner
5. Evening Hours: Work hours regarding noise generating activities may be completed at night pending 7 days prior notification and approval by Owner.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:

1. Notify Owner not less than 48 hours in advance of proposed utility interruptions.
2. Obtain Owner’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than 48 hours in advance of proposed disruptive operations.
2. Obtain Owner’s written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner’s property is not permitted.

F. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

G. Site Construction Plan: Prior to the start of Work on the Site or within public rights-of-way, submit a project-specific traffic control plan for acceptance by the Owner. Following acceptance of the plan, traffic control shall comply with the accepted plan unless deviations are accepted by the Owner in writing, prior to implementing any such deviation.

H. Site Work Sequence:

1. Construct the Site Work to accommodate Owner's occupancy requirements and time restrictions. Coordinate construction schedule and operations with Owner.

2. Sequencing of Construction Plan: Prior to the start of Work on the Site, submit a construction plan regarding sequencing and related staging, storage, temporary facilities and controls, stockpiling, access and parking for acceptance by the Owner. Following acceptance of the plan, sequencing shall comply with the accepted plan unless deviations are accepted by the Owner in writing, prior to implementing any such deviation.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

1.5 SCHEDULE OF ALTERNATES

1. Multi-Purpose Rooms 111 and 113 (Deductive)
    a. Base Bid: Built per bid documents.

b. Alternate #1: Between gridlines G and J, locate the south exterior wall of the building at gridline 3.9, refer to alternate floor plan #1 and supplemental drawings. Refer to mechanical, plumbing, and electrical system alternate drawings for extents of impacts to those trades as a result.

2. Administration Rooms 103, 104, 105, and 106 (Deductive)
    a. Base Bid: Built per bid documents.
    b. Alternate #2: Between gridlines 2 and 3, locate the east exterior wall of the building at gridline J, refer to alternate floor plan #2 and supplemental drawings. Refer to mechanical, plumbing, and electrical system alternate drawings for extents of impacts to those trades as a result.

3. Solar Panels (Additive)
    a. Base Bid: Provide and install solar panels per bid documents, 15KW PV array.
    b. Alternate #3: Provide and install solar panels for full upper roof coverage. PV array KW capacity to be determined, assumed to be approximately 150KW.

4. Pool Construction (Deductive)
    a. Base Bid: Steel pool system per bid documents.
    b. Alternate #4: Traditional concrete-shelled pool tank structure, gutter, and detailing. Bidder-designed engineering of alternate pool construction required to be included as part of alternate pricing. Resubmission and approval of pool documents by Washington State Health to be included as part of bidder's responsibilities and pricing.
    c. Pool shall be machine excavated and hand trimmed, where permitted by soil conditions. If soil conditions are not suitable for using the excavation as a form, pool shall be over-excavated and formed (one-sided formwork). Upon completion of pool structure curing period, forms shall be stripped, and engineered backfill shall be compacted to 95% maximum density provided to pool deck sub-grade elevation.
    d. Finish sub-grade elevation of pool floor shall be lowered by a minimum of 18" (450 millimeters) to accommodate a layer of drain rock within the excavation and provide a working mat during construction. Hydrostatic relief valves shall be installed within pool main drain sumps (minimum of 2 each) to mitigate potential for hydrostatic pressure when pool is drained post-construction.
    e. Pool structure shall be steel reinforced, pneumatically-applied concrete (shotcrete) with a minimum compressive strength of 4,000 pounds per square inch with an integral Xypex crystallin admixture. Shotcrete finish shall be compatible with installation of pool interior waterproof finishes.
    f. Pool finishes shall consist of a rim-flow gutter spanning over a continuous perimeter gutter system, a 150-millimeter (6") band of ceramic tile below waterline, 300 millimeter (12") wide unglazed ceramic mosaic tile lane lines and targets on the tank floor and walls, and white quartz pool plaster for all other interior finishes.
    g. Bidder to provide warranty matching that of base-bid steel pool system manufacturer.

5. Audio Visual System (Additive)
    a. Base Bid: Per specification section 27 41 16, base bid includes all conduit rough in and power for the AV system.
    b. Alternate #5: Provide Audio Visual system per specification section 27 41 16.

6. Equipment with Singlewire Fusion Software (Additive)
    a. Base Bid: Built per bid documents specifically refer to specification section 27 51 23.
    b. Alternative #6a: AND equipment with Singlewire Fusion Software
    c. Alternative #6b: Telecor Equipment with Singlewire Fusion Software

7. Video Surveillance System (Additive)

a. Base Bid: Rough-in only, providing raceway, boxes, and data cabling, cameras will be furnished by Owner and installed by the contractor
b. Alternate #7: To provide complete video surveillance system consisting of cameras, accessories, and licenses per Section 271500. Provide CD62 cameras at interior video data drop locations. Provide CH52-E cameras at exterior video data drop locations. Quantities shall be per drawings. Allow for an additional (5) CH52-E cameras, including data drop rough-in (up to 150ft each), locations to be determined by Owner at construction start.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION – 01 23 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 00 63 00 “Clarification, Modification, and Closeout Forms.”
2. Section 00 70 00 “General Conditions”.
3. Section 01 23 00 "Alternates" for deductive and additive bid alternates.
4. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form provided, see section 00 63 00 “Clarification, Modification, and Closeout Forms.”
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
    b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action during Bidding: If necessary, Architect will request additional information or documentation for evaluation, where required. Rejected requests will be returned to the Contractor only. Approved requests will be included within an addendum.
   a. Forms of Acceptance: Substitution Request Form, provided by Contractor.

4. Architect's Action during Construction: If necessary, Architect will request additional information or documentation for evaluation, where required. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Substitution Request Form, provided by Contractor.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Contractor to engage a qualified testing agency to perform compatibility tests recommended by manufacturer(s).

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will reject and return requests without further action, except to record noncompliance with these requirements:
   a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   b. Substitution request is fully documented and properly submitted.
   c. Requested substitution will not adversely affect Contractor's construction schedule.
   d. Requested substitution has received necessary approvals of authorities having jurisdiction.
   e. Requested substitution is compatible with other portions of the Work.
   f. Requested substitution has been coordinated with other portions of the Work.
   g. Requested substitution provides specified warranty.
   h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will reject and return requests without further action, except to record noncompliance with these requirements:
   a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
   b. Requested substitution does not require extensive revisions to the Contract Documents.
   c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
   d. Substitution request is fully documented and properly submitted.
   e. Requested substitution will not adversely affect Contractor's construction schedule.
   f. Requested substitution has received necessary approvals of authorities having jurisdiction.
   g. Requested substitution is compatible with other portions of the Work.
   h. Requested substitution has been coordinated with other portions of the Work.
   i. Requested substitution provides specified warranty.
   j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 00 63 00 “Clarification, Modification, and Closeout Forms.”
2. Section 00 70 00 “General Conditions”.
3. Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
4. Section 01 31 00 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 NO COST/TIME CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 “Architect’s Supplemental Instructions.”

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time, on AIA Document G709 “Proposal Request.” If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 14 calendar days maximum, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.

d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
e. Quotation Forms: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail," or similar formatted Contractor form(s) approved by Architect. See section 00 63 00 “Clarification, Modification, and Closeout Forms.”
f. Include Contractors and subcontractors detailed take-offs, proposals, and other backup information requested by Owner.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Forms: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail," or similar formatted Contractor form(s) approved by Architect. See section 00 63 00 “Clarification, Modification, and Closeout Forms.”
8. Include Contractors and subcontractors detailed take-offs, proposals, and other backup information requested by Owner.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 “Change Order.”

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work immediately, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract for Owner consideration.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 00 63 00 “Clarification, Modification, and Closeout Forms”
2. Section 00 70 00 “General Conditions”.
3. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
4. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Architect, Owner, and Owner’s Repat earliest possible date, but no later than thirty days before the date scheduled for submittal of initial Applications for Payment.
3. Sub-schedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide sub-schedules showing values coordinated with each element.

B. Format and Content: Use Project Manual (aka Project Specifications) table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Owner's name.
c. Owner's Project number.
d. Name of Architect.
e. Contractor's name and address.
f. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703~~S~~. See section 00 63 00 “Clarification, Modification, and Closeout Forms.”
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

a. Related Specification Section or division.
b. Description of the Work.
c. Name of subcontractor.
d. Name of manufacturer or fabricator.
e. Name of supplier.
f. Change Orders (numbers) that affect value.
g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
   1) Labor.
   2) Materials.
   3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site.
6. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Architectural Supplemental Instructions result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Architectural Supplemental Instruction.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: Submit approved Application for Payment to Owner/Architect by the 25th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment two days prior to due date for review by Owner and Architect. Hold “pencil review” meetings with Architect, Owner, and Owner’s Rep prior to finalizing Payment Application.

D. Application for Payment Forms: Use AIA Document G702~~S~~ and AIA Document G703~~S~~, or adopted contractor forms of similar format as allowed by Architect, Owner and Owner's Rep, as form for Applications for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Cover sheet to be attached to each payment application and, at minimum, include the completed and stored to date, sales tax, and current invoice amount, and other information as requested by Owner.
2. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
3. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
4. Include amounts of Change Orders and Architectural Supplemental Instruction issued before last day of construction period covered by application.
5. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:
   a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
   b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
   c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit electronic signed and notarized copy of each Application for Payment to Architect, Owner and Owner's Rep. Copy shall include waivers of lien and similar attachments if required.

H. Waivers of Mechanic's Lien: With each Application for Payment, submit notarized waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Submittal schedule (preliminary if not final).
5. List of Contractor's staff assignments.

J. Application for Payment at Substantial Completion: After Architect issues the final Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 01 77 00 "Closeout Procedures."
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. Evidence that claims have been settled.
6. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
7. Final liquidated damages settlement statement.
8. Proof that taxes, fees, and similar obligations are paid.
9. Waivers and releases.
10. As-built documents for all divisions in PDF and hard copy formats.
11. All TAB, startup, and commissioning reports.
12. All Submittals and RFI’s.
13. Attic stock materials delivered to Owner.
14. Warranties, guarantees, and related documentation.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Web-based Project management software package.
6. Project meetings.
7. Construction schedule updated monthly

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Section 00 63 00 “Clarification, Modification, and Closeout Forms”
2. Section 00 70 00 “General Conditions”.
3. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
4. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
5. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Provide Contractor communication plan.
2. Preparation and distribution of Contractor's construction schedule updated monthly.
3. Preparation of the schedule of values.
4. Installation and removal of temporary facilities and controls.
5. Delivery and processing of submittals and RFI’s.
6. Progress meetings and distribution of minutes within two (2) days after meeting.
7. Preinstallation conferences.
8. AHJ coordination and pre-construction meetings.
9. Project closeout activities.
10. Startup and adjustment of systems.

1.5 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor to the Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Owner name.
3. Owner's Project number.
4. Name of Architect.
5. Architect's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.
9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.
15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Form by Contractor with substantially the same content as AIA Document G716, deemed acceptable to Architect. See section 00 63 00 “Clarification, Modification, and Closeout Forms”.

1. Form and attachments shall be electronic files in PDF format submitted through Web-Based Project Management Software.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m local time. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
   a. Requests for approval of submittals.
   b. Requests for approval of substitutions.
   c. Requests for approval of Contractor's means and methods.
   d. Requests for coordination information already indicated in the Contract Documents.
   e. Requests for adjustments in the Contract Time or the Contract Sum.
   f. Requests for interpretation of Architect's actions on submittals.
   g. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 2 days of receipt of the RFI response.

E. RFI Log: Utilize Web-Based Project Management Software to prepare and maintain a tabular log of RFIs organized by the RFI number. Provide a printed log for the Owner, Owner’s Rep and Architect at each progress meeting. RFI log to be reviewed weekly in OAC meeting for brief status update on each open RFI. Alternatively, a separate meeting may be required for review and discussion of open RFI’s. RFI log to include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number, including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Change in the Work and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response. Amended RFIs may be submitted under the same RFI number if additional information is requested or a revised response is warranted subsequent to the original response(s).

1.6 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model and CAD drawings will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in Revit/AutoCAD.
4. Contractor shall agree to the Architect's terms and conditions and sign the Architect's, or sub-consultant's, standard release forms prior to utilizing data files.

B. Web-Based Project Management Software Package: Provide, administer, and manage web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion. Contractor FTP, OneDrive, Dropbox (or similar) or e-mail is **not** an acceptable means of Project Management Software.

1. Web-based Project management software includes, at a minimum, the following features:
   a. Compilation of Project data, including Contractor, subcontractors, Architect, Owner, Owner's Rep and other entities involved in Project. Include names of individuals and contact information.
   b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
   c. Document workflow planning, allowing customization of workflow between project entities.
   d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Changes in Work (Architectural Supplemental Instruction), and Change Orders.
   e. Track status of each Project communication in real time, and log time and date when responses are provided.
   f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
   g. Processing and tracking of payment applications.
   h. Processing and tracking of contract modifications.
   i. Storing and distributing meeting minutes.
   j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
   k. Management of construction progress photographs.
2. Provide full access to Architect, and Architect's consultants, Owner and the Owner's Rep. Provide training for web-based Project software users.
3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.
4. Provide one of the following Project management software packages under their current published licensing agreements:
   a. Procore Technologies, Inc.
   b. Autodesk; BIM 360.
   c. Corecon Technologies, Inc.
   d. Meridian Systems; Prolog.
   e. Newforma, Inc.
   f. Viewpoint, Inc.
   g. No substitutions allowed after bid award.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.7 PROJECT MEETINGS

A. General: Contractor to schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner, Owner's Rep and Architect of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
2. Agenda: Contractor to prepare the meeting agenda; previous, recorded and distributed meeting minutes may act as agenda for following meeting. Distribute the agenda to all invited attendees.
3. Logs: Contractor to prepare and provide printed copies of current logs to Architect, Owner and Owner's Rep, including but not limited to, RFIs, Submittals, Change Order Proposals and Change Orders.
4. Minutes: Contractor is responsible for conducting meeting and will record meeting minutes. Contractor to post minutes to Web-Based Project Management Software with notification, including Owner, Owner's Rep and Architect, within 3 days of the meeting for review and comment. Contractor to provide printed copies of meeting minutes to Owner, Owner's Rep and Architect.

B. Preconstruction Conference: Contractor to schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner, Owner's Rep and Architect, but no later than 10 working days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Use and protocols of web-based Project software.
    h. Procedures for processing field decisions and Change Orders.
    i. Procedures for RFIs.
    j. Procedures for testing and inspecting.
    k. Procedures for processing Applications for Payment.
    l. Distribution of the Contract Documents.
    m. Submittal procedures.
    n. Sustainable design requirements.
    o. Preparation of Record Documents.

p. Use of the premises and existing building.
q. Work restrictions.
r. Working hours.
s. Owner's occupancy requirements.
t. Responsibility for temporary facilities and controls.
u. Procedures for moisture and mold control.
v. Procedures for disruptions and shutdowns.
w. Construction waste management and recycling.
x. Parking availability.
y. Office, work, and storage areas.
z. Equipment deliveries and priorities.
aa. First aid.
bb. Security.
cc. Progress cleaning.

3. Minutes: Contractor is responsible for conducting meeting and will record meeting minutes. Contractor to post minutes to Web-Based Project Management Software with notification, including Owner, Owner's Rep and Architect, within 3 days of the meeting for review and comment. Contractor to provide printed copies of meeting minutes to Owner, Owner's Rep and Architect.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
   a. Contract Documents.
   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
   f. Deliveries.
   g. Submittals.
   h. Sustainable design requirements, where applicable.
   i. Review of mockups.
   j. Possible conflicts.
   k. Compatibility requirements.
   l. Time schedules.
   m. Weather limitations.
   n. Manufacturer's written instructions.
   o. Warranty requirements.
   p. Compatibility of materials.
   q. Acceptability of substrates.
   r. Temporary facilities and controls.
   s. Space and access limitations.
   t. Regulations of authorities having jurisdiction.
   u. Testing and inspecting requirements.
   v. Installation procedures.
   w. Coordination with other work.
   x. Required performance results.
   y. Protection of adjacent work.

z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Contractor is responsible for conducting meeting and will record meeting minutes. Contractor to post minutes to Web-Based Project Management Software with notification, including Owner, Owner's Rep and Architect, within 3 days of the meeting for review and comment. Contractor to provide printed copies of meeting minutes to Owner, Owner's Rep and Architect.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner, Owner's Rep and Architect, but no later than 10 working days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
   a. Preparation of Record Documents.
   b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
   c. Procedures for completing and archiving web-based Project software site data files.
   d. Submittal of written warranties.
   e. Requirements for completing sustainable design documentation, where applicable.
   f. Requirements for preparing operations and maintenance data.
   g. Requirements for delivery of material samples, attic stock, and spare parts.
   h. Requirements for demonstration and training.
   i. Preparation of Contractor's punch list.
   j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
   k. Submittal procedures.
   l. Coordination of separate contracts.
   m. Owner's partial occupancy requirements.
   n. Installation of Owner's furniture, fixtures, and equipment.
   o. Responsibility for removing temporary facilities and controls.
4. Minutes: Contractor is responsible for conducting meeting and will record meeting minutes. Contractor to post minutes to Web-Based Project Management Software with notification, including Owner, Owner's Rep and Architect, within 3 days of the meeting for review and comment. Contractor to provide printed copies of meeting minutes to Owner, Owner's Rep and Architect.

E. Progress Meetings: Conduct progress meetings at determined intervals assigned by Architect; assume weekly.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Owner's Rep and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities may be represented

at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedules:
      1) Short Interval Schedule (aka 3 week lookahead): Update, print and provide copies for Owner, Owner's Rep and Architect, and review short interval schedule progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
   b. Review present and future needs of each entity present, including the following:
      1) Interface requirements.
      2) Sequence of operations.
      3) Resolution of BIM component conflicts.
      4) Status of submittals.
      5) Status of sustainable design documentation, where applicable.
      6) Deliveries.
      7) Off-site fabrication.
      8) Access.
      9) Site use.
      10) Temporary facilities and controls.
      11) Progress cleaning.
      12) Quality and work standards.
      13) Status of correction of deficient items.
      14) Field observations.
      15) Status of RFIs.
      16) Status of Proposal Requests.
      17) Pending changes.
      18) Status of Change Orders.
      19) Pending claims and disputes.
      20) Documentation of information for payment requests.
4. Minutes: Contractor is responsible for conducting meeting and will record meeting minutes. Contractor to post minutes to Web-Based Project Management Software with notification, including Owner, Owner's Rep and Architect, within 3 days of the meeting for review and comment. Contractor to provide printed copies of meeting minutes to Owner, Owner's Rep and Architect.

F. Coordination Meetings: Conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of

schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

c. Review present and future needs of each contractor present, including the following:
   1) Interface requirements.
   2) Sequence of operations.
   3) Resolution of BIM component conflicts.
   4) Status of submittals.
   5) Deliveries.
   6) Off-site fabrication.
   7) Access.
   8) Site use.
   9) Temporary facilities and controls.
   10) Work hours.
   11) Hazards and risks.
   12) Progress cleaning.
   13) Quality and work standards.
   14) Status of RFIs.
   15) Proposal Requests.
   16) Change Orders.
   17) Pending changes.

3. Reporting: Contractor is responsible for conducting meeting and will record meeting minutes. Contractor to post minutes to Web-Based Project Management Software with notification, including Owner, Owner’s Rep and Architect, within 3 days of the meeting for review and comment. Contractor to provide printed copies of meeting minutes to Owner, Owner’s Rep and Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule. Microsoft Project software preferred.
2. Logistics plan indicating, at minimum, truck routes, laydown area, job trailer location, and other project information as may be requested by the Owner.
3. Contractor's Construction Schedule. MS Project software preferred.
4. Construction schedule updating reports.
5. Daily construction reports.
6. Material location reports.
7. Site condition reports.
8. Unusual event reports.

B. Related Requirements:

1. Section 00 63 00 “Clarification, Modification, and Closeout Forms.”
2. Section 00 70 00 “General Conditions.”
3. Section 01 29 00 "Payment Procedures."
4. Section 01 40 00 "Quality Requirements" for schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. PDF file, submitted through Web-based Project management software package.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals through Web-based Project management software package. Full construction schedule updated monthly and provided to Owner.

C. Daily Construction Reports: Submit no less frequently than at weekly intervals through Web-based Project management software package and included in weekly OAC minutes.

D. Material Location Reports: Submit at weekly intervals through Web-based Project management software package.

E. Cash Flow Reports: Submit monthly updated cash flow projections through project completion.

1.5 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

1. Use Microsoft Project (preferred) or Architect-approved software for current Windows operating system.

B. Scheduling: Provide planning, evaluation, and reporting, using CPM scheduling.

1. In-House Option: In-house CPM scheduling management may be utilized if contractor employs skilled personnel with experience in CPM scheduling and reporting techniques.
2. Meetings: Scheduling manager shall attend all meetings related to Project progress, alleged delays, and time impact.

C. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

D. Activities: Treat each separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
   a. Securing of approvals and permits required for performance of the Work.
   b. Temporary facilities.
   c. Construction of mock-ups, prototypes and samples.
   d. Owner interfaces and furnishing of items.
   e. Interfaces with Separate Contracts.
   f. Regulatory agency approvals.
   g. Punch list.
3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
4. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
6. Commissioning Time: Include no fewer than 15 days for commissioning.
7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
8. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.
9. Owner-related items: Show coordination and/or overlap of OFCI or OFOI scope.

E. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase, where applicable.

2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Work Restrictions: Show the effect of the following items on the schedule:
    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use-of-premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.
5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Building flush-out.
    m. Startup and placement into final use and operation.
    n. Commissioning.
6. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.
    f. Substantial Completion.

F. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Acceptance.

G. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule with the monthly payment application. Payment application is not considered complete without a provided, updated overall schedule.

H. Distribution: Distribute copies of approved schedule to Architect, Owner, Owner’s Rep, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility. Archive electronic copies of the monthly schedules via the Web-based Project management software package with access by Owner and Architect.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their

assigned portion of the Work and are no longer involved in performance of construction activities.

1.7 REPORTS

A. Daily Construction Reports: Prepare and post a daily construction report through Web-based Project management software package recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Architectural Supplemental Instructions received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit through Web-based Project management software package a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner and Owner’s Rep in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner and Owner's Rep within one day of an occurrence. Distribute copies of report through Web-based Project management software package.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 00

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.

B. Related Requirements:

1. Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.

1.3 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Submit image files within three days of taking photographs via the Web-based Project management software package.

1. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in web-based Project management software site:
   a. Date photograph was taken.
3. Drone photography is acceptable only with Owner’s prior approval of each instance along with any required AHJ approvals.
4. Fixed on-going camera photography is acceptable with prior Owner approval.

1.4 QUALITY ASSURANCE

A. Photographer Qualifications: An individual with access to and knowledge of digital camera.

1.5 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 x 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. File Names: Name media files with date and sequential numbering suffix.

1.6 CONSTRUCTION PHOTOGRAPHS

A. Preconstruction Photographs: Before commencement of the Work, take photographs and post via the Web-based Project management software package of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.

1. Flag construction limits before taking construction photographs.
2. Take 20 minimum photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 minimum photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

B. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take and post photographs via the Web-based Project management software package sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.
2. Underslab services.
3. Piping.
4. Electrical conduit.
5. Wall cavities.
6. Waterproofing and weather-resistant barriers.

C. Periodic Construction Photographs: Take a minimum of 10 photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken. Post via the Web-based Project management software package.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 00 70 00 “General Conditions”.
2. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
3. Section 01 31 00 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
4. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
5. Section 01 32 33 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs.
6. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
7. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
8. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
9. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
10. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as a submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required

to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
   a. Submit revised submittal schedule as required to reflect changes in status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
   a. Scheduled date for first submittal.
   b. Specification Section number and title.
   c. Name of subcontractor.
   d. Description of the Work covered.
   e. Scheduled date for Architect's final release or approval.
   f. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.
10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
11. Drawing number and detail references, as appropriate.
12. Indication of full or partial submittal.
13. Location(s) where product is to be installed, as appropriate.
14. Other necessary identification.
15. Remarks.
16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal and notify Architect, Owner and Owner’s Rep of posted date(s).

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, Owner's Rep, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 working days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Use only final submittals that are marked with approval notation from Architect's or Engineer's stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
   c. Standard color charts.
   d. Statement of compliance with specified referenced standards.
   e. Testing by recognized testing agency.
   f. Application of testing agency labels and seals.
   g. Notation of coordination requirements.
   h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams that show factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless allowed by Architect.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.
2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
   a. Project name and submittal number.
   b. Generic description of Sample.
   c. Product name and name of manufacturer.
   d. Sample source.
   e. Number and title of applicable Specification Section.
   f. Specification paragraph number and generic name of each item.
3. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Where applicable, samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit one set of Samples. Architect will retain one Sample set; mark up and retain identical Sample set as a project record Sample.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects, owners and Owner’s Rep, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   a. Name of evaluation organization.
   b. Date of evaluation.
   c. Time period when report is in effect.
   d. Product and manufacturers' names.
   e. Description of product.
   f. Test procedures and results.
   g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

A. Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

C. Submittal Log: Contractor to maintain a log of all submittals and inclusive of submittal number, name, date submitted, and date due. Submittal log to be review weekly in OAC meeting or in separate weekly meeting if required.

1.9 ARCHITECT'S REVIEW

A. Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.

1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action, as follows:
   a. Approved – Submittal is approved without comment or correction
   b. Approved as Noted – Submittal is approved with comment(s) or correction(s) as noted.
   c. Revise & Resubmit – Submittal is not approved and requires corrections and resubmittal for approval as noted.
   d. Rejected – Submittal is incomplete or similar, is rejected and requires resubmittal for approval.

B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Architect will reject and return without review submittals received from sources other than Contractor.

E. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

SECTION 01 35 16 - ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes special procedures for alteration work.

1.3 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's pre-bid selection of work to be matched; it may be existing work or work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep and protect existing items that are not to be removed.

L. Reuse: To dismantle or retain, protect, and reinstall within the project site.

M. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 COORDINATION

A. Alteration Work Sub-schedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.

1. Schedule construction operations in sequence required to obtain best Work results.
2. Coordinate sequence of alteration work activities to accommodate the following:
    a. Owner's continuing occupancy of portions of existing property, where applicable.
    b. Owner's partial occupancy of completed Work, where applicable.
    c. Other known work in progress.
    d. Tests and inspections.
3. Detail sequence of alteration work, with start and end dates.
4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
5. Use of elevator and stairs, where applicable.
6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structures, where applicable. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

B. Pedestrian and Vehicular Circulation: Coordinate alteration work with circulation patterns within Project building(s) and site, where applicable. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of work. Access to restricted areas may not be obstructed. Plan and execute the Work accordingly.

1.5 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner on- or off-site where directed.

1.6 INFORMATIONAL SUBMITTALS

A. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations. See section 01 32 33 “Photographic Documentation.”

1.7 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged and Reused Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

B. Salvaged and Reused Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.

E. Storage Space:

1. Owner will arrange for limited on-site location(s) for free storage of salvaged material. This storage space does not include security or climate control for stored material.
2. Arrange for off-site locations for storage and protection of salvaged material that cannot be stored and protected on-site.

1.8 FIELD CONDITIONS

A. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

B. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

C. Protection Plan: Contractor to provide Owner with protection plan for adjacent features and facilities onsite that are outside of the project scope of this project.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other occupied areas.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.2 PROTECTION FROM FIRE

A. General:

1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled “Owner’s Responsibility for Fire Protection.”
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
    a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of open-flame or welding or other high-heat equipment. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
    a. Train each fire watch in the proper operation of fire-control equipment and alarms.
    b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
    c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
    d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
    e. Maintain fire-watch personnel at Project site until 60 minutes after conclusion of daily work.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.

1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs. Comply with requirements in Section 01 32 33 "Photographic Documentation."

D. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 01 35 16

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Full-size physical assemblies that are constructed either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not

Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.4 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.6 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged in the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:

1. Provide test specimens representative of proposed products and construction.
2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
5. Build laboratory mockups at testing facility, using personnel, products, and methods of construction indicated for the completed Work.
6. When testing is complete, remove test specimens and test assemblies; do not reuse products on Project.
7. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
   a. Allow seven days for initial review and each re-review of each mockup.
7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.

1. Coordinate construction of the mockup to allow observation of air barrier installation, flashings, air barrier integration with fenestration systems, and other portions of the building air/moisture barrier and drainage assemblies, prior to installation of veneer, cladding elements, and other components that will obscure the work.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.
   a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
2. Distribution: Distribute schedule to Owner, Owner’s Rep, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

J. Substantial Completion of Site Work and Work in the public right-of-way: The day the Architect determines the Owner has full and unrestricted use and benefit of the facilities, both from the operational and safety standpoint, any remaining traffic disruptions will be rare and brief, and only minor incidental work, replacement of temporary substitute facilities, plant establishment periods, or correction or repair remains for the Physical Completion of the total Contract.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.

22. APWA: American Public Works Association
23. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
24. APA - APA - The Engineered Wood Association; www.apawood.org.
25. APA - Architectural Precast Association; www.archprecast.org.
26. API - American Petroleum Institute; www.api.org.
27. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
28. ARI - American Refrigeration Institute; (See AHRI).
29. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
30. ASCE - American Society of Civil Engineers; www.asce.org.
31. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
32. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
33. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASSP - American Society of Safety Professionals (The); www.assp.org.
36. ASTM - ASTM International; www.astm.org.
37. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
38. AVIXA - Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); www.soundandcommunications.com.
39. AWEA - American Wind Energy Association; www.awea.org.
40. AWI - Architectural Woodwork Institute; www.awinet.org.
41. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
42. AWPA - American Wood Protection Association; www.awpa.com.
43. AWS - American Welding Society; www.aws.org.
44. AWWA - American Water Works Association; www.awwa.org.
45. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
46. BIA - Brick Industry Association (The); www.gobrick.com.
47. BICSI - BICSI, Inc.; www.bicsi.org.
48. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
49. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
50. BMP – Best Management Practice
51. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
52. CDA - Copper Development Association; www.copper.org.
53. CE - Conformite Europeenne; http://ec.europa.eu/growth/single-market/ce-marking/.
54. CEA - Canadian Electricity Association; www.electricity.ca.
55. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
56. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
57. CGA - Compressed Gas Association; www.cganet.com.
58. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
59. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
60. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
61. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
62. CPA - Composite Panel Association; www.compositepanel.org.
63. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
64. CRRC - Cool Roof Rating Council; www.coolroofs.org.
65. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
66. CSA - CSA Group; www.csa-group.org.
67. CSI - Construction Specifications Institute (The); www.csiresources.org.
68. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
69. CTA - Consumer Technology Association; www.cta.tech.

70. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org .
71. CWC - Composite Wood Council; (See CPA).
72. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
73. DHA - Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); www.decorativehardwoods.org.
74. DHI - Door and Hardware Institute; www.dhi.org.
75. DIPRA: Ductile Iron Pipe Research Association
76. ECA - Electronic Components Association; (See ECIA).
77. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
78. ECIA - Electronic Components Industry Association; www.eciaonline.org.
79. ECY: Washington State Department of Ecology.
80. EIA - Electronic Industries Alliance; (See TIA).
81. EIMA - EIFS Industry Members Association; www.eima.com.
82. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
83. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
84. ESTA - Entertainment Services and Technology Association; (See PLASA).
85. ETL - Intertek (See Intertek); www.intertek.com.
86. EVO - Efficiency Valuation Organization; www.evo-world.org.
87. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
88. FHWA: Federal Highway Administration
89. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
90. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
91. FM Approvals - FM Approvals LLC; www.fmglobal.com.
92. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
93. FOP: Field Operating Procedure
94. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
95. FSA - Fluid Sealing Association; www.fluidsealing.com.
96. FSC - Forest Stewardship Council U.S.; www.fscus.org.
97. GA - Gypsum Association; www.gypsum.org.
98. GANA - Glass Association of North America;(See NGA).
99. GS - Green Seal; www.greenseal.org.
100. HI - Hydraulic Institute; www.pumps.org.
101. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
102. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
103. HPVA - Hardwood Plywood & Veneer Association; (See DHA).
104. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
105. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
106. IAS - International Accreditation Service; www.iasonline.org.
107. IBC – International Building Code, current edition unless otherwise noted.
108. ICBO - International Conference of Building Officials; (See ICC).
109. ICC - International Code Council; www.iccsafe.org.
110. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
111. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
112. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
113. IEC - International Electrotechnical Commission; www.iec.ch.
114. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
115. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
116. IESNA - Illuminating Engineering Society of North America; (See IES).
117. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
118. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
119. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org..

120. II - Infocomm International; (See AVIXA).
121. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
122. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
123. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
124. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
125. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
126. ISO - International Organization for Standardization; www.iso.org.
127. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
128. ITU - International Telecommunication Union; www.itu.int/home.
129. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
130. LMA - Laminating Materials Association; (See CPA).
131. LPI - Lightning Protection Institute; www.lightning.org.
132. MBMA - Metal Building Manufacturers Association; www.mbma.com.
133. MCA - Metal Construction Association; www.metalconstruction.org.
134. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
135. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
136. MHIA - Material Handling Industry of America; www.mhia.org.
137. MIA - Marble Institute of America; (See NSI).
138. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
139. MPI - Master Painters Institute; www.paintinfo.com.
140. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
141. MUTCD: Manual on Uniform Traffic Control Devices
142. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
143. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
144. NADCA - National Air Duct Cleaners Association; www.nadca.com.
145. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
146. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
147. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
148. NBI - New Buildings Institute; www.newbuildings.org.
149. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
150. NCMA - National Concrete Masonry Association; www.ncma.org.
151. NEBB - National Environmental Balancing Bureau; www.nebb.org.
152. NECA - National Electrical Contractors Association; www.necanet.org.
153. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
154. NEMA - National Electrical Manufacturers Association; www.nema.org.
155. NETA - InterNational Electrical Testing Association; www.netaworld.org.
156. NFHS - National Federation of State High School Associations; www.nfhs.org.
157. NFPA - National Fire Protection Association; www.nfpa.org.
158. NFPA - NFPA International; (See NFPA).
159. NFRC - National Fenestration Rating Council; www.nfrc.org.
160. NGA - National Glass Association (The); (Formerly: Glass Association of North America); www.glass.org.
161. NHLA - National Hardwood Lumber Association; www.nhla.com.
162. NLGA - National Lumber Grades Authority; www.nlga.org.
163. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
164. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
165. NRCA - National Roofing Contractors Association; www.nrca.net.
166. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
167. NSF - NSF International; www.nsf.org.

168. NSI - National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
169. NSPE - National Society of Professional Engineers; www.nspe.org.
170. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
171. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
172. NWFA - National Wood Flooring Association; www.nwfa.org.
173. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
174. PDI - Plumbing & Drainage Institute; www.pdionline.org.
175. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
176. PPI: Plastic Pipe Institute
177. QPL: Qualified Products List.
178. RAM: Request for Approval of Material.
179. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
180. RFCI - Resilient Floor Covering Institute; www.rfci.com.
181. RIS - Redwood Inspection Service; www.redwoodinspection.com.
182. SAE - SAE International; www.sae.org.
183. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
184. SDI - Steel Deck Institute; www.sdi.org.
185. SDI - Steel Door Institute; www.steeldoor.org.
186. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
187. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
188. SIA - Security Industry Association; www.siaonline.org.
189. SJI - Steel Joist Institute; www.steeljoist.org.
190. SMA - Screen Manufacturers Association; www.smainfo.org.
191. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
192. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
193. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
194. SPIB - Southern Pine Inspection Bureau; www.spib.org.
195. SPRI - Single Ply Roofing Industry; www.spri.org.
196. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
197. SSINA - Specialty Steel Industry of North America; www.ssina.com.
198. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
199. STI - Steel Tank Institute; www.steeltank.com.
200. SWI - Steel Window Institute; www.steelwindows.com.
201. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
202. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
203. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
204. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
205. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
206. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
207. TMS - The Masonry Society; www.masonrysociety.org.
208. TPI - Truss Plate Institute; www.tpinst.org.
209. TPI - Turfgrass Producers International; www.turfgrasssod.org.
210. TRI - Tile Roofing Institute; www.tileroofing.org.
211. UL - Underwriters Laboratories Inc.; www.ul.com.
212. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
213. USAV - USA Volleyball; www.usavolleyball.org.
214. USGBC - U.S. Green Building Council; www.usgbc.org.
215. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.

216. WA - Wallcoverings Association; www.wallcoverings.org.
217. WASTEC - Waste Equipment Technology Association; www.wastec.org.
218. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
219. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
220. WDMA - Window & Door Manufacturers Association; www.wdma.com.
221. WI - Woodwork Institute; www.wicnet.org.
222. WSDOT: Washington State Department of Transportation
223. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
224. WWPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.

2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
   a. Available from Defense Standardization Program; www.dsp.dla.mil.
   b. Available from General Services Administration; www.gsa.gov.
   c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Section also includes:

1. Temporary Utilities:
   a. Water.
   b. Power.
2. Construction Facilities:
   a. Pedestrian access.
   b. Vehicular access.
   c. Parking.
   d. Staging, storage, stockpiling.
   e. Traffic regulation.
   f. Progress cleaning and waste removal.
3. Temporary Controls:
   a. Barriers.
   b. Enclosures and fencing.
   c. Signage.
   d. Security.
   e. Water control.
   f. Erosion and sediment control.
   g. Dust control.
4. Removal of utilities, facilities, and controls.

C. Related Requirements:

1. Section 01 10 00 "Summary" for any work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner’s construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.

E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use with a hydrant permit; water must be metered. No fees will be charged for the site water use or the hydrant permit, but Contractor must make application for the permit. Provide connections and extensions of services and metering as required for construction operations.

F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board’s ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. The Park is active year around with public events. The Owner will be as accommodating as possible related to parking and noise, however Contractor shall coordinate its activities to not conflict with or disrupt Owner’s activities, and at no additional cost to Owner. See Owner’s website for additional activities information, but note that activities and dates are susceptible to change at any time.

1.7 SITE CONSTRUCTION FACILITIES

A. Pedestrian access.

1. Pedestrian access to/egress from existing building entrance(s) shall always be maintained, where applicable.

B. Vehicular access.

1. Provide unimpeded access for emergency vehicles. Maintain 20 feet wide minimum driveways with turning space between and around combustible materials.
2. Provide and maintain access to fire hydrants, control valves, fire department connections, pad-mounted transformers and switching gear free of obstructions.
3. Construct stabilized construction entrances and sediment control BMPs in accordance with the accepted TESC plan.
4. Metal tracked equipment is not allowed.
5. Bases for permanent roads and parking areas may be used for construction traffic.

C. Parking.

1. Construction personnel:
   a. Use of parking area by construction personnel is prohibited unless approved in advance by Owner. Evening and weekend parking is more difficult and Contractor to coordinate with Owner.
2. Owner and tenant employees and the public shall always be maintained, either on the Site or in the public right-of-way.
3. Maintenance:
   a. Maintain traffic and parking areas in sound condition.
   b. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies.

D. Staging, storage, stockpiling

1. Contractor shall designate area on the Site to be utilized for staging, storage, and stockpiling.
2. Under no circumstance shall the public rights-of-ways be utilized for staging, storage, or stockpiling of equipment, materials, debris, or rubbish.

E. Progress cleaning and waste removal.

1. Maintain Site and public rights-of-ways in clean and orderly condition.
2. Sweep and remove debris in accordance with the accepted TESC plans.

1.8 TEMPORARY CONTROLS

A. Barriers

1. Protect non-owned vehicular traffic, stored materials, Site, and structures from damage.

B. Enclosures and fencing.

C. Security.

D. Water control.

1. Maintain excavations free of water. Provide, operate, and maintain necessary pumping equipment.
2. Protect Site from puddles or running water.

E. Dust control.

1. Execute Work by methods that prevent dust from becoming airborne.
2. Provide positive means to prevent airborne dust from dispersing into atmosphere.

F. Erosion and sediment control.

1. Comply with erosion and sediment control plan indicated on Drawings.
2. Work shall be in accordance with WSDOT Standard Specifications Section 8-01 Erosion Control and Water Pollution Control.
3. Appropriate erosion and sedimentation control shall be installed prior to Construction.
4. All erosion control measures shall be maintained in place until vegetation is planted.
5. Plan and execute construction by methods to control surface drainage from cuts and fills from borrow and waste disposal areas. Prevent erosion and sedimentation.
6. Minimize surface area of bare soil exposed at one time.
7. Provide temporary measures including berms, dikes, drains, and other devices to prevent water flow.
8. Periodically inspect earthwork to detect evidence of erosion and sedimentation. Promptly apply corrective measures.
9. Clean the Site and public rights-of-ways and install all permanent vegetation before Final Application for Payment inspection.

G. REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

1. Remove temporary utilities, equipment, facilities, and materials before Final Application for Payment inspection.
2. Clean and repair damage caused by installation or use of temporary Work.
3. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts with 1-5/8-inch OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide bases for supporting posts.

C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.

E. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.

F. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 8 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table and chairs.
3. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
4. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
5. Guest wifi shall be available for all project team members use at no additional charge.
6. Four (4) sets of PPE shall be available for Owner and Owner’s guests.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Where applicable, connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

F. Isolation of Work Areas in Occupied Facilities: Where applicable, prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.

b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.

3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. Electric Power Service: Where applicable, connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations, unless otherwise noted.

1. Install electric power service underground unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.
3. Coordinate with Owner for locking of main park gate, if needed.

C. Storage and Staging: Use designated areas of Project site for storage and staging needs.

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

E. Project Identification Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Project Identification Signs:
   a. Sign Surfaces: Large scale color output adhesive vinyl mounted to ½" gatorboard (white)
   b. Size: 4'x8'
   c. Image: Provided by Architect.
   d. Quantity: 2; relocated during construction, as required.
   e. Hardware: Galvanized..
2. Temporary Signs: Provide signs as required to inform public and individuals seeking entrance to Project.
   a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touch up signs, so they are legible at all times.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

H. Existing Elevator Use: Where applicable, use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work, so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

I. Existing Stair Usage: Where applicable, use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas, so no evidence remains of correction work.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with any noted work restrictions specified in Section 01 10 00 "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings or authorities having jurisdiction, whichever is more stringent.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: For existing trees within the in the area of work to remain, install tree protection as indicated on drawings or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Where applicable, provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the

sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.

3. Where fire-resistance-rated temporary partitions are required by authorities having jurisdiction, construct partitions according to the required assembly(s).
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
6. Protect air-handling equipment.
7. Provide walk-off mats at each entrance through temporary partition.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

B. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

C. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours.
    c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 57 13 - TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes, but is not limited to:

1. Temporary Erosion and Sediment Control (TESC) measures, which are shown on the Contract Documents, proposed by the Contractor, and reviewed and required by public Authorities Having Jurisdiction (AHJ) during the life of the Contract. This Work is intended to prevent, control and provide abatement for water pollution and erosion resulting from the Project site construction and to minimize damage to the Work, adjacent property, and to other bodies of water in accordance with CSWGP, AHJ and other applicable standards.
2. Preparation of and submission to AHJ for their review the Contractor's Construction Stormwater Pollution Prevention Plan (SWPPP). The SWPPP shall include overall TESC management and coordination of construction access and specific TESC installation and maintenance.
3. Preparation of and submission to AHJ for their review the Contractor's Spill Prevention, Control & Countermeasures Plan (SPCC).
4. Assume responsibility for transfer from Owner of Washington State Department of Ecology Construction Stormwater General Permit (CSWGP).
   a. CSWGP compliance includes monitoring and reporting of discharge flows and testing discharge including turbidity per permit requirements.
5. Protection of existing natural and constructed drainage systems at all times.
6. Testing, monitoring and reporting of discharge per CSWGP and AHJ permit requirements, at designated points or otherwise approved by AHJ.

B. It shall be the Contractor's responsibility to modify the TESC plan(s) as necessary to meet the Contractor's anticipated construction sequencing and means and methods for the Work. Modifications to the TESC Plans and specifications need to be adequately described in the Contractor's SWPPP and submitted to AHJ for review.

1.2 REFERENCES

A. Reference the following standards:

AHJ	Public Authority Having Jurisdiction: AHJ is an abbreviation for public Authorities Having Jurisdiction. For this project the AHJ includes permitting agencies including but not limited to Island County and Ecology.
BMPs	Best Management Practices per Ecology SWMMWW
Ecology	Washington State Department of Ecology
Ecology SWMMWW	State of Washington Department of Ecology Stormwater Management Manual for Western Washington, 2019. (www.ecy.wa.gov/programs/wq/stormwater/manual.html)

CSWGP	Washington State Department of Ecology Construction Stormwater General Permit https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Stormwater-general-permits/Construction-stormwater-permit
WAC 173-201A	Washington Administrative Code Chapter 173-201A, Water Quality Standards for Surface Waters of the State of Washington
WAC 173-200	Washington Administrative Code Chapter 173-200, Water Quality Standards for Groundwaters of the State of Washington
WSDOT	Washington Department of Transportation 2025 Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction

1.3 SUBMITTALS

A. Submit the following documents in accordance with Division 01 of the Specifications.

1. Product data sheets and shop drawings for materials listed in Part 2 Products and/or noted on Plans.
2. Prepare and submit to AHJ a Construction Stormwater Pollution and Prevention Plan (SWPPP).
3. Prepare and submit to AHJ Spill Prevention Control and Countermeasures (SPCC) Plan.
4. Provide product data on TESC materials and BMPs to be utilized.

B. Permits

1. Contractor to accept transfer from Owner of Owner's Washington State Department of Ecology Construction Stormwater General Permit (CSWGP).

C. Certified Erosion and Sediment Control Lead (CESCL)/Erosion and Sediment Control Lead (ESC Lead)

1. The Certified Erosion and Sediment Control Lead (CESCL)/Erosion and Sediment Control Lead (ESC Lead) shall meet the requirements of WSDOT Section 8-01.3(1)B.

D. Water Quality Sampling and Monitoring Plan per CSWGP requirements.

1. Submit turbidity and pH sampling reports to Ecology per CSWGP requirements.

E. Dewatering

1. Dewatering and construction stormwater discharge requirements shall be in conformance with CSWGP requirements. Dewatering is considered incidental to the contract and Contractor shall submit documentation and obtain the permit at no additional expense to Owner.

1.4 FIELD CONDITIONS

A. The following practices are prohibited within Infiltration and Soil Protection Zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Erection of sheds or structures.
4. Impoundment of water.
5. Non-manual excavation unless otherwise indicated.
6. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Catch Basin Protection: Conform to detail as noted on Plans and WSDOT Section 8-01.3(9)D.

B. Straw: Conform to WSDOT Section 9-14.5(1).

C. Silt Fence: Conform to detail as noted on Plans and WSDOT Section 9-14.6(9).

D. Hydroseeding Materials:

1. Fertilizer: Conform to WSDOT Section 9-14.3.
2. Seed Mix: Conform to WSDOT Section 9-14.3 and shall be the following seed mix or an AHJ approved equal, except as noted on Plans.

	% Weight	% Purity	% Germination
Chewings or annual blue grass Festuca rubra var. commutate or Poa anna	40	98	90
Perennial rye / Lolium perenne	50	98	90
Redtop or colonial bentgrass Agrostis alba or Argostis tenius	5	92	85
White dutch clover Trifolium repens	5	98	90

E. Erosion Control Blankets: Conform to WSDOT Section 9-14.6(2).

F. Plastic Covering: Conform to WSDOT Section 9-14.6(3).

G. Wattles: Conform to detail as noted on Plans and WSDOT Section 9-14.6(5).

H. Portable Storage and Filtration Systems:

1. Design and sizing for pumps, portable storage tanks, filtration and treatment system shall be designed and provided by a certified CESCL/ESC Lead. Design and calculations shall be included in Contractor’s SWPPP.
2. Filtration treatment shall conform to CSWGP requirements.

I. High Visibility Construction Fence: Conform to detail as noted on Plans and WSDOT Section 8-01.3(9)A1.

J. Stabilized Construction Entrance: Conform to detail as noted on Plans and WSDOT Section 8-01.3(7), or an approach identified and detailed in the SWPPP for AHJ review.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall designate a CESCL/ESC Lead and CESCL/ESC Lead back-up to be responsible for implementing and maintaining effective TESC to prevent violations of the CSWGP permit and other permits.

B. Arrange for AHJ inspection of the TESC facilities as required by AHJ.

C. Install fences for Owner's Representative and AHJ Inspector's review and approval prior to clearing.

D. Perform TESC measures in accordance with the requirements of this Section, WSDOT Section 8-01, the AHJ permits and requirements by other AHJ.

3.2 INSTALLATION, COORDINATION AND MAINTENANCE

A. Coordinate, install and maintain the TESC measures in accordance with the SWPPP, Manufacturer's specifications and recommendations, and WSDOT Section 8-01, whichever is more stringent.

1. Coordinate and upgrade, revise or add additional TESC measures as needed to achieve compliance with the Project CSWGP permit and/or related County permits as required to prevent sediment transport to surface waters, drainage systems, and adjacent properties.
    a. The TESC measures shown on the Contract Documents are shown for AHJ permit review only. The contractor is solely responsible for all means and methods and sequencing of TESC measures.
    b. Install and sequence TESC measures as appropriate for the Contractor's actual construction activities and phasing.
    c. Install, maintain and upgrade TESC measures to conform with AHJ and Owner requirements at no additional cost to the Owner.

B. Protection of Infiltration and permanent stormwater management facilities:

1. General: Coordinate with Work by others in adjacent or nearby construction activities:
    a. Do not allow construction stormwater runoff to be directed toward or enter the infiltration facility.
    b. Do not store construction materials, debris, vehicles (moving or parking), equipment or stockpiles within footprint of infiltration facility.
    c. If the Infiltration facility is damaged or becomes contaminated from construction stormwater or sedimentation due to Contractor's operations, remove and restore paving, swale soil and mulch, landscaping, etc. as directed by AHJ Inspector at no additional cost to the Owner.

3.3 SPILL PREVENTION CONTROL AND COUNTERMEASURES PLAN

A. Prepare and abide by Spill Prevention Control and Countermeasures Plan in accordance with WSDOT Section 1-07.15(1).

B. Spill Clean-Up:

1. Notify Owner's Representative immediately if toxic or hazardous materials are spilled.
2. Notify the Washington State Department of Ecology and AHJ Inspector/SDCI Geotechnical Special Inspector/ SDCI Site Development Inspector immediately following a spill of a toxic or hazardous material.
3. Clean up spills promptly and completely, and in accordance with AHJ requirements.
4. Report as required to AHJ.

3.4 TESC REMOVAL AND CLEANUP

A. Upon completion of improvements and when areas upstream are stabilized from erosion and approval is obtained from the owner and AHJ Inspector, remove TESC measures. Identify in writing if removal operations deviate from the SWPPP and/or TESC Plan submitted.

B. Install restoration measures and implement measures for establishment of grass and plantings upon removal and backfilling of sediment ponds, interceptor swales and other TESC measures. These measures shall include providing temporary BMP's as appropriate at the site edges such as compost sock, wattles or silt fencing. The edge control BMP's to be removed 30-days after certificate of occupancy or otherwise approved by Owner.

END OF SECTION 01 57 13

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 00 70 00 “General Conditions”.
2. Section 01 10 00 "Summary" for Contractor requirements related to Owner-furnished products.
3. Section 01 23 00 "Alternates" for additive and deductive bid alternates.
4. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
5. Section 01 42 00 "References" for applicable industry standards for products specified.
6. Section 01 77 00 "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. If a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: A submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: A submittal complying with requirements in Section 01 33 00 "Submittal Procedures."

F. Substitution: Refer to Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Resolution of Compatibility Disputes between Multiple Contractors:
   a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
   a. Name of product and manufacturer.
   b. Model and serial number.
   c. Capacity.

d. Speed.
e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, 26, and 27 for additional equipment identification requirements.

1.5 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
    a. Submit additional documentation required by Architect to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements unless otherwise indicated.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements unless otherwise indicated.
7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
    a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements of individual Specification Sections.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 33 00 "Submittal Procedures."

1. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Installation of the Work.
3. Cutting and patching.
4. Coordination of Owner's portion of the Work.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

B. Related Requirements:

1. Section 00 70 00 “General Conditions”.
2. Section 01 10 00 "Summary" for coordination of Owner-furnished products, and limits on use of Project site.
3. Section 01 33 00 "Submittal Procedures" for submitting surveys.
4. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
5. Section 02 41 19 "Selective Demolition" for select existing site feature demolition.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify

Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following**:**
   a. Primary operational systems and equipment.
   b. Fire separation assemblies.
   c. Air or smoke barriers.
   d. Fire-suppression systems.
   e. Plumbing piping systems.
   f. Mechanical systems piping and ducts.
   g. Control systems.
   h. Communication systems.
   i. Fire-detection and -alarm systems.
   j. Conveying systems.
   k. Electrical wiring systems.
   l. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
   a. Water, moisture, or vapor barriers.
   b. Membranes and flashings.
   c. Exterior curtain-wall construction.
   d. Sprayed fire-resistive material.
   e. Equipment supports.
   f. Piping, ductwork, vessels, and equipment.
   g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner and Owner's Rep that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
8. Schedule a "Box Walk" once all electrical and low voltage device j-boxes (but not pipe) have been roughed in, for verification by Owner, Architect, and Owner Vendors. This may occur in phases, if agreed to by Owner.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and

duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading more than that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

J. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 01 10 00 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel.

1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
2. Refer to Section 01 10 00 "Summary" for other requirements for Owner-furnished, Contractor-installed products.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.

1. Construction Schedule: Inform Owner and Owner’s Rep of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner and Owner’s Rep if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel and Owner's separate contractors at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   a. Use containers intended for holding waste materials of type to be stored.
4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 19 “Construction Waste Management and Disposal.”

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 91 00 “Commissioning," when incorporated.

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.10 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse/Reinstall: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

B. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 RECYCLING RECEIVERS AND PROCESSORS

A. Subject to compliance with requirements, available recycling receivers and processors are limited to the following:

1. Designated facilities acceptable to authority(s) having jurisdiction.

2.2 PERFORMANCE REQUIREMENTS

A. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:
    a. Wood studs.
    b. Wood joists.
    c. Plywood and oriented strand board.
    d. Wood paneling.
    e. Wood trim.
    f. Structural and miscellaneous steel.
    g. Rough hardware.
    h. Roofing.
    i. Insulation.
    j. Doors and frames.
    k. Door hardware.
    l. Windows.
    m. Glazing.
    n. Metal studs.
    o. Gypsum board.
    p. Acoustical tile and panels.
    q. Carpet.
    r. Carpet pad.
    s. Demountable partitions.
    t. Equipment.

u. Cabinets.
v. Plumbing fixtures.
w. Piping.
x. Supports and hangers.
y. Valves.
z. Sprinklers.
aa. Mechanical equipment.
bb. Refrigerants.
cc. Electrical conduit.
dd. Copper wiring.
ee. Lighting fixtures.
ff. Lamps.
gg. Ballasts.
hh. Electrical devices.
ii. Switchgear and panelboards.
jj. Transformers.

2. Construction Waste:
   a. Lumber.
   b. Wood sheet materials.
   c. Wood trim.
   d. Metals.
   e. Roofing.
   f. Insulation.
   g. Carpet and pad.
   h. Gypsum board.
   i. Piping.
   j. Electrical conduit.
   k. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
      1) Paper.
      2) Cardboard.
      3) Boxes.
      4) Plastic sheet and film.
      5) Polystyrene packaging.
      6) Wood crates.
      7) Wood pallets.
      8) Plastic pails.
   l. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
      1) Paper.
      2) Aluminum cans.
      3) Glass containers.

PART 3 - EXECUTION

3.1 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse/Reinstallation in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.2 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

1. Remove recyclable waste from Owner’s property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.

B. Related Requirements:

1. Section 00 70 00 “General Conditions”.
2. Section 01 29 00 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
3. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
4. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
5. Section 01 79 00 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.3 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.5 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

D. TAB Reports: For coordination with Owner’s Commissioning Agent.

E. Attic Stock: For review and confirmation by Owner.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.7 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list, projected completion date, and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect’s signature for receipt of submittals.
5. Submit testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.

2. Install permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. See individual trade bid documents for additional substantial completion requirements specific to trade scopes.

E. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion (AIA Document G704) after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.8 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 01 29 00 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.9 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.
4. Submit list of incomplete items in the following format:
    a. MS Excel Electronic File: Architect will return annotated file.
    b. Web-Based Project Software Upload: Utilize software feature for storing, distributing, and updating list of incomplete items (punch list).

1.10 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit via Web-based Project management software package.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
   a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
   b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
   c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
   d. Remove tools, construction equipment, machinery, and surplus material from Project site.
   e. Remove snow and ice to provide safe access to building.
   f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
   g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
   h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
   i. Vacuum and mop concrete.
   j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
   k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
   l. Remove labels that are not permanent.
   m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
   o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
   p. Clean ducts, blowers, and coils.
      1) Clean HVAC system in compliance with Division 23. Provide written report on completion of cleaning.
   q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
   r. Clean strainers.
   s. Leave Project clean and ready for occupancy.

C. See individual trade bid documents for additional closeout requirements specific to trade scopes.

D. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

E. Construction Waste Disposal: Comply with waste-disposal requirements in Section 01 74 19 “Construction Waste Management and Disposal.”

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Requirements:

1. Section 00 70 00 “General Conditions”.
2. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect and Owner will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Initial Submittal: Submittal single, bookmarked PDF file via Web-based Project management software package.

2. Final, Approved Submittal: Single, bookmarked PDF file and 1 paper/ binder copy delivered to Owner.

C. Initial Manual Submittal: Submit draft digital copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple volume sets
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Prepared on 8-1/2-by-11-inch white bond paper.

5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.

B. Related Requirements:

1. Section 00 70 00 “General Conditions”.
2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:
   a. Submit PDF electronic files of scanned record prints.
   b. One (1) fullsize, edge-bound drawing set, printed in color; delivered to Owner.

1.4 RECORD DRAWINGS

A. Record Prints: Utilize Web-based Project management software package to incorporate new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an acceptable drawing technique.
   c. Record data as soon as possible after obtaining it.
   d. Record and check the markup before enclosing concealed installations.
   e. Cross-reference record prints to corresponding photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.

c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Architectural Supplemental Instruction.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Architectural Supplemental Instruction numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files and hard copies of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file and physical hard copies.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
1. Referenced changes via Web-based Project management software package (ex: RFIs, Change Orders) may be referenced on drawings by individual item numbers and accompany the drawings via a separate, 8.5x11 format, individually bookmarked, supplemental log/inventory of the change items complete will all requests and change documentation and attachments filed by item number.
3. Refer instances of uncertainty to Architect for resolution.
4. Architect will review annotated drawing set as a submittal. Upon approval, contractor to provide owner with (1) bound, full-sized printed copy of annotated drawing set.

1.5 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Digital record drawings to be backed up on secondary device throughout construction. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Systems and equipment operation manuals.
   c. Systems and equipment maintenance manuals.
   d. Product maintenance manuals.
   e. Project Record Documents.
   f. Identification systems.
   g. Warranties and bonds.
   h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.

l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning.
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least 7 days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of demonstration performance-based test.

E. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 01 79 00

SECTION 01 91 00 - COMMISSIONING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Owner documentation, where applicable, is included by reference for information only.

1.2 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

B. Related Sections:

1. Divisions 21, 22, 23 and 26, including LOSS and Water systems.

1.3 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

C. CxA: Commissioning Authority.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity they represent, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

1. Members Appointed by Owner: CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES

A. Engage a qualified CxA.

B. Provide the OPR documentation to the CxA and Contractor for information and use.

C. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

D. Provide the BoD documentation, prepared by Engineer of Record and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings held on a variable basis, no more than monthly frequency.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the CxA.
6. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.
7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Convene commissioning team meetings.

D. Provide Project-specific construction checklists and commissioning process test procedures.

Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test

reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

E. Prepare and maintain the Issues Log.

F. Prepare and maintain completed construction checklist log.

G. Witness systems, assemblies, equipment, and component startup.

H. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 91 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner requirements.
2. Section 017300 "Execution" for cutting and patching procedures.
3. 017419 "Construction Waste Management and Disposal" for procedures and requirements related to waste management and disposal.
4. Section 311000 "Site Preparation" for site clearing and removal of above- and below-grade site features not part of selective demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for store.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property for dust control. Indicate proposed locations and construction of fencing.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 FIELD CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. Storage or sale of removed items or materials on-site is not permitted. However, for the tree clearing required by the documents selling the fallen trees and including the associated credit as part of the overall bid for site clearing shall be considered as part of the bid.

E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.9 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's ongoing operations of adjacent park and park entrance.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

EXECUTION

2.2 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

2.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. Disconnect, demolish, and remove fire-suppression systems, underground plumbing, equipment, and any components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.

d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

2.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied areas of site.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

C. Remove temporary barricades and protections where hazards no longer exist.

2.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Maintain adequate ventilation when using cutting torches.
4. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
6. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied or used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Store items in a secure area until delivery to Owner.
3. Transport items to Owner's storage area designated by Owner.
4. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Protect items from damage during transport and storage.
3. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

2.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

2.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

2.8 CLEANING

A. Clean adjacent occupied areas of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION – 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The General Structural Notes shall be used in conjunction with this specification. The General Structural Notes shall supersede items in this specification when discrepancies exist.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, vapor retarders, waterstops and finishes.

B. Related Requirements:
1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
2. Section 079200 “Joint Sealants” for sealants at traffic and non-traffic joints in concrete slabs.
3. Section 024119 “Selective Demolition” for demolition and removal of existing concrete slabs-on-grade.
4. Section 055000 “Metal Fabrications” for cast-in and post-installed anchors, rods, and embed plates.
5. Section 071113 “Bituminous Waterpproofing” for cold-applied cut-back-asphalt dampproofing at below-grade concrete walls.
6. Section 099600 "High Performance Coatings" for anti-graffiti sealer applied to exposed concrete surfaces where indicated.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.
e. Special concrete finish Subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, anchor rod and anchorage device installation tolerances, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers ,forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to the approval of the Architect.

E. Embedded Item Placement: Shop drawings shall indicate the location and type of plates, anchorages, or other items to be embedded in the finished concrete surfaces. Include wall elevations, slab plans, and details required to locate and install embeds.

1.6 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Vapor retarders.
9. Semirigid joint filler.
10. Joint-filler strips.
11. Repair materials.

B. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

C. Minutes of preinstallation conference.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.10 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1, ACI 301, and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301, ACI 305.1, and as follows:

1. Maintain concrete temperature below 100 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Overlaid Finnish birch plywood.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

2.3 ACCESSORIES

1. Geofoam block for insulative fill material in non-structural concrete pours.
   a. Source Limitations: Obtain geofoam through one source from a single manufacturer
   b. Deliver geofoam labeled with ASTM D6817 Type.
   c. Store protected from moisture and sunlight prior to installation.

d. Product should not be exposed to open flame or other ignition sources.
e. Product should not be exposed to organic solvents, petroleum products and their vapors. Examples include but are not limited to are acetone, paint thinner, and gasoline.
f. Provide temporary ballast or other restraint prior to and during installation.
g. Rigid Cellular Polystyrene Geofoam

B. Rigid Cellular Polystyrene Geofoam: ASTM D6817 Type, compressive resistance indicated below and with flame spread index less than 25 and smoke developed index less than 450 per ASTM E84/UL723. Compressive resistance, flexural strength and minimum density to be determined by bidder/manufacturer for application.

2.4 STEEL REINFORCEMENT

A. Reinforcing Bars: per structural drawings.

2.5 REINFORCEMENT ACCESSORIES

A. Zinc Repair Material: ASTM A 780/A 780M.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.6 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type II, or ASTM C595, Type IL, gray. Cement in concrete exposed to earth shall be ASTM C150, Type II or ASTM C595, Type IL-MS, gray.
2. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
3. Fly Ash: ASTM C618, Class C or F, Maximum loss of ignition shall be 1.0 percent.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S, Class 3M, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: Per structural drawings.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

F. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

G. Water: ASTM C 94/C 94M and potable.

2.7 WATERSTOPS

A. PVC or Rubber waterstops, contractor’s option.

B. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Profile: Flat dumbbell with center bulb.
2. Dimensions: 6 inches by 3/8-inch thick (or as shown on drawings); non-tapered.

C. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Profile: Flat dumbbell with center bulb.
2. Dimensions: 6 inches by 3/8-inch thick (or as shown on drawings); non-tapered.

D. Mastic Waterstop: Sika Lockstop and Sika Lockstop Primer for use in waterproofing concrete curbs to the slab below.

2.8 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape. Acceptable manufacturer and product includes, but is not limited to:

1. Stego Wrap Vapor Barrier – 15 mils.

2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Curing and sealing compounds shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1752, cork or self-expanding cork.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of Portland cement, which would otherwise be used, by not less than the minimum amounts provided on the structural drawings.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15% of percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use plasticizing admixture in concrete, as required, for placement and workability.
2. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Normal-weight concrete.

1. Minimum Compressive Strength: Per structural drawings.
2. Maximum W/C Ratio: per structural drawings.
3. Slump Limit: Tolerance shall be plus or minus 1 1/2” inch.
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Foundation Walls, Stem Walls, and Column Bases: Normal-weight concrete.

1. Minimum Compressive Strength: Per structural drawings.
2. Maximum W/C Ratio: per structural drawings
3. Slump Limit: Tolerance shall be plus or minus 1 1/2” inch.
4. Air Content: 4.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 5 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

C. Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: per structural drawings.
2. Maximum W/C Ratio: per structural drawings.
3. Minimum Cementitious Materials Content: per structural drawings.
4. Slump Limit: Tolerance shall be plus or minus 1 ½” inch.
5. Air Content: 4.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
6. Air Content: 5 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size. Use at exposed polished concrete slabs.
7. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.14 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F , reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F , reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints per structural drawings. Embed keys at least 1-1/2 inches into concrete.

3. Roughen concrete where shown on structural drawings to a minimum amplitude of ¼" using impact hammer. Remove all lost or damaged concrete, thoroughly flush all surfaces with potable water, air blast with oil free compressed air to remove all water.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls per structural and architectural drawings Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas per structural drawings. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete and time such that cutting action does not tear, abrade, or otherwise damage surface and is before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, per structural drawings.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.7 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints per structural drawings. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 .
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities. Apply a sack finish or sack rub to exposed surfaces for uniform finish.

1. Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.

1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view, to be covered with resilient flooring, carpet, or ceramic tile set over a cleavage membrane.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
   a. Unless otherwise noted: Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17.
   b. At polished concrete floors: specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere per structural drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with a fiber-bristle broom. Refer to drawings for direction of broom finish. Verify texture of broom finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 6” high unless otherwise indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: same as adjacent concrete slab.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing

operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch . Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to

manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from walls and pilasters/columns.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. , but less than 25 cu. yd. , plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each

composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi .
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

END OF SECTION 03 30 00

SECTION - 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Field-installed shear connectors.
3. Grout.

B. Related Requirements:

1. Section 054000 “Cold-Formed Metal Framing” for light gauge metal framing systems.
2. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
3. Section 055213 “Pipe and Tube Railings” for galvanized and stainless-steel railings.
4. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for surface-preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Force-Resisting System: Elements of structural-steel frame designated as "F" or along grid lines designated as "F" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:

1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
2. Welded built-up members with plates thicker than 2 inches.
3. Column base plates thicker than 2 inches.

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Force-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the Seismic-Force-Resisting System.
6. Indicate locations and dimensions of protected zones.
7. Identify demand critical welds.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, and shop-painting applicators.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.

2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

F. Source quality-control reports.

G. Field quality-control reports.

1.8 QUALITY ASSURANCE

A. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P3 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341.
3. AISC 360.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Construction: Shear wall system. The shear walls are constructed using cold-formed steel framing with sheet metal sheathing. The structural steel (HSS's) located at the ends of shear walls are to be considered part of the lateral force resisting system.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: per structural drawings.

B. Channels, Angles: per structural drawings.

C. Plate and Bar: per structural drawings.

D. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: per structural drawings.

E. Cold-Formed Hollow Structural Sections: per structural drawings.

F. Corrosion-Resisting, Cold-Formed Hollow Structural Sections: per structural drawings.

G. Steel Pipe: per structural drawings.

1. Weight Class: per structural drawings.
2. Finish: Black except where indicated to be galvanized.

H. Steel Castings: per structural drawings.

I. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: per structural drawings.

B. High-Strength Bolts, Nuts, and Washers: per structural drawings.

C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating

D. Headed Anchor Rods: ASTM F 1554, Grade 36 or ASTM F 1554, Grade 55, weldable, straight.
1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436, Type 1, hardened carbon steel.
4. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

E. Threaded Rods: ASTM A 36/A 36M
1. Nuts: ASTM A 563 heavy-hex carbon steel.

2. Washers: ASTM F 436, Type 1, hardened carbon steel.
3. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

2.4 PRIMER

A. Primer for exposed to view structural steel: Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

B. Primer for enclosed structural steel (not exposed to view): Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

C. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.5 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Galvanized surfaces.
5. Surfaces enclosed in construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. Structural steel enclosed in construction: SSPC-SP 3, "Power Tool Cleaning."
2. Structural steel exposed to view: SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.9 GALVANIZING

A. Where indicated, provide Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in

intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

B. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

END OF SECTION 05 12 00

SECTION 052119 – OPEN WEB STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. LH-series long-span steel joists.
2. Joist girders.
3. Joist accessories.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

1.2 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Indicate locations and details of bearing plates to be embedded in other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Welding certificates.

C. Manufacturer certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

F. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications ."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications ."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Per structural general notes.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.

1. Use: Per structural drawings.
2. Design special joists to withstand design loads with live-load deflections no greater than the following:
   a. Roof Joists: Per structural drawings.

2.3 STEEL JOISTS

A. Long-Span Steel Joist: Manufactured steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on Drawings.

1. Joist Type: LH-series long-span steel joists.
2. End Arrangement: Underslung.
3. Top-Chord Arrangement: Parallel

4. Provide holes in chord members for connecting and securing other construction to joists.
5. Camber long-span steel joists according to SJI's "Specifications."
6. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 JOIST GIRDERS

A. Manufacture joist girders according to "Standard Specification for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements as indicated:

1. End Arrangement: Underslung with bottom-chord extensions as noted on drawings.
2. Top-Chord Arrangement: Parallel.
3. Provide holes in chord members for connecting and securing other construction to joist girders.
4. Camber joist girders according to SJI's "Specifications."

2.5 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

C. Bridging: Fabricate as indicated and according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

D. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Hot-dip zinc coat according to ASTM A 123/A 123M.

E. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."

F. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

G. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

H. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.6 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Shop priming of joists and joist accessories is specified in Section 099600 – High Performance Coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications, joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Bolt joists to supporting steel framework using carbon-steel bolts.

D. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 REPAIRS

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Touchup Painting:

1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
    a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
    b. Apply a compatible primer of type as primer used on adjacent surfaces.

2. Cleaning and touchup painting are specified in Section 099600 "High-Performance Coatings."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Visually inspect bolted connections.

C. Prepare test and inspection reports.

END OF SECTION 052119

SECTION 05 30 00 – METAL DECK

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

A. General: The latest versions of the publications listed below form a part of this Specification; comply with provisions of these publications except as otherwise shown or specified.

B. American Iron and Steel Institute (AISI):

1. AISI: Specification for the Design of Cold-Formed Steel Structural Members

C. American Society for Testing and Materials (ASTM):

1. ASTM A36: Structural Steel
2. ASTM A108: Steel Bars, Carbon, Cold-Finished, Standard Quality
3. ASTM A653: Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process
4. ASTM A611: Standard Specification for Structural Steel (SS) Sheet, Carbon, Cold Rolled
5. ASTM A924: General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process

D. American Welding Society (AWS):

1. AWS D1.1: Structural Welding Code - Steel
2. AWS D1.3: Structural Welding Code - Sheet Steel

E. Steel Deck Institute (SDI):

1. SDI Design Manual for Composite Decks, Floor Decks, and Roof Decks

F. Underwriters' Laboratories (UL) Fire Resistance Manual

G. Factory Mutual (FM) Research Corporation Approval

1.2 DEFINITIONS

A. Testing Agency refers to the organization or group of organizations responsible for representing the Owner and performing all inspection, testing, and laboratory services as described herein.

1.3 QUALITY ASSURANCE

A. Qualification of Erector/Installer: Must have a minimum of 5 years' experience in the installation and/or erection of metal decking and accessories.

B. All deck material and connections are to have current ICBO approvals.

C. Each welder performing work on this project shall be qualified in accordance with the American Welding Society before commencement of welding on this project.

D. Unless otherwise noted, the materials of this Section are used as part of an assembly in which fire-resistive construction ratings are required. Demonstrate rated approval by Underwriter's Laboratories, Inc., and the governmental agencies having jurisdiction.

E. See Section 01400, "Quality Requirements" for testing and inspection.

F. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

G. Factory Mutual (FM) Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings for the plan deck spans.

H. Continuous inspection shall be provided for field attachment of all metal roof decking; check and verify attachment and location of all closures and accessories.

Welding Inspection: In addition to the specified operator qualifications, prior to each welder starting work on the job and periodically as the testing agency determines, each welder shall perform a weld test to demonstrate to the inspector his ability to produce a satisfactory weld. The weld test shall be as follows:

1. Weld at least two samples of deck material to a base steel section simulating the framing with one weld each sample. Twist the deck sample with respect to the base until failure occurs. If the decking tears or if the welds shearing in torsion show the proper fusion area, the welds are satisfactory.
2. Questionable welding of the permanent decking shall be checked by the inspector by suitable means, including ultrasonic methods, if applicable.

I. Pre-Construction Conference: Schedule a job conference to review the Structural Documents prior to development of shop drawings. The conference shall be attended by all pertinent parties, which at a minimum is to include the Fabricator, Erector, Contractor, Owner's Testing Agency, and Project Representative.

1.4 SUBMITALS

A. Shop Drawings: Clearly indicate the following:

1. Deck layout and orientation, type and gage, framing and supports, and unit dimensions and sections
2. Size and location of holes and openings through deck
3. Edge condition details and locations, including type and locations of all closures
4. Additional deck support framing where required
5. Types of welds and weld patterns, including weld washer requirements
6. Types of connection fasteners and locations
7. Location and patterns for button punching
8. Shoring locations, if required

B. Manufacturer's Product Data: Clearly indicate all technical information that specifies full compliance with requirements of this Section and contract documents, including manufacturer's published installation recommendations.

C. Copies of each welder's qualification records shall be made available to the Project Representative for inspection.

D. Mill Test Reports: Submit mill test reports.

E. Submit ICBO Report confirming compliance of metal deck with regulatory fire-resistance requirements.

1.5 HANDLING AND STORAGE

A. Handling: Handle and stack all materials carefully in order to prevent deformation, corrosion, or damage. During unloading and hoisting, extra care shall be given to prevent damage to the ends and sides. Decking shall not be placed in direct contact with the ground. Store deck at a slope to prevent water from ponding. Protect with a waterproof covering and ventilate to avoid condensation. Where the underside of deck is architecturally exposed, it shall be free from visual defects such as scratches, dents, flame cut edges, holes, etc. All damaged deck shall be replaced.

B. Damaged Units: The Contractor shall replace damaged deck units that are rejected by the Owner's Testing Agency. All rejected deck shall be immediately removed from the job site.

1.6 JOB CONDITIONS

A. General: Conform to all local, state and federal safety regulations, especially where decking is used as planking prior to welding in place. Exercise extreme care so as to prevent decking from blowing off in wind.

1.7 CONDITION OF STEEL

A. Pre-Fireproofing Inspection: The Contractor, metal decking erector, sprayed-on fireproofing applicator, and the Owner's Testing Agency shall conduct a visual inspection of all metal decking prior to receiving fireproofing. The purpose of this inspection is to check for foreign substances on the surfaces that could impair adhesion. Any cleaning that may be necessary as a result of this inspection shall be done at no additional cost to the Owner.

1. All metal decking shall be free of oil, dirt, or other materials that will impair bond of concrete or fireproofing.
2. Application of the sprayed-on fireproofing will not commence until all steel surfaces have been accepted by sprayed-on fireproofing subcontractor and material manufacturer. No additional compensation shall be granted to the Contractor, metal decking erector, or fireproofing applicator should it be determined at a later date that foreign substances that were allowed to remain on the steel surfaces will have a detrimental effect in obtaining total adhesion in accordance with the fireproofing Specification Section.

1.8 REQUIREMENTS AT EDGE CONDITIONS

PRODUCT DATA SHEET 0 - The Contractor shall make specific provisions to provide the necessary framing materials at slab and roof edge conditions. The Contractor shall provide and install all gauge metal edge closures where required by the plans and specification and shall coordinate shoring requirements at composite slab edges. The Contractor shall provide and install all structural steel bent plate edge closures or structural steel edge materials and any corresponding bracing or shoring where required by the plans and specifications.

PRODUCT DATA SHEET 1 - At edge closures, provide necessary modifications to the edge closure to ensure that shear connector studs can be properly connected to the structural framing. Where possible, weld through the edge closure. Where this is not possible or where an inadequate weld occurs, cut the edge plate at each stud and connect the stud directly to the framing.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Roof Deck:

1. Material: Metal roof deck shall be galvanized steel conforming to ASTM A653 Grade 50 Fy (min) = 50,000 psi with a minimum G60 coating of zinc prior to being formed or ASTM A611 Grade C or D with Fy (min) = 50,000 psi with primed and painted surfaces where specified as being painted per the Project Representative. Furnish decking of depth, gauge, and profile as indicated in drawings with all connections as indicated in the drawings and notes.
2. Where the deck and connections are not sized on the drawings, they shall be designed by the Contractor to satisfy the requirements of the plan superimposed vertical gravity and uplift loads in conjunction with the required diaphragm capacity as indicated in the load maps and notes. The minimum deck gauge is 20. Live/snow load deflections shall be limited to L/240, where 'L' is the center to center span of the deck. Total load deflections shall be limited to L/180. The capacities of the deck and its connections shall be based on current ICBO reports.
3. Uplift Loading: Steel roof deck and its connections to the supporting steel members shall be capable of resisting an ultimate wind uplift load of 25 pounds per square foot or the loads indicated on the load maps, whichever is greater.
4. For deck indicated as part of a fire rated system, furnish decking listed in the UL "Fire Resistance Directory" and bearing the UL label for the system detailed.

B. Connections: Connections shall be determined by the Contractor based on the more stringent of the manufacturer's minimum recommendations for the plan configurations and loading or as specified in the contract documents. Connections may be made by any method recommended by the manufacturer, except that button punching of side laps shall not be allowed at roof decks unless indicated specifically as being required per the Structural Plans. Connection materials shall be as follows:

1. Welded Shear Connectors: ASTM A108, Grade 1015 or 1020; of dimensions complying with AISC specifications and the contract drawings; through deck stud welded shear connectors. Install in such a manner as to provide complete fusion between the end of the stud and structural steel base material.
2. Mechanical Fasteners: Corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
3. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
4. Welding Materials: Applicable AWS D1.1 and D1.3 type required for materials being welded.
5. Weld Washers: Provide as required per manufacturer's recommendations.

C. Support Framing: Where necessary to provide support of the deck at edges of openings and at columns, additional support framing shall be provided by the Contractor per the typical details so that the deck flutes are supported with a minimum 2 inches of bearing. Where no details are provided or are not applicable, the Contractor shall design and provide secondary structural steel framing consisting of ASTM A36 steel to support the deck. The secondary framing shall satisfy the requirements of Section 05120, "Structural Steel."

D. Accessories: At roof conditions, the Contractor is to design and provide all accessories of types required to complete the installation of metal decking in the system shown, including edge forms,

end closures, sump pans, closure strips, cover plates, etc. Finish sheet metal items to match deck. Include the following items:

1. Metal cover plates to close gaps at changes in deck direction, columns, walls, and openings; 20 gage minimum.
2. Continuous sheet metal edging at openings and concrete slab edges, 20 gage minimum or as required per plan.
3. Sealed closures for ends of cells on single-unit decking, 20 gage minimum.
4. Fabricate metal closure strips of 20-gage sheet steel for openings between decking and other construction. Form to provide tight fitting closures at open ends of cells or flutes, sides of decking, and between decking.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.2 TOLERANCES

A. Unless otherwise noted, edge materials shall be field installed to the minimum tolerances of this Section or as required for the installation of the cladding system, whichever is more stringent.

1. Edge Location: 1/2 inch from established building working lines.
2. Edge Height: 1/8 inch from established slab thickness

3.3 INSTALLATION

A. General: Install decking in accordance with approved shop drawings and manufacturer's recommendations and commentary in SDI Publication No. 31. Where the metal deck is to be welded to steel framing with puddle welds, the steel framing shall be free of dirt and debris prior to laying the metal deck. Any water in the deck's valley shall be released so it does not become entrapped between the deck and the beam. The deck shall be installed so that the bottom rib is in continuous contact with the steel framing.

B. Accurately align and adjust steel panel units in place before permanently fastening. Place deck panels flat and square and fasten to supporting frame without warp or deflection. Inaccuracies in alignment or level shall be brought to the attention of the Project Representative and corrected by the Contractor before steel panels are finally placed.

C. Install closure strips and angle flashings as required to close openings between deck and walls, columns, and openings and gaps between deck.

D. Connections: After deck has been aligned, provide permanent connections to the support framing with welds, screw fasteners, or powder driven fasteners as required by the manufacturer or per plan. All closures, edge forms, plates, etc. shall be securely connected to the support framing per the manufacturers recommendations and per plan.

E. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting work. Use welding washers where recommended by deck manufacturer.

F. Furnish shoring as required to maintain position of structures and prevent deflection beyond allowable limits. Ensure construction loads do not exceed deck carrying capacity per manufacturer.

G. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum or butted at Contractor's option.

H. Hanging Loads: Do not hang concentrated loads exceeding 50 pounds from metal roof deck. Loads shall be located no closer than 5’-0” from any adjacent hanging load. For loads greater than 50 pounds, see the requirements in the structural drawings.

I. Cleaning: Prior to placement of concrete or other finish materials, the deck shall be cleaned to be free of debris and water.

3.4 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Repair galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions at cut edges or locations where coating has been damaged.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

C. Provide protection against concrete splatter or spillage for all materials that would be adversely affected by this occurrence.

3.5 CONSTRUCTION LOADING

A. The Contractor shall assume complete responsibility for the loading of roof deck due to construction loads. The Contractor shall verify when it is acceptable to place loads on the roof deck with the deck supplier, who shall substantiate that the roof deck will not be damaged, additional deflection, or have a reduced capacity as a result of the proposed construction loads.

B. The Contractor shall be responsible to repair any damage that occurs to the deck due to construction loads.

END OF SECTION 053000

SECTION – 054000
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior, non-load-bearing wall framing.
2. Design-build ceiling joist and soffit framing.

B. Related Requirements:

1. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: At contractor’s option for cold-formed framing substitution. Refer to structural drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 COLD-FORMED STEEL FRAMING, GENERAL

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: 33 (Grade 230).
2. Coating: G60

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 33 (Grade 230).
2. Coating: G60.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: per structural drawings
2. Flange Width: per structural drawings
3. Section Properties: per structural drawings

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: per structural drawings.
2. Flange Width: per structural drawings.

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: per structural drawings.
2. Flange Width: 1 inch plus the design gap for one-story structures.

D. Drift Clips and Deflection Tacks: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure. Provide deflection tacks where indicated on structural drawings.

2.4 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: per structural drawings
2. Flange Width: per structural drawings
3. Section Properties: per structural drawings

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Stud kickers and knee braces.
8. Joist hangers and end closures.
9. Hole reinforcing plates.
10. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36 or Grade 55, as noted on structural drawings, threaded carbon-steel hex-headed bolts headless, hooked bolts headless bolts, with encased end threaded, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C mechanically deposition according to ASTM B 695, Class 50.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.

C. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install load bearing shims or grout between the underside of shear wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete construction.

B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch .

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072119 "Foamed-In-Place Insulation" in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work. Not applicable at exterior walls within the natatorium environment except where specifically required in the drawings.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on structural drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Connect drift clips to cold-formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging per structural drawings. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

    a. Install solid blocking at centers indicated.

2. Channel Bridging: Cold-rolled steel channel welded or mechanically fastened to webs of punched studs.
3. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
4. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION – 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Steel framing and supports for countertops.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Hoist beam at pool pump pit
4. Miscellaneous steel trim and shapes at window openings per architectural details
5. Miscellaneous steel plate at custom thru-wall roof scupper
6. Aluminum sunshade ‘slats’, vertical and horizontal orientations
7. Miscellaneous steel trim and shapes at sunshade

B. Related Sections:

1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 051200 "Structural Steel Framing."
3. Section 055213 "Pipe and Tube Railings"
4. Section 076200 “Sheet Metal Flashing and Trim” for sheet metal fabrications related to downspout installation and collection boxes.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS.

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 316L.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

2.3 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209 , Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221 , Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 , Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A ; with hex nuts, ASTM A 563 ; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 ; with hex nuts, ASTM F 594 ; and, where indicated, flat washers; Alloy Group 2 .

D. Lock Washers: Helical, spring type, ASME B18.21.1 .

E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 , Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593 , and nuts, ASTM F 594 .

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 Interior Painting, “and Section 099600 "High-Performance Coatings."

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports primers that comply with Section 099113 "Exterior Painting," Section 099123 Interior Painting, “and Section 099600 "High-Performance Coatings.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with primer specified in Section 099600 "High-Performance Coatings."

2.9 SUNSHADE SLATS

A. Aluminum Tube Sunshade ‘Slats’: Formed and coated product complying with AAMA 1402.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Knotwood US LLC; Wall Cladding or comparable product by one of the following:
      a. Gentek Building Products, Inc.
      b. Kaycan Ltd.
      c. Mastic Home Exteriors; PLY GEM Siding Group.
      d. Norandex Building Materials Distribution, Inc.
      e. Rollex Corporation.
   2. Material: Coil-coated aluminum sheet, ASTM B209 (ASTM B209M), alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.
      a. Shape: Aluminum Tube material 2”x8” Battens, Batten Caps and associated fasteners and miscellaneous materials required for installation, horizontal and vertical locations per drawings.
      b. Nominal Thickness: 0.071 inch (1.8 mm)
      c. Finish: As selected by Architect from manufacturer’s full line of standard woodgrain colors.

2.10 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.11 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

   1. Shop prime with zinc-rich primer is indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.13 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: non-specular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

05 52 00 – EXTERIOR METAL RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Handrails

B. Related Requirements:
1. Section 03 30 00 – Cast-In-Place Concrete
2. ASTM A312 – Stainless Steel Pipe
3. ASTM A240 – Stainless Steel Plate
4. ASTM A480 – Stainless Steel Sheet Finishes
5. ASTM A967 – Passivation of Stainless Steel
6. AWS D1.6 – Structural Welding Code – Stainless Steel

1.3 QUALITY ASSURANCE

A. Standards: Conform to American Institute of Steel Construction (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings," and "Code of Standard Practice for Steel Buildings and Bridges," and "American Welding Society" (AWS) "Standard Code for Welding in Building Construction."

B. Building Code: Conform to current International Building Code (IBC) as amended by local authority having jurisdiction.

C. All welding shall be by a WABO certified welder.

1.4 SUBMITTALS

A. Shop Drawings: Submit for approval prior to fabricating in accordance with General Provisions and Special Provisions. Show dimensions, details, welds and necessary accessory items, include all information necessary for fabrication and for erection. Verify dimensions and correlated work with adjoining work.

PART 2 - PRODUCTS

2.1 HANDRAILS

A. Description:

1. Frame: 1.66” O.D. Schedule 40 Steel Tubing. Complying with ASTM A312.
2. Finish: Stainless Steel Finish

3. Dimensions: See Plans
4. Mounting: Core Drill and Epoxy

B. Warranty

1. Minimum five (5) year manufacturer's warranty covering finish, defects, and corrosion.

2.2 PIPE COLLARS

A. Pipe collars shall be stainless steel matching finish and appearance of the handrails.

2.3 NON-SHRINK GROUT

A. Sealtight CG-86 by WR Meadows, NBEC, or approved equal

PART 3 - EXECUTION

3.1 FABRICATION GENERAL

A. Verify dimensions on site prior to shop fabrication.

B. Fabricate items with joints tightly fitted and secured.

C. Fit and shop assemble in largest practical sections for delivery to site.

D. Grind exposed welds flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts unobtrusively located consistent with design of structure, except where specifically noted otherwise.

F. Make exposed joints butt tight, flush, and hairline.

G. Supply components required for anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, except where specifically noted otherwise.

3.2 HANDRAILS

A. Fabrication
1. Railing splices shall be butted and reinforced by a tight-fitting interior sleeve not less than six inches (6") long. Splice sleeves shall be fabricated from stainless steel and shall match the handrail material and finish.
2. Handrails shall be factory-fabricated from stainless steel pipe conforming to ASTM A312, Type 304L or 316L, with a No. 4 satin-brushed finish.
3. Field welds shall be ground smooth, cleaned, and mechanically finished to match adjacent stainless steel surfaces.
4. All exposed stainless steel surfaces, including field welds, shall be cleaned and passivated in accordance with ASTM A967 to restore corrosion resistance.

B. Installation in Concrete:

1. Rail posts shall be installed in pre-drilled holes in concrete as shown. Annular space between the post and core-drilled hole shall be filled with non-shrink grout
2. Posts shall be held plumb and true until grout has cured.
3. Pipe collars shall be set over grout joints and epoxied to the concrete base with a two-part epoxy adhesive. Align to fully cover the grout joint and match handrail finish.

C. Pipe Collars:
1. Anchorage joint shall be covered with pipe collar secured to concrete with epoxy.
2. Pipe collars shall be set tight to the finished concrete surface and epoxied in place using a two-part structural epoxy adhesive suitable for exterior use. Surfaces shall be clean, dry, and free of dust or debris before application. Collar shall fully conceal the grout-filled annular space and be aligned concentrically with the pipe post. Remove excess adhesive after placement and allow to cure per manufacturer instructions.

3.3 CLEANUP

A. Contractor shall leave grounds in good condition, remove all sand, gravel, debris, dirt, and leave handrails complete and workable in all details.

END OF SECTION 32 33 00

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wood blocking and nailers.
2. Plywood backing and wall panels.
3. Framing with timber.

B. Related Requirements:

1. Section 061600 "Sheathing" for sheathing.

2. Section 075419 “Polyvinyl-Chloride (PVC) Roofing” for roofing that requires nailers and blocking associated with roof construction.

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Timber: Lumber of 5-inches nominal size or greater in least dimension

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Regional Materials: The following wood materials shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site:

1. Dimension lumber.

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground and Use Category UC3b for exterior construction not in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, stripping, and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat items indicated on Drawings, and the following:
1. Plywood backing panels where indicated

2.4 TIMBER FRAMING

A. Comply with the following requirements, according to grading rules of grading agency indicated:
1. Species and Grade: Per structural drawings.
2. Maximum Moisture Content: 19 percent.
3. Additional Restriction: Free of heart centers.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.

2. Nailers.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species: the following species:

1. Western woods; WCLIB or WWPA.
2. Northern species; NLGA.

C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:

1. Northern species; No. 2 Common grade; NLGA.
2. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

1. Plywood shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 .

2.8 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch .

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 TIMBER FRAMING INSTALLATION

A. Install timber beams with crown edge up and provide not less than 4 inches (102 mm) of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports as indicated if not continuous.

B. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061324 - STRUCTURAL GLUED-LAMINATED TIMBER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. References and standards listed herein are to be the latest edition available, unless specifically stated otherwise.

1.2 SUMMARY

A. This section includes framing using structural glued-laminated timber.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for dimensional lumber items associated with structural glued-laminated timber.

1.3 DEFINITIONS

A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber product assembled from selected and prepared wood laminations bonded together with adhesives with the grain of the laminations approximately parallel longitudinally.

1.4 SUBMITTALS

A. Product Data: For glulam timber and accessories. Include installation instructions and data on lumber, adhesives, fabrication, treatment, and protection.

B. Shop Drawings: Show layout of structural glulam timber system and full dimensions of each member. Indicate species and laminating combination, adhesive type, and other variables in required work.

C. Samples: Full width and depth, 24 inches long, showing the range of variation to be expected in appearance of structural glulam timber, including treatment and finishing.

D. Certificates of Conformance: Issued by a Qualified Inspection and Testing Agency indicating that glulam timbers comply with requirements of AITC A190.1.

E. Wood Treatment Certificates: Signed by wood treater certifying that treatment processes comply with requirements.

F. Qualification Data: For firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed structural glulam timber construction similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.

B. Manufacturer Qualifications: Provide factory-glued structural units produced by an AITC-licensed firm, with a minimum of 5 years experience.

1. Factory mark each piece of structural glulam timber with AITC Quality Mark. Place mark on surfaces that will not be exposed in completed work.

C. Quality Standard: Comply with AITC A190.1, "Structural Glued-Laminated Timber; "Product Standard PS56, "Structural Glued-Laminated Timber;" and AITC 117, "Standard Specifications for Structural Glued-Laminated Timber of Softwood Species."

1.6 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with provisions of AITC 111, "Recommended Practice for Protection of Structural Glued-Laminated Timber During Transit, Storage, and Erection."

B. Individually wrap members with plastic-coated paper covering, with water-resistant seams, before shipping or exposing to outdoor conditions.

C. Use padded, nonmarring slings when handling architectural grade members.

D. Coordinate deliveries with the General Contractor's erection sequence.

E. Store on level surface. Members shall be supported with blocking so spaced as to provide uniform and adequate support. Members shall be blocked well off the ground at a well-drained location.

F. Do not overload the structure with stored units.

PART 2 - PRODUCTS

2.1 STRUCTURAL GLULAM TIMBER FRAMING

A. General: Provide structural glued-laminated timber that complies with AITC A190.1 and AITC 117 or research/evaluation reports acceptable to authorities having jurisdiction.

1. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that are not exposed in the completed Work.

2. Provide structural glued-laminated timber made from single species.
3. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
4. Provide structural glued-laminated timber made with wet-use adhesive complying with AITC A190.1.

B. Species and Grades for Structural Glued-Laminated Timber: per structural drawings.

C. Appearance Grade: Provide architectural appearance grade members complying with AITC 110.

D. Preservative Treatment: Where preservative-treated glulams are indicated, pressure treat lumber before gluing according to AWPA C28 for waterborne preservatives. After dressing and end cutting each member to final size and shape, apply a field-treatment preservative to comply with AWPA M4 to surfaces cut to a depth of more than 1/16-inch.

1. Use preservative solution without water repellents or other substances that might interfere with application of indicated finishes.

E. Adhesive: Wet use-type complying with ASTM D 2559.

1. Do not use melamine-urea-formaldehyde adhesives for preservative-treated structural glulam timber.

F. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective in retarding the transmission of moisture at cross-grain cuts and is compatible with indicated finish.

G. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is compatible with indicated finish.

H. Connectors, Anchors, and Accessories: Fabricate from structural steel shapes, plates, and bars complying with ASTM A 36; steel bars complying with ASTM A 575, Grade M 1020; and hot-rolled steel sheet complying with ASTM A 570, Grade 33.

1. Fabricate beam seats with 3/4-inch steel bearing plates, 5/8-inch diameter by 12-inch long deformed bar anchors, and 3/8-inch side plates.
2. Fabricate strap ties from 3-inch wide, 0.239-inch steel sheet.
3. Provide bolts, 5/8-inch, unless otherwise indicated, complying with ASTM A 307, Grade A; nuts complying with ASTM A 563; and, where indicated, flat washers.
4. Finish each assembly and fastener with rust-inhibitive primer, 2-mil dry film thickness.

2.2 FABRICATION

A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.

B. Camber: Fabricate horizontal and inclined members, units of less than 1:1 slope, with either circular or parabolic camber equal to 1/500 of span.

C. End Cut Sealing: Immediately after end cutting each member to final length and after wood treatment (if any), apply a saturation coat of end sealer to ends and other crosscut surfaces, keeping surfaces flood-coated for not less than 10 minutes.

D. Seal Coat: After fabricating and sanding each unit and end coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit, except for treated wood where treatment included a water repellent.

2.3 FACTORY FINISHING

A. Wiped Stain Finish: Manufacturer's standard, dry appearance, penetrating acrylic clear stain and sealer, oven-dried, and resistant to mildew and fungus.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Erect structural glulam timber framing true and plumb, with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

1. Use padded slings and protect corners with wood blocking.

B. Fit structural glulam timber framing by cutting and restoring exposed surfaces to match specified surfacing. Predrill for fasteners and assembly of units.

1. Use connectors as templates for drilling bolt holes.
2. Machine sand exposed surfaces to remove planing or surfacing marks, finishing with No. 120 grit sandpaper.
3. Coat crosscuts with end sealer.
4. Where treated members must be cut during erection, apply a field treatment preservative to comply with AWPA M4.

C. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

1. Where treated members must be cut during erection, apply a field treatment preservative to comply with AWPA M4.

D. Install steel connectors, anchors, and accessories as indicated.

3.2 ADJUSTING AND CLEANING

A. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glulam timber if repairs are not approved by Architect.

3.3 PROTECTION

A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, soiling, and damage from other trades.

B. Coordinate wrapping removal with finishing work specified in Division 09. Retain wrapping where it can serve as a painting shield.

END OF SECTION 061324

SECTION - 06 15 43
CROSS LAMINATED TIMBER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this section.

1.02 SUMMARY

A. This Section includes Cross Laminated Timber (CLT) Roof Panels as shown on the drawings.

B. Related Sections:
   1. Section 099300 “Staining and Transparent Finishing” for finishes applied to CLT Panels

1.03 REFERENCES

A. ANSI D3737-07 Structural Glued Laminated Timber.

B. AITC 405 and ASTM D2559-00 Standards for Wood Adhesives.

C. ANSI A190.1-2002 Structural Glued-laminated.

D. APA Standard for Performance Related CLT- ANSI/APA PRG 320/2012.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include panel location plans, sequence of placement, joint accessories, dimensions, shapes and sections, openings, support conditions, connections.

   1. Indicate lifting connections and special erection instructions. Reinforcement is necessary for safe handling and erection.
   2. Indicate locations, tolerances, and details of anchorage to supporting structure.
   3. Include and locate openings larger than 9 inches in width or diameter.
   4. Indicate location of CLT panel by same identification mark placed on panel.
   5. Indicate relationship of CLT panels to adjacent materials.
   6. Clearly indicate stress grade, service grade, appearance grade.
   7. Provide three dimensional models of all interfaces, CLT panels, secondary timber members, plus all connections.
   8. Indicate special preparation of substrate, erection, installation and attachment procedures, product storage and handling, and perimeter conditions requiring special attention.
   9. Special erection instructions. Reinforcement necessary for safe handling and erection.
   10. Show and coordinate panel to panel connections.
   11. Provide erection bracing plan stamped by a licensed professional engineer.

C. CLT supplier to provide a fully accurate three-dimensional (3D) model of the interfaces (supports, abutments, etc.), CLT panels, secondary timber members, plus all connections prior to submission of shop drawings. Model to be generated using CADWorkv22, or approved alternate. 3D model to use as-built foundation X, Y, Z coordinates for CLT panel bases.

D. Structural design calculations: When required by contract drawings provide CLT structural design calculations, by a registered Professional Engineer.

E. Samples:
   1. Submit 4 samples of CLT panel; approximately 12 by 12 by thickness inches for field applied coatings by others.

F. APA Product Report and Certified ANSI PRG 320 certificate.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

   1. Provide panels that meet ANSI/APA PRG 320-18 standards, factory produced by an American Institute of Timber Construction (AITC) or APA - The Engineered Wood Association (APA) licensed manufacturer.
   2. Factory mark every panel with AITC Quality Mark or APA-EWS trademark on top side of panel; provide certificate of conformance.
   3. Manufacture of the panels must conform to AWC NDS and SP-529E.
   4. Manufacturer specializing in performing work of the type specified in this Section with not less than 3 years of documented experience.
   5. Manufacturer shall be pre-qualified in accordance with PRG 320-2018, Section 8.

B. Installer Qualifications: Installer specializing in performing work of type specified in Section with not less than 3 years documented experience or approved prior to bid.

C. Temporary Moisture Management Plan (TMMP): Submit for record a written statement of the means and methods employed to monitor and manage the effects of exterior exposure on the CLT during construction. Protect panel decking in accordance with manufacturer's instructions and AITC 111 requirements for individually wrapped material.

   1. Coordinate with roofing installation.
   2. Apply factory installed high build paraffin edge protection.
   3. Apply factory installed hydrophobic wood sealer to top exposed surface of panel.
   4. Moisture protection membrane to be either shop or site applied on top-side of roof CLT only.
   5. Affix authorized label to panel; identify panel with mark number.
   6. Protect corners with wood blocking during transportation.
   7. Protect from moisture using weather-resistive cover material/bundle wrapping prior to transit. Cover with wrapping material prior to shipping. Cut holes or slits in underside of wrapping to avoid water pooling from condensation.
   8. Tape deck seams/splines and interfaces at columns during the course of installation. Tape should also be installed at penetrations in panels to prevent water intrusion and staining.
   9. Maintain protection of panels during construction.
   10. Remove standing water from deck immediately using mop, squeegee, or shop vacuums.
   11. At panels exposed to wetting, operate fans, heaters and dehumidifiers to promote drying; do not over-dry to avoid causing panels to check.
   12. Inspect and repair joint and seams of membrane and tape after installation.
   13. Moisture content to not exceed 16 percent, including all wood products used for joints and splines; measure with moisture meter.
   14. Supplier to measure moisture content prior to application of sealer and prior to shipment. Installer to measure moisture content of approximately 10 percent of panels prior to offloading.
       a. If moisture content above 16 percent, check moisture content readings for 100 percent of truck loads. Prior to and during installation, monitor moisture content of mass timber panels. Identify why panel wetting occurred, install rain protection

accordingly. Monitor moisture content daily Checklist until panels are completely protected/covered by enclosure assembly.

15. After building enclosed, allow timber to dry out slowly by air circulation or low heat.
    a. Continuously monitor ambient temperature and humidity to ensure the rate of change does not exceed manufacturer recommendations.
    b. Low Heat: Monitor framing to ensure checking does not occur. Do not install finishes until moisture content 16 percent or less.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Follow the provisions of the Temporary Moisture Management Plan under Section 1.05: QUALITY ASSURANCE.

B. Wrap panel pallets using manufacturer recommended vapor barrier; plastic wrap not accepted:

1. Stack flat with spacers between each bundle to provide air circulation.
2. Protect materials from weather by covering with waterproof sheeting, securely anchored.
3. Wrapping should be slit or punctured on the underside to permit the draining of water "puddles" resulting from condensation or precipitation.
4. Provide for air circulation around stacks and under coverings.
5. Use package banding materials (i.e., plastic bands) that will not cause iron staining.

C. Label and deliver in construction sequence and in accordance with manufacturer's recommended handling and delivery instructions.

1. Coordinate delivery with manufacturer and contractor to ensure that necessary off-loading and lifting equipment is available on-site. Padded/non-marring slings should be used to lift panels.
    a. If slings are unavailable, non-corrosive wire rope may be utilized. Provide wood blocking protection at panel corners. Do not drag or drop panels.
2. Following panel erection, immediately install site protection of panels as specified in approved moisture control plan. Provide additional temporary protection as required.
3. During installation, monitor weather daily, visually inspect timber. Members should never be dragged or dropped.
4. Because of specific lay-up used to produce timber, each member has a specific "top" and "bottom" face, it is essential that mass timbers are installed in their correct orientation.

D. Storage of Panels:

1. Minimize inventory at construction site.
2. Utilize installation requirements during construction and installation.
3. Do not to tear/rip or damage product wrapping. Color of product can be adversely affected by direct sun light or exposure to rainwater.
4. Store in covered area. If not possible, store in level storage area stored off ground to minimize water splash-on. If finished product is not stored on dry surface, it is recommended to use heavy-duty tarps on ground to minimize surface moisture contamination.
5. Set on supports with minimum thickness of 8 inches, approximately spaced 10 feet on center.
6. If panels need to be stacked, separate by spacers with a minimum of 1 1/2 inches and spaced 10 feet on center.
7. Loosely cover with tarpaulin to promote air circulation and avoid tight contact with packaging.

E. Stack panels in such a way that surfaces that are to be exposed in final work are protected from exposure to sunlight.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products as indicated on drawings by the following manufacturer, or approved equal.
   1. Structurlam Products Ltd.
   2. DR Johnson Wood Innovations
   3. SmarLam

2.02 MATERIALS

A. Wood Species – Spruce-Pine-Fir for Cross Laminated Timber (CLT) panels.

B. Laminating Adhesive: Pass ANSI/APA PRG 320-18 testing requirements.

C. Span: Minimum 2-span; as shown on Structural Drawings.

D. Panel Thickness:

1. 3-ply: 4.14 inches.

2. 5-ply: 5.48 inches min, 6.9 inches maximum.

E. Lamination Thickness: Minimum 0.67 inches; Maximum 1.38 inches.

F. Stress Grade: V2 or better.

G. Appearance Grade: Architectural per ANSI/APA PRG 320 requirements.

1. Knot holes and voids over 1/4 inch diameter are filled and where panel is exposed and installed lower than 8 feet above finish floor.

2. Fill color to be approved by Architect.

H. Face Surface: Smooth according to AITC 110.

1. Misses and wane are not permitted.

I. Moisture Content: Comply with ANSI/APA PRG 320-18, maximum 16 percent.

2.03 ACCESSORIES

A. Joint Tape:
   1. Basis of Design: Provide Siga Wigluv 60, Rothoblaas Frost Band, ZIP 3-3/4" flashing tape or accepted equal.

B. Paraffin Edge Protection:
   1. Basis of Design: Provide Broda Check Stop or accepted equal.

C. Hydrophobic Wood Sealer:
   1. Basis of Design: Provide Sansin KP-12, KP-12UVW or accepted equal.

D. Hardware: Connective hardware in accordance with AISC 360, hot-dip galvanized, or as indicated in division 5, or as indicated in structural drawings.

E. Structural Steel: Provide structural hot-dip galvanized steel shapes, plates, and flat bars as indicated for assembly and connection of members conforming to ASTM A36/A36M.

F. Spline Connectors: Plywood or manufactured gauge metal strap unless otherwise indicated on Drawings.

G. Hot-Rolled Steel Sheet: Hot-dip galvanized.

H. Fasteners: As indicated on Structural Drawings.

I. Moisture Protection Membrane: For protection of CLT roof panels in transit, storage, and on the jobsite.

1. Basis of Design: Provide Wetguard 200 SA by Siga Cover Inc., Slopeshield SA by VaproShield, or accepted equal:
   a. Composition: Flexible non-woven PO with anti-slip finish; backed with polypropylene release film.
   b. Thickness: At least 20 mils.
   c. Tensile Strength: EN 12311-2; 16 pounds per inch.
   d. Elongation: EN 12311-2; 80 percent.
   e. Water Vapor Transmission: ASTM E96, method A; 0.5 perms.
   f. Outdoor Exposure: At least 4 weeks.
   g. Flame Spread Index: Class A, ASTM E84.

2.04 FABRICATION

A. Fabricate panel decking in lengths for two-span minimum continuous lay-up.

B. Mark members for identification during erection; Clearly mark top surface.

C. Shop Assembly: Fabricate units in as large a part or section as practical. Provide shop installed cuts, holes, and penetrations in panels as indicated in drawings as much as practical.

D. Shop applied hydrophobic wood sealer on top-side and edges of CLT.

E. Moisture protection membrane to be either shop or site applied on top-side of roof CLT only.

1. Do not install in snow, rain, fog or mist or temperature is below what is recommended by manufacturer.
2. Ensure all surfaces are clean, dry, sound, smooth and comply with membrane manufacturer's requirements.
3. Install on CLT panels (either on site or shop). Install with 4 inch minimum overlap over seams and joints on site to complete water seal.
4. Misaligned, punctures or other damages to be repaired with a patch of membrane extending.

F. Fabrication Tolerances: Per PRG 320-18.

1. Thickness: +/- 1/16 inch or 2 percent of the panel thickness, whichever is greater.
2. Width: +/- 1/8 inch of the panel width.
3. Length: +/- 1/4 inch of the panel length.
4. Squareness: Panel face diagonals shall not differ by more than 1/8 inch.
5. Straightness: Deviation of edges from straight line between adjacent panel corners shall not exceed 1/16 inch.

PART 3 - EXECUTION

3.01 EXAMINATION:

A. Prior to fabrication and installation, check all panel dimensions relating to this section of work. Report any discrepancies to Engineer.

B. Prior to site erection, examine all site conditions for structure supporting panels to ensure compliance with installation tolerances and other conditions affecting performance of panels.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Erected by certified crane operators and workers.

B. Prior to placement of each panel, verify panel installed with accurate orientation. When in doubt check with manufacturer.

C. Joint at panel edges using manufactured gauge metal strap or continuous spline as indicated on Structural Drawings.

D. Install panel decking to comply with manufacturer's written instructions and APA EWS T300.

1. AITC Quality Mark or APA-EWS trademarks not viewable visible when installed.
2. Hoist with non-marring straps and connectors.
3. Cut panels to size when field-cutting openings.
4. Do not install electrical chases inside cross laminated timber panels without consulting manufacturer and obtaining written instructions and approval from Architect.
5. Do not install plumbing inside cross laminated timber panels without consulting manufacturer and obtaining written instructions and approval from Architect.
6. Protect cross laminated timber panels from solvents and solvent vapors.

E. On-site cutting unacceptable unless approval obtained from Architect and engineer of record.

1. Fastener drilling acceptable.
2. Coat cuts and inside surface of drilled holes with sealer.

F. Make adequate provision for erection stress. Set panels level and plumb to correct positions. Securely brace panels and anchor in place to maintain plumb until permanently secured by finished structure.

G. Install joint/seam tape to protect joints and seams from water intrusion and moisture while exposed to elements.

H. Erector to install temporary bracing poles as required by erection bracing plan.

3.03 CLEANING

A. Clean exposed surfaces of CLT panels after erection and completion of field touch up.
1. Perform cleaning procedures, if necessary, according to CLT manufacturer’s written recommendations, Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed CLT panels or damage adjacent materials.

3.04 ADJUSTING

A. Inspect panels for damage from transit prior to unloading material. Field repairs for damage caused during shipping or installation responsibility of mass timber supplier/installer. Replace

damaged panel decking if repairs are not approved by Architect at Manufacturer/Installer expense.

B. Prior to final finishing, remove stains, marks and damage caused by responsible party.

3.05 ERECTION TOLERANCES

A. Connections used may require tighter tolerances than specified below. Supplier and installer are responsible to coordinate during the Shop Drawing process.
B. Overall Squareness: For rectangular areas, the corner-to-corner diagonal measurements should not deviate from each other by more than 1/2 inch or 25 percent of the length of the shortest side of the rectangle, whichever is greater.
C. Overall Surface Levelness (Floors and Flat Roofs): 1/4 inch in 10 feet maximum.
D. Elevation: +/- 1/4 inch from theoretical.
E. Panel End Joints: 3/16 inch maximum gap between adjacent panels unless noted otherwise.

3.06 PROTECTION

A. Install joint tape over seams and joints to maintain low-moisture content.
   1. Protect from weather and standing water, per moisture management plan.
B. Do not leave panels exposed to moisture. Remove wet panels or allow to dry completely before installation of sealants, and tape.
C. Provide water-resistive barrier over roof decking as Work progresses to protect roof decking until roofing is applied.
   1. Protect from weather and standing water, as specified in Article "DELIVERY, STORAGE, AND HANDLING".
D. Maintain daily protection until building enclosed.

3.07 REPAIRS

A. Preparation:
   1. Exposed bare wood (i.e. wood checks and cracks) and visible abraded small areas on wood surface consider "Touch-Up and Blend" to affected area or restore via "Saturate and Back-brush" approach within larger surface areas.
   2. Use manufacturer approved solution to remove residues and contaminants.
   3. Allow to dry to moisture content below 20 percent.
   4. Obtain approval prior to sanding surfaces. Sand surface smooth, remove sander-dust and re-apply one repair/maintenance coat of same product in accordance with manufacturers requirements.
B. Sealer or stain Installation: As specified in Section 099000 - Painting and Coating.

END OF SECTION - 06 15 43

SECTION – 061600
SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.

B. Related Requirements:

1. Section 072713 "Weather Resistant Barriers and Air Barriers" for water-resistive barrier applied over wall sheathing.

2. Section 054000 “Cold-Formed Metal Framing” for framing of exterior walls to receive sheathing.

3. Section 061543 “Cross Laminated Timber” for CLT roof panels that have plywood sheathing spline strips associated with the CLT installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated on drawings.

C. Factory mark panels to indicate compliance with applicable standard.

2.3 WALL SHEATHING

A. Glass-Mat Gypsum Sheathing (noted as Exterior Moisture Resistant Gypsum Panel on drawings): ASTM C 1177/1177M.

1. Products: to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corporation; GlasRoc.
b. Continental Building Products, LLC; Weather Defense.
c. Georgia-Pacific Building Products; Dens-Glass Gold.
d. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
e. Temple-Inland Building Products by Georgia-Pacific; GreenGlass Exterior Sheathing.
f. USG Corporation; Securock.

2. Type and Thickness: Type X, 5/8 inch thick.
3. Size: At contractor’s option, 48 by 96 inches, 48 by 108 inches, or 48 by 120 inches for vertical installation.

B. Sheet Metal Sheathing: Per structural drawings.

2.4 ROOF SHEATHING

A. Plywood Sheathing Splines: Per structural drawings.

1. Span Rating: Per structural drawings
2. Nominal Thickness: Per structural drawings.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Refer to structural drawings for fastener type(s), spacing, and penetration dimension.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:

a. Space panels 1/8 inch apart at edges and ends.

3.3 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with nails or screws.
2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

E. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION - 06 16 00

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior woodwork trims and sills
2. Interior wood butcher block bench topper and countertop at lobby

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry."
2. Section 06 41 16 “Plastic-Laminate-Clad Architectural Cabinets."
3. Section 08 14 16 “Flush Wood Doors.”
4. Section 09 93 00 “Staining and Transparent Finishing.”
5. Section 12 36 61 “Solid Surfacing Countertops.”

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.4 ACTION SUBMITTALS

A. Shop Drawings:

1. Include the following:
   a. Dimensioned plans, elevations, and sections.
   b. Attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

B. Samples: For each exposed product and for each shop-applied color and finish specified.

1. Size:
   a. Trim/Board Products: 12” long section of specified profile and species

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Architectural Woodwork Standards, Section 2.

B. Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of the construction period.

C. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

D. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

E. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.7 FIELD CONDITIONS

A. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

B. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

2.2 INTERIOR TRIM AND SILLS

A. Architectural Woodwork Standards Grade: Premium.

B. Hardwood Lumber Trim:

1. Wood Species and Grade: Maple, First and Seconds (FAS)
2. Maximum Wood Moisture Content: 9 percent.
3. Finger Jointing: Allowed.
4. Gluing for Width: Not allowed
5. Veneered Material: Not allowed
6. Face Surface: Surfaced (smooth).
7. Matching: Selected for compatible grain and color.
8. Profiles/Sizes: per drawings
9. Finish: Per Section 09 93 00 “Staining and Transparent Finishing”

2.3 PRESERVATIVE-TREATED-WOOD MATERIALS

A. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWPA N1 (dip, spray, flood, or vacuum-pressure treatment) for areas in contact with moisture or humidity.

1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC)**,** combined with a compatible EPA-registered insecticide.
2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

2.4 PLYWOOD STUDS FOR CASEWORK BUILT IN FIELD

A. 1” Plywood studs for casework infill, slotted for cable routing where required.

2.5 WOOD SLAB BENCH TOPPERS

1. Source Limitations: Obtain wood bench topper and countertop products, including related accessories, from single source from single manufacturer.
2. Basis-of-Design Product: Subject to compliance with requirements, provide Birch Blended Grain Countertop by Hardwood Lumber Company (Phone: 800-798-1269) or comparable product from other manufacturer.
   a. Applications: Concrete bench topper and countertop at lobby per drawings.
   b. Nominal Thickness: 1 ½”
   c. Panel Size: 24-inch (min) x 12-foot, quantity four.
   d. Finish: Factory pre-finished clear coat sealer. Cut edge touch-ups in the field

2.6 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

1. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
2. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
3. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

B. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.7 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

1. Back out or kerf backs of the following members, except those with ends exposed in finished work:
   a. Interior standing and running trim.

2. Ease edges to radius indicated for the following:
   a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
   b. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
3. Notify Architect seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
   a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
   b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

2.8 SHOP PRIMING & FINISHING

A. Preparations for Finishing: Comply with the Architectural Woodwork Standards for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

B. Interior Architectural Woodwork for Transparent Finish: Shop-seal concealed surfaces with required pretreatments and first coat of finish as specified in Section 09 93 00 "Staining and Transparent Finishing."

1. Backpriming: Apply one coat of sealer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine woodwork materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

B. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

C. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion.

1. Shim as required with concealed shims for alignment
2. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.

F. Fire-Retardant-Treated Wood: Install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

G. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

H. Standing and Running Trim:

1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Do not use pieces less than 36 inches long, except where shorter single-length pieces are necessary.
3. Scarf running joints and stagger in adjacent and related members.
4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth.
5. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
6. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
7. Countersink fastener heads on exposed carpentry work and fill holes.

I. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate woodwork.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity shall prepare and submit report of inspection.

3.4 REPAIR

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects.

B. Where not possible to repair, replace defective woodwork.

C. Shop Finish: Touch up finishing work specified in this Section after installation of interior architectural woodwork.

1. Fill nail holes with matching filler where exposed.
2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

D. Adjust joinery for uniform appearance.

3.5 CLEANING

A. Clean interior architectural woodwork on exposed and semi-exposed surfaces.

B. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

END OF SECTION 06 40 23

SECTION 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural casework and countertops.
2. Cabinet hardware and accessories.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural casework that is not concealed within other construction.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
2. Section 06 40 23 “Interior Architectural Woodwork”
3. Section 12 36 61.16 “Solid Surfacing Countertops”.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For plastic-laminate-faced architectural cabinets.

1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products like those required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS & COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Grade: Premium

C. Drawer & Cabinet Construction

1. Type of Construction: Frameless.
2. Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.
3. Door and Drawer-Front Style: Flush overlay.
   a. Reveal Dimension: ½ inch.
   b. Door/Panel edging: High-Pressure Decorative Laminate to match laminate face.
4. Laminate Cladding for Exposed Surfaces:
   a. Horizontal Surfaces: Grade HGS.
   b. Vertical Surfaces: Grade VGS.
   c. Edges: Grade HGS, Grade VGS
5. Materials for Semiexposed Surfaces:
   a. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS
      1) Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
      2) For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS
   b. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
   c. Drawer Bottoms: Thermoset decorative panels.
6. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
7. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

D. High-Pressure Decorative Laminate Countertops & Splashes

1. Grade: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
2. Substrate: Particleboard: ANSI A208.1, 45-pound density, ¾” thickness. Marine Plywood at wet locations.
3. Adhesives: Water-based polyvinyl acetate (PVA).

E. Acceptable Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wilsonart
2. Formica Corporation
3. Lamin-Art, Inc.
4. Nevamar; a Panlom Industries International, Inc. brand.

F. Colors, Patterns, and Finish: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by manufacturer's designations.

2.2 LAMINATE SCHEDULE

A. PLAM CABINETS
1. Wilsonart Laminate: Monticello Maple 7925

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.4 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 71 00 "Door Hardware."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 110 degrees of opening, self-closing.

C. Cabinet Pulls: Back mounted, solid metal, 5-1/16” inches long center to center handle cabinet pull, finish white; basis-of-design Altas Homeswares Model A874-WG

D. Catches: Magnetic catches, BHMA A156.9, B03141

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081

F. Shelf Rests: BHMA A156.9, B04013; metal.

G. Drawer Slides: BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted
   a. Type: Full extension.
   b. Material: Zinc-plated steel with polymer rollers.
2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 2.
4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100

H. Door Locks: BHMA A156.11, E07121.

1. Locations: all casework cabinet locations

I. Drawer Locks: BHMA A156.11, E07041.

1. Location: all casework drawer locations

J. Casters: 3” polyurethane heavy-duty swivel caster with brake, swivel plate mount.

1. Basis-of-Design: Rockler Item #38865

K. Door and Drawer Silencers: BHMA A156.16, L03011.

L. Waste Bins Pull-Out Drawer Slides

1. Product: Subject to compliance with requirements, provide Hafele Kessebohmer Double Bottom Mount Waste Bin Pull-Out, chrome, 2x52qt, item no. 502.56.242; or sim.

M. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide “SG series” by Doug Mockett & Company, Inc. or as approved by Architect.
2. Color: White.

N. Exposed Hardware Finishes: For exposed hardware, unless indicated elsewhere, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

O. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 KNEE BRACES & CONCEALED SHELF BRACKETS

A. Basis-of-Design Manufacturer: The Original Granite Bracket

B. Products:

1. L-Bracket Countertop Support Bracket
   a. Size: 24”x26” unless otherwise noted
   b. Finish: Black
2. Side Wall Countertop Support Bracket
   a. Size: 24”x26” unless otherwise noted
   b. Finish: Black
3. Industrial Free Hanging Shelf Bracket
   a. Size: 12” (Tang)
   b. Finish: Black

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement

1. Adhesive for Bonding Edges: Hot-melt adhesive

2.7 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.

D. Install glass to comply with applicable requirements in Section 08 80 00 "Glazing" and in GANA's "Glazing Manual."

1. For glass in frames, secure glass with removable stops.
2. For exposed glass edges, polish and grind smooth.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 06 41 16

SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cold-applied, cut-back-asphalt dampproofing.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete."
2. Section 051200 "Structural Steel Framing."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course and auxiliary materials recommended in writing by manufacturer of primary materials.

B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

2.2 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. APOC, Inc.; a division of Gardner-Gibson.
2. Brewer Company (The).
3. Euclid Chemical Company (The); an RPM company.
4. Henry Company.
5. Malarkey Roofing Products.
6. Meadows, W. R., Inc.

B. Trowel Coats: ASTM D 4586, Type I, Class 1, fibered.

C. Brush and Spray Coats: ASTM D 4479, Type I, fibered or non-fibered.

D. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Cut-Back-Asphalt Primer: ASTM D 41.

C. Patching Compound: Asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.

D. Protection Course: ASTM D 6506, 1/8-inch- (3-mm-) thick, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substances detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless more stringent requirements are indicated.

1. Apply dampproofing to provide continuous plane of protection.
2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches (150 mm) over outside face of footing.

1. Extend dampproofing 12 inches (300 mm) onto intersecting walls and footings, but do **NOT** extend onto surfaces exposed to view when Project is completed.

C. Where dampproofing below-grade portions of structural steel columns, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches (150 mm) over outside face of footing.

1. Do **NOT** extend onto surfaces exposed to view when Project is completed.

3.4 COLD-APPLIED, CUT-BACK-ASPHALT DAMPPROOFING

A. Concrete Foundations and Parged Masonry Foundation Walls: Apply two brush or spray coats at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m) for first coat and 1 gal./100 sq. ft. (0.4 L/sq. m) for second coat or one trowel coat at not less than 4 gal./100 sq. ft. (1.6 L/sq. m).

B. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).

3.5 INSTALLATION OF PROTECTION COURSE

A. Install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.

1. Install a protection course within 24 hours of installation of dampproofing (while coating is tacky) to ensure adhesion.

3.6 CLEANING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071113

SECTION – 07 17 00
BENTONITE WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bentonite waterproofing membrane and associated accessories.
2. Drainage / protection panel at bentonite waterproofing.

B. Related Requirements:

1. Section 310000 "Earthwork" for excavating and backfilling.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, and installation instructions.

B. Shop Drawings: Include installation details for waterproofing, penetrations, and interface with other work.

C. Samples: For each of the following products, in sizes indicated:

1. Waterproofing: 6 inches square.
2. Drainage / Protection Panels: 6 inches square.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of waterproofing material.

B. Field quality-control reports.

C. Sample Warranty: For manufacturer's special warranty.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to set quality standards for fabrication and installation.

1. Build mockup of installation on typical vertical surfaces 10 sq. ft. in size.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturer's written instructions and warranty requirements.

1. Do not apply bentonite waterproofing materials to surfaces where ice or frost is visible.
2. Do not apply bentonite waterproofing materials in areas with standing water.
3. Do not place bentonite clay products in panel or composite form on damp surfaces unless such practice is approved in writing by manufacturer.

1.8 WARRANTY

A. Special Warranty: Manufacturer and Installer agree(s) to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BENTONITE WATERPROOFING MEMBRANE

A. Polyethylene-Lined Geotextile/Bentonite Sheet: Minimum of 1.0 lb/sq. ft. of bentonite clay granules between two layers of geotextile fabric, heat-fused together; and with a low-permeability polyethylene geomembrane bonded to one surface.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CETCO, a Minerals Technologies company; Voltex DS.

b. W.R. Meadows Clay-Tite

2. Grab Tensile Strength: 120 lbf according to ASTM D 4632.
3. Puncture Resistance: 140 lbf according to ASTM D 4833.
4. Vapor Permeance: 0.03 perms according to ASTM E 96/E 96M.

2.2 DRAINAGE / PROTECTION PANELS

A. Drainage / Protection Panels at Bentonite Systems: Prefabricated drainage product complying with ASTM D 4491 and D 1621.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. MEL-DRAIN sheet products 9072 or approved equal and MEL-DRAIN TOTAL DRAIN connection system or approved equal.

2.3 ACCESSORIES

A. Bentonite Waterstops: Cetco Waterstop RX, or equal at bentonite systems assembly locations. For other required waterstops on the project, refer to Section 033000 - Concrete.

B. Bentonite Mastic: Bentonite compound of trowelable consistency, specifically formulated for application at joints and penetrations.

C. Termination Bar: Extruded-aluminum or formed-stainless-steel bars with upper flange to receive sealant.

D. Sealants: As recommended in writing by the waterproofing manufacturer. Comply with requirements specified in Section 079200 "Joint Sealants."

E. Tapes: Waterproofing manufacturer's recommended waterproof tape for joints between sheets, membranes, or panels.

F. Adhesive: Waterproofing manufacturer's water-based adhesive used to secure waterproofing to both vertical and horizontal surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate preparations and other conditions affecting performance of bentonite waterproofing.

B. Examine bentonite materials before installation. Reject materials that have been prematurely exposed to moisture.

C. Verify that substrate is complete and that work that will penetrate waterproofing is complete and rigidly installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions.

B. Formed Concrete Surfaces: Remove fins and projections. Fill voids, rock pockets, form-tie holes, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.

C. Horizontal Concrete Surfaces: Remove debris, standing water, oily substances, mud, and similar substances that could impair the bonding ability of concrete or the effectiveness of waterproofing. Fill voids, cracks greater than 1/8 inch, honeycomb areas, and other defects with bentonite mastic or cement grout patching material according to manufacturer's written instructions.

D. Excavation Support and Protection System: If water is seeping, use plastic protection sheets or other suitable means to prevent wetting the bentonite waterproofing. Fill minor gaps and spaces 1/8 inch wide or wider with wood, metal, concrete, or other appropriate filling material. Cover or fill large voids and crevices with cement mortar according to manufacturer's written instructions.

3.3 INSTALLATION, GENERAL

A. Scope, General: Waterproofing is for all below-grade foundation wall locations, including the pump pit and surge tank.

B. Prepare substrates, voids, cracks, and cavities; and install waterproofing and accessories according to manufacturer's written instructions.

1. Before installing, verify the correct side of waterproofing that shall face substrate surface.
2. Apply bentonite tubes, bentonite mastic, or both at changes of plane, construction joints in substrate, projections, and penetrations.
3. Prime concrete substrates. Primer may be omitted on concrete surfaces that comply with manufacturer's written requirements for dryness, surface texture, and freedom from imperfections.

C. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts.

3.4 GEOTEXTILE/BENTONITE SHEET INSTALLATION

A. Install a continuous layer of waterproofing sheets directly against surface to be waterproofed. Lap ends and edges a minimum of 4 inches on horizontal and vertical substrates unless otherwise indicated. Stagger end joints between sheets a minimum of 24 inches. Fasten seams by stapling to adjacent sheet or nailing to substrate.

B. Concrete Walls: Starting at bottom of wall, apply waterproofing sheets horizontally against wall. Secure with masonry fasteners spaced according to manufacturer's written instructions. Extend to bottom of footing, grade beam, or wall, and secure.

1. Termination at Grade: Extend waterproofing sheets to within 6" of finish grade unless otherwise indicated. Secure top edge with termination bar. Apply sealant to top edge of termination bar.

3.5 DRAINAGE / PROTECTION PANEL INSTALLATION

A. Install over geotextile/bentonite sheet.

B. Ensure that drainage channels are aligned and free of obstructions.

C. On vertical surfaces, set drainage / protection units in adhesive or tape applied according to manufacturer's written instructions.

D. On horizontal surfaces, loosely lay drainage / protection panels according to manufacturer's written instructions.

3.6 WATERSTOP INSTALLATION

A. Install at all below-grade cold-joints and construction-joints where bentonite waterproofing membrane system is used.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed waterproofing installation before covering with other construction and provide written report stating that installation complies with manufacturer's written instructions.

1. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.

END OF SECTION – 07 17 00

SECTION – 07 21 00
THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Mineral-wool board.
3. Thermal and acoustic batt Insulation.
4. Vapor Retarding Membrane for interior surface of exterior walls and non-tiled locker room walls.
5. Air and Vapor Control Membrane

B. Related Requirements:
1. Section 033000 "Cast In Place Concrete"
2. Section 071700 “Bentonite Waterproofing” at below grade pit walls.
3. Section 072119 “Foamed in Place Insulation” for spray foam.
4. Section 075419 “PVC Roofing” for polyiso insulation in roof assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Written insulation schedule describing where each type of insulation will be used.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene closed cell foam boards in this article are also called "XPS boards."

B. Extruded Polystyrene Board, rigid thermal insulation boards made of extruded polystyrene closed-cell foam in thickness of 1-inch and 2-inch boards. Long-term thermal performance of R-5/inch minimum and complying with ASTM C578-14.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Sopra-XPS 20 or comparable product by one of the following:

   a. DuPont.
   b. Owens Corning.

2.2 MINERAL-WOOL BOARD

A. Mineral-Wool Board, Type IVB, ASTM C 612.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ROCKWOOL COMFORTBOARD 80 or comparable, approved product.
2. Density: 8 lbs/ft^3 minimum for direct through-attached fiberglass clips.

2.3 BATT INSULATION

A. Basis-of-Design Thermal Insulation Product: Subject to compliance with requirements, provide ROCKWOOL COMFORTBATT or comparable approved product.

B. Basis-of-Design Acoustic Insulation Product: Subject to compliance with requirements, provide ROCKWOOL SAFE'N'SOUND or comparable approved product.

2.4 VAPOR RETARDING MEMBRANE

A. Basis -of-Design product is CertainTeed MemBrain, comparable approved product

B. Accessories: Spray adhesives and tapes for vapor barrier continuity.

2.5 AIR AND VAPOR CONTROL MEMBRANE (Interior Natatorium Walls, also called "AIR AND VAPOR BARRIER")

A. Basis -of-Design: 6 mil polyethylene

B. Accessories: Spray adhesives and tapes for air vapor barrier continuity.

2.6 ACCESSORIES

A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thickness, widths, and lengths. Apply single layer of insulation units unless multiple layers are shown or required to make up total thickness or to achieve R-values shown on drawings.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line or to top of footing, whichever is less.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF MINERAL-WOOL BOARD INSULATION

A. Mineral-Wool Board Insulation: Install adhesive per manufacturer’s written instructions and recommendations. Fit courses of insulation between any obstructions, with edges butted tightly in both directions. Press units firmly against substrates.

3.5 INSTALLATION OF BATT INSULATION

A. Cavity-Wall Insulation. Install per manufacturer's written instructions and recommendations. Fit insulation tight to framing and other and obstructions filling the entire framing depth. Press units firmly substrates.

3.6 INSTALLATION OF VAPOR RETARDING MEMBRANE

A. Vapor Retarding Membrane. Install per manufacturer's written instructions and recommendations. Installation shall be continuous, full taped and sealed membrane. Seal to walls, floors, penetrations and other transitions to prevent vapor migration through the wall. Position tight against insulation without voids/gaps.

3.7 INSTALLATION OF AIR AND VAPOR CONTROL MEMBRANE

A. Air and Vapor Control Membrane. Seal to walls, floors, penetrations and other transitions to prevent vapor migration through the wall.

B. Install at perimeter of natatorium environment. Refer to drawings for additional information.

3.8 PROTECTION

A. Protect installed insulation and vapor retarding membrane from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

B. Seal all punctures and discontinuities in vapor retarding membrane before installing interior finishes.

END OF SECTION – 07 21 00

SECTION 07 21 19 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop drawing: Highlighted plan showing extents of spray foam insulation.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 2.0 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F. Closed cell content shall be not less than 98% and vapor permeance of 1.70 perms at 2” thick.

B.

1. Basis of Design Product: BASF Walltite Max HeatLok HFO Pro or an equal, approved product from the following manufacturers or others with equal products.

a. Diversified Foam Products

b. Dow Chemical Company

c. Owens Corning.

2. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop the entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

E. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 07 21 19

SECTION – 07 27 13
WEATHER RESISTANT BARRIERS AND AIR BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes
1. Air barriers
2. Weather resistant barriers
3. Associated materials

B. Related Requirements:

1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

A. Barrier Material: A primary element that provides a continuous barrier to the movement of air, moisture and vapor.

B. Barrier Accessory: A transitional component of the barrier that provides continuity.

C. Barrier Assembly: The collection of barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air, moisture and vapor movement through the wall.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier and weather resistant barrier requirements and installation, special details, mockups, air-leakage and bond testing, barrier protection, and work scheduling that covers barriers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

B. Shop Drawings: For air barrier and weather resistant barrier assemblies.

1. Show locations and extent of barriers. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
2. Include details of interfaces with other materials that form part of air or weather resistant barrier.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include a list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.

B. Product Certificates: From air-barrier and weather resistant barrier manufacturer, certifying compatibility of barriers and accessory materials with Project materials that connect to or that come in contact with barriers.

C. Product Test Reports: For each barrier assembly, for tests performed by a qualified testing agency.

D. Evaluation Reports: For air barriers, weather resistant barriers and flexible flashing, from ICC-ES.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly, 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, weather resistant barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.

a. Include junction with roofing membrane, building corner condition, foundation wall intersection, and typical window opening (head, jamb, sill)
b. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Testing: barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
   1. Whole Building air leakage testing per ASTM E 779, as required by the Washington State Energy Code.
   2. Adhesion Testing: Air-barrier assemblies will be tested for minimum air-barrier adhesion as recommended by air barrier manufacturer, but not less than 16 PSI. according to ASTM D 4541 for each 600 sq. ft.of installed air barrier or part thereof.
   3. Test using blower door equipment consistent with ASTM E 779 at a pressure differential of 30 Pa and air temperature differential no less than 20F. Review the natatorium perimeter with infrared imaging equipment to detect potential air leakage paths. Diagnose air leakage paths using tracer smoke and repair as directed by the Architect/Owner.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.

   1. Protect substrates from environmental conditions that affect air-barrier performance.
   2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 SELF-ADHERING SHEET AIR AND WATER BARRIER

A. Fully Adhered Vapor Permeable Air and Water Barrier Membrane: self-adhering sheet barrier, formulated for application with primer that complies with VOC limits of authorities having jurisdiction.

   1. Basis-of-Design Product: Subject to compliance with requirements, provide Sopraseal Stick VP w/ related fluid-applied flashings or equal product by one of the following:

      a. WrapShield SA by VaproShield
      b. VP160 by Henry.

B. Fully Adhered Vapor Impermeable Air and Water Barrier Membrane: Self-adhering sheet barrier, formulated for application with primer that complies with VOC limits of authorities having jurisdiction.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Sopra Seal Stick 1100T by Soprema or equal product by one of the following:

b. Henry Blueskin SA
c. Perm-A-Barrier Wall Membrane by Grace.

2.3 LIQUID APPLIED SILYL-TERMINATED POLYETHER (STPE) POLYMER FLASHING – noted as LAF on drawings.

A. Liquid Applied STPE flashing: moisture cure single-component elastomeric liquid-applied flashing, for use with vapor permeable WRB/AB.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Sopraseal Liquid Flashing by Soprema or equal product by one of the following:

b. Henry Blueskin Air-Bloc LF
c. Vapro Liquiflash by VaproShield

2.4 FOIL FACED SELF-ADHERED MEMBRANE FLASHING – noted as FFSAM and SAM on the drawings.

A. Foil Faced Self-Adhering Membrane Flashing, for use with vapor impermeable WRB/AB.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Sopraseal foil faced flexible flashing or one of the following:

a. Henry Metal Clad HE 200 AM
b. Perma-Barrier Aluminum Wall Membrane by Grace.

2.5 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

C. Butyl Strip: Vapor retarding, 30 to 40 mils thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.

D. Modified Bituminous Strip: Vapor retarding, 40 mils thick, smooth surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick, cross-laminated polyethylene film with release liner backing.

E. Termination Mastic: Air-barrier manufacturer's standard cold fluid-applied elastomeric liquid; trowel grade.

F. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

G. Adhesive and Tape: Barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.

H. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0250 inch thick, and Series 300 stainless-steel fasteners.

I. Sprayed Polyurethane Foam Sealant: Refer to Section 072110 “Foamed-in-Place Insulation.”

J. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 "Joint Sealants.”

K. Butyl rubber, Flexible Flashing (noted as SAM and FFSAM on drawings): Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density aluminum foil to produce an overall thickness of not less than 0.030 inch.

L. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

M. Nails and Staples: ASTM F 1667.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that concrete has cured and aged for minimum time period recommended by air-barrier manufacturer.
3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application. Existing concrete wall substrate is painted. Remove paint as necessary to meet WRB manufacturer requirements for surface preparation.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.

D. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

E. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 AIR BARRIER INSTALLATION

A. General: Install sheets and accessory materials according to air-barrier manufacturer's written instructions.

1. When ambient and substrate temperatures range between 25 and 40 deg F , install self-adhering, air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F .

B. Corners: Prepare, prime, and treat inside and outside corners according to manufacturer’s written instructions.

1. Install strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.

C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.

D. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier sheet on same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve the required bond, with adequate drying time between coats.

E. Apply and firmly adhere sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
2. Roll sheets firmly with a mechanical roller to enhance adhesion to substrate.

F. Apply continuous sheets over strips bridging substrate cracks, construction, and contraction joints.

G. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inch-wide strip. Maintain shingle lapping and pre-strip membrane as required to ensure shingle fashion laps at tie-ins and flashings.

H. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic. Seal all lap edges at horizontal surfaces such as windowsills and wall ledges.

I. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.

1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install butyl strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.

J. Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

K. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply liquid applied LAF or FFSAM flashing as shown on drawings and per manufacturer’s written instructions.

L. Unless otherwise shown, fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air-barrier membrane with foam sealant.

M. At the end of each working day, seal top edge of air-barrier material to substrate with termination mastic.

N. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.

P. Do not cover the air barrier until it has been tested and inspected by the Owner’s testing agency.

Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.4 FLASHING INSTALLATION

A. Apply flashing where indicated to comply with manufacturer's written instructions.
1. Install Liquid Applied STPE flashing (noted as LAF on drawings) at Permeable Air and Water Barrier Membrane. See drawings.
2. Install Foil Faced Flexible Flashing (noted as SAM and FFSAM on drawings) to Impermeable Air and Water Barrier Membrane. See drawings.
3. Prime substrates as recommended by flashing manufacturer.
4. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
5. Lap flashing over water-resistive barrier at bottom and sides of openings.
6. Lap water-resistive barrier over flashing at heads of openings.
7. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Continuous structural support of the air-barrier system has been provided.
3. Site conditions for application temperature and dryness of substrates have been maintained.
4. Maximum exposure time of materials to UV deterioration has not been exceeded.
5. Surfaces have been primed.
6. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
7. Termination mastic has been applied on cut edges.
8. Air barrier has been firmly adhered to substrate.
9. Compatible materials have been used.
10. Transitions at changes in direction and structural support at gaps have been provided.
11. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
12. All penetrations have been sealed.

C. Tests: As determined by Owner's testing agency from among the tests noted in 1.8.B “Testing.”

D. Barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
2. Remove and replace deficient barrier components for retesting as specified above.

E. Repair damage to barriers caused by testing; follow manufacturer's written instructions.

3.6 CLEANING AND PROTECTION

A. Protect barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect barriers from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace barrier or install additional, full-thickness, barrier application after repairing and preparing the overexposed membrane according to barrier manufacturer's written instructions.
2. Protect barriers from contact with incompatible materials and sealants not approved by barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION – 07 27 13

SECTION 07 42 33
EXTERIOR SOLID PHENOLIC RAINSCREEN SIDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Exterior solid phenolic cladding system and accessories as required for a complete drained and back-ventilated rainscreen system.
1. Flush Cladding
2. Cladding support strapping and accessories for cladding installation.

1.2 RELATED SECTIONS

A. Section 07 21 00 “Thermal Insulation” for continuous outboard insulation
B. Section 07 27 13 “Weather Resistant Barriers and Air Barrier” for specifications and installation requirements for barriers.

1.4 SUBMITTALS

B. Product Data: Manufacturer's data cladding on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Submit plan, section, elevation and perspective drawings necessary to describe and convey the layout, profiles and product components, including edge conditions, cladding joints, fixture location, anchorage, accessories, finish colors, patterns and
textures.

E. Engineering Calculations: Submit engineering calculations as required by the local building code, showing that the installed cladding and attachments system meets the wind load requirements for the project. Design and engineering shall include accommodation of movement of cladding as a result of temperature differentials and moisture absorption.

G. Verification Samples: For each finish product specified, two samples a minimum of 3.5 inches by 3.5 inches (89 mm by 89 mm) representing actual product, color, and patterns. Sample edges may vary from field cladding edges.

H. Operation and Maintenance Data: Submit operation, maintenance, and cleaning information for products covered under this section.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary cladding products specified in this section will be supplied by a single manufacturer with a minimum of ten years’ experience.
1. Products covered under the Work listed in this section are to be manufactured in an ISO 9001 certified facility.

B. Installer Qualifications: All products listed in this section are to be installed by a

single installer trained and approved by the manufacture or representative.

C. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

D. Mock-Up: Provide a mock-up for evaluation of the product and application workmanship.

1. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

E. Pre-installation Meetings: Conduct pre-installation conference to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. During transportation, use stable, flat pallets that are at least the same dimension as the cladding.
2. Materials shall be packaged to minimize or eliminate the possibility of damage during shipping. Items such as wooden side boards, wooden lid, and spacers or protective cladding between cladding shall be used to protect the cladding from surface and/or edge damage.

B. Storage:

1. Store products in an enclosed area protected from direct sunlight, moisture and heat. Maintain a consistent temperature and humidity.
2. Store products in manufacturer's unopened packaging until ready for installation.
3. Stack siding using protective dividers to avoid damage to decorative surface.
4. For horizontal storage, store cladding on pallets of equal or greater size as the cladding with a protective layer between the pallet and cladding and on top of the uppermost cladding.
5. Do not store vertically.

C. Handling:

1. Remove protective film within 24 hours of the cladding being removed from the pallet.
2. When moving cladding, lift evenly to avoid dragging cladding across each other and scratching the decorative surface.
3. Remove all labels and stickers immediately after installation.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Field Measurements: Verify actual measurements/openings by field measurements performed by the installer prior to release for fabrication. Recorded measurements to be indicated on shop drawings based on field measurements provided by the installer.
Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.8 WARRANTY

A. Warranty: At project closeout, provide manufacturer's limited ten-year warranty covering defects in materials. Warranty only available when material installed by an installation contractor trained and approved by the manufacturer's representative. At project closeout provide installers warranty covering installation defects not covered by the material warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Trespa International. www.trespa.com., or manufacturer and product listed below, or approved equal

1. Fundermax, Scaleo

B. Requests for substitutions will be considered in accordance with provisions Division 1 specifications.

2.2 WALL CLADDING

A. Solid Phenolic Wall Planks: Trespa Pura NFC by Trespa International, or approved equal.

1. Material: a combination of high pressure and temperature to create a flat plank created from thermosetting resins, homogenously reinforced with wood-based fibers and an integrated decorative surface or printed décor.
2. Color on Primary Face:
   1.) SIDING 1: PU17 Aged Ash, verify with Architect.
   2.) WD (Interior Wood Wall Paneling): PU02 Classic Oak, verify with Architect.
3. Finish: Matte
4. Cladding Core: Fire retardant (FR) black core.
5. Cladding Thickness: 5/16 inch (8 mm).
6. Plan Profile: Flush Cladding
7. Physical Properties:
   1) Cladding shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 15 pounds per square foot (psf). Wind load testing shall be done in accordance with this standard to obtain the following results:
   2) Normal to the plane of the wall, the maximum cladding deflection shall not exceed L/175
   3) Normal to the plane of the wall between supports, deflection sub-framing members shall not exceed L/175 or 3/4 inch, whichever is less
      a) At 1-1/2 times design pressure, permanent deflection of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion.
      b) If system tests are not available, mockups shall be constructed and tests performed under the direction of an independent third-party laboratory which show compliance to the minimum standards listed above.
8. Fire Performance:
   a. Flame Spread: Class A, ASTM E 84.
   b. Smoke Development: Less than 450, ASTM E 84.

B. Mounting System:

1. Manufacturer’s clip system attached to sub-system, including plywood strapping strips.
2. 3/4” borate treated plywood strips or 1x borate treated nailers or approved alternate material. Width as recommended by siding mfr. for attachment of clip system.

C. Fiberglass Sub Structure: Fiberglass sub-structure designed to withstand structural loading due to wind load and the dead load of the cladding, painted as required to conceal behind the open joinery of the attachment system.
1. Refer to drawings for sizes needed for alignments indicated. Only occurs at exterior corners at natatorium environment (all out-board insulation).

D. Extruded Aluminum Trim: Manufacturer’s flush cladding trim. Color: Aged Ash PU17.

E. Fasteners (Concealed): Fasteners shall be 300 series stainless steel or Leland D2000 coated fasteners.

2.3 FABRICATION

A. Cladding: Solid phenolic impregnated Kraft paper wall cladding with no voids, air spaces or foamed insulation in the core material. Accessory items in accordance with manufacturer's recommendations and approved submittals

B. Appearance: Cladding lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Surfaces to receive cladding shall be even, smooth, dry, and free from defects detrimental to the installation of the cladding system. Notify Contractor in writing of conditions detrimental to proper and timely completion of the work.

C. Confirm exterior sub framing is plumb and level, with no deflection greater than 1/4 inch (6 mm) in 20 feet (6096 mm).

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install solid phenolic wall cladding and sub-frame system in accordance with manufacturer's

instructions.

B. Install solid phenolic wall cladding plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals and drawings.

C. Anchor cladding and sub-framing securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary movement and structural support.

D. Fasten solid phenolic wall cladding with fasteners approved for use with supporting substrate.

E. Do not install cladding or component parts which are observed to be defective or damaged including, but not limited to: warped, bowed, abraded, scratched, and broken members.

F. Do not cut or trim component parts during installation in a manner that would damage the finish, decrease the strength, or result in visual imperfection or a failure in performance. Return component parts with require alteration to the shop for re-fabrication or
replacement.

G. Install corner profiles and trim with fasteners appropriate for use with adjoining construction as indicated on the Contract Drawings and as recommended by manufacturer.

3.4 ADJUSTING AND CLEANING

A. Remove masking or cladding protection as soon as possible after installation. Any masking intentionally left in place after cladding installation on an elevation, shall become the responsibility of the General Contractor to remove.

B. Adjust final cladding installation so that all joints are true and even throughout the installation. Cladding out of plane shall be adjusted with the surrounding cladding to minimize any imperfection.

C. Repair cladding with minor damage. Remove and replace cladding damaged beyond repair as a direct result of the cladding installation. After installation, cladding repair and replacement shall become the responsibility of the General Contractor.

D. Clean finished surfaces as recommended by cladding manufacturer. After installation cleaning, cleaning during construction shall become the responsibility of the General Contractor.

END OF SECTION – 07 42 33

SECTION - 07 46 46
FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:
   1. Fiber-cement cladding panels.
   2. Fiber-cement trim
   3. Cladding support strapping and accessories for cladding installation.

B. Related Requirements:
   1. Section 061000 "Rough Carpentry" for additional wood furring, grounds, nailers, and blocking.
   2. Section 072713 "Weather Resistant Barriers and Air Barriers" for weather-resistive barriers and air barriers.

1.3 COORDINATION

A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Provide engineered design verification for attachment of strapping and cladding to substrate.

1.6 MOCK-UP

A. Provide a 5’ wide x 6’ tall minimum mock-up showing stud wall framing w/ sheathing, WRB, strapping, siding, and window opening wrap per A8.1. Window installation not required. Install jamb trim and siding layout in the sample.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish full lengths of fiber-cement siding and soffit including related accessories, in a quantity equal to 4 percent of the amount installed.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including cracking and deforming.
b. Deterioration of materials beyond normal weathering.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT CLADDING PANELS

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide James Hardie Building Products fiber cement panels or comparable product from other manufacturer.

B. Nominal Thickness: Not less than 5/16 inch

C. Panel: 48-inch-(1200-mm-) nominal width sheets with smooth texture.

D. Finish: Smooth - Factory primed

E. SCHEDULE:
1. SIDING 2: Base panels. Minimize seams. 10’ lengths, typical. See elevations for layout. Plan layout to align seams with adjacent window mullions or other features.

2.3 FIBER-CEMENT TRIM BOARDS

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.

1. Basis-of-Design Product: Subject to compliance with requirements, provide James Hardie Building Products fiber cement panels or comparable product from other manufacturer.

B. Thickness: Not less than 3/4 inch

C. Finish: Smooth - Factory primed

D. SCHEDULE:
1. BATTEN 1: 2.5” width, 0.75” thickness.
2. BATTEN 2: 5.5” width, 1.0” thickness.

2.4 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, plywood strapping (for ventilated open joint rainscreen installation), inside and outside corner caps, and other items as recommended by siding manufacturer for building configuration.

B. Flashing and Trim: Provide aluminum flashing and trim complying with Section 076200 “Sheet Metal Flashing and trim” at window and door heads and where indicated.
1. Finish for aluminum flashing: factory prime coating.

C. Fasteners:

1. For fastening fiber cement to strapping strips, use manufacturer’s recommended hot-dip galvanized or stainless-steel fasteners.

2. For fastening strapping strips to exterior walls and soffits, use siding self-taping screws of sufficient length to penetrate a minimum of 1” into the substrate.

3. For fastening to metal, use ribbed bugle head screws of sufficient length to penetrate a minimum of 1/4 inch or three screw threads into substrate.

D. Insect Screening: Aluminum 18 by 16 mesh or PVC coated, glass fiber fabric 18 by 14 or 18 by 16 mesh.

E. Strapping Strips:

F. 3/4” borate treated plywood strips or 1x borate treated nailers or approved alternate material. Width as recommended by siding mfr. for nailing.

G. Fiberglass Sub Structure: Fiberglass sub-structure designed to withstand structural loading due to wind load and the dead load of the cladding, painted as required to conceal behind the open joinery of the attachment system.

H. Refer to drawings for sizes needed for alignments indicated. Only occurs at exterior corners at natatorium environment (all out-board insulation).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and soffit and related accessories. Examine wall framing to verify that studs and furring straps and anchorage have been installed within alignment tolerances required by siding manufacturer.

B. Verify that air or water resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration and water penetration.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

1. Installation: Ventilated rainscreen. Joints width shall be as described in the drawings.
2. Do not install damaged components.
3. Install fasteners no more than the spacing required by the manufacturer and the engineered design. Maximum 24” o.c.

B. Install joint sealants as specified in Section 0792 00 “Joint Sealants” and to produce a weathertight installation.

C. Install per manufacturer’s written instructions for installing mineral wool board insulation, cladding support strapping and cladding.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

C. Dispose of all waste material in compliance with the project’s Waste Management Plan in accordance with Section 01 81 13.19 - Construction Waste Management.

END OF SECTION 07 46 46

SECTION 07 54 19 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Polyvinyl-chloride (PVC) roofing system; adhered and induction welded
2. Coverboard; adhered
3. Roof insulation; mechanically fastened lowest layer, adhered all subsequent layers
4. Temp Roof / Air and Vapor Barrier; adhered
5. Roof Substrate Board; mechanically fastened at metal deck (not required at CLT)
6. Accessories

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
2. Section 061600 "Sheathing" for wood-based, roof deck panels per structural.
3. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
4. Section 221000 "Plumbing Piping" for roof drains and downspouts.
5. Sections 260533 “Raceways and Boxes for Electrical Systems” and 260534 “Raceways and Boxes for Communications Systems” for conduits that are to be installed above roof decks and within the roofing insulation layer.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for the roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:

1. Base flashings and membrane terminations.
2. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings.
3. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Walkway pads or rolls, of color required.

D. Manufacturer’s Letter of Intent to Warrant document.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Product Test Reports: For components of roofing system, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Sample Warranties: For manufacturer's special warranties.

D. Letter of Intent to Warrant.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Executed Warranty.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

B. The roofing manufacturer representative shall visit the site a minimum of two times during installation and one time upon completion of work. Submit manufacturer’s reports.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit the roofing system to be installed according to the manufacturer’s written instructions and warranty requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, and other components of roofing system, including vapor retarder.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain components including roof insulation for roofing system from same manufacturer as membrane roofing.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.

1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under the conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the corner, perimeter and field uplift pressures resulting from the wind exposure category and pressures indicated on the structural drawings.

D. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

E. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.

F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings from an applicable testing agency.

2.3 PVC ROOFING

A. PVC Sheet: ASTM D6754-02, 55-oz/square yard membrane roofing.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Seaman’s Corporation FiberTite-XT 60 mill, or approved equal

2. Thickness: 60 mils, nominal.
3. Exposed Face Color: Energy Gray, verify with architect.
4. Installation method: roofing shall be induction welded per manufacturer’s written instruction.

2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of the weather barrier shall comply with VOC requirements for LEED certification.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.

C. Bonding Adhesive: Low-rise polyurethane foam adhesive, FiberTite CR-20 or equal and as approved by roofing manufacturer.

D. Slip Sheet: Manufacturer's standard, of thickness required for application.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

F. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Building Products; Dens Deck Prime or approved equal.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.6 VAPOR RETARDER

A. Self-Adhering-Sheet Vapor Retarder:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Seaman’s Corporation FiberTite VaporTite or approved equal. Product shall be listed as air and vapor barrier underlayment.

2. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

B. Provide primer when recommended by vapor-retarder manufacturer.

2.7 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured by PVC roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.
   1. Polyisocyanurate Board Insulation: ASTM C 1289, felt or glass-Seaman's Corporation Fiber mat facer on both major surfaces. Provide tapered polyiso boards, or similar by approved equal for use at tapered crickets and transitions, see roof plan for extents.

   2. Basis-of-Design Product: Subject to compliance with requirements, provide Seaman's Corporation FiberTite FTR-Value or approved equal.

B. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Insulation, Coverboard, and Roofing Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

   1. Basis-of-Design Product: Seaman's Corporation FiberTite CR-20 or approved equal.

C. Cover Board: 1/2 inch thick

   1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Building Products; DensDeck Prime cover board or approved equal.

2.9 FLASHING AND EDGE ACCESSORIES

A. Pre-molded pipe and inside / outside corner flashings
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Seaman Corporations Seaman's Corporation FiberTite accessory components or approved equal
      a. Color: Match roofing color

B. Metal Fascia
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Seaman's Corporation FiberTite AT Mechanically Attached Fascia for Larger Face Heights, or comparable and approved fascia by Metal-Era or other approved manufacturer for other PVC roofing manufacturers.
   2. Metal thickness: .063"
   3. Finish and Color: Kynar 500, color as selected from manufacturer's full range of standard colors.

C. Drip Edge
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Seaman's Corporation FiberTite AT Mechanically Attached Drip Edge, or comparable and approved fascia by Metal-Era or other approved manufacturer for other PVC roofing manufacturers.
   2. Metal thickness: .063"
   3. Finish and Color: Kynar 500, color as selected from manufacturer's full range of standard colors.

4.

D. Coated Metal Flashings
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Seaman's Corporation Fibertite's Corporation FiberClad Coated Metal flashing or approved equal by other PVC roofing manufacturers.
   2. Metal: 24 ga. hot dipped G-90 steel
   3. PVC Color: match roofing color, typical. Verify with Architect.

2.10 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16-inch-thick and acceptable to roofing system manufacturer.

B. Color: match roof color

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 SUBSTRATE BOARD INSTALLATION

A. Mechanically fastened. See drawings for location of fasteners relative to decking profile.

B. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly abut substrate boards together.

3.5 VAPOR-RETARDER INSTALLATION

A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling. Adhere the entire sheet by roller pressure as required by roofing manufacturer.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSULATION INSTALLATION

A. Prior to installation of substrate boards, install acoustic insulation - specified and provided by Section 053100 “Steel Decking - in metal deck flutes.

B. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.

C. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Provide routed out channels at bottom of insulation for above-deck installation of conduits and electrical boxes. Refer to drawings for locations.

G. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

H. Adhered Insulation: Above Roof 1 natatorium environment, see drawings for extents. Install each layer of insulation and adhere to substrate as follows:

1. Insulation shall be adhered in ribbons (beads) of low-rise foam adhesive, spacing of which is per roofing manufacturer’s requirements.

I. Mechanically Fastened Insulation. Mechanically fastened at all roof areas except where adhered above natatorium environment, see drawings for extents: Install each layer of

insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FM Global's "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

J. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely abut cover boards together.
1. Mechanically fastened except adhered above Roof 1 natatorium environment, see drawings for extents.
2. Install cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.7 ADHERED ROOFING INSTALLATION

A. Adhered roofing installation above natatorium environment, see drawings for extents.

B. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

1. Install sheet according to ASTM D 5036.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

F. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.

G. Apply roofing with side laps shingled with slope of roof deck where possible.

H. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.8 INDUCTION WELDED ROOFING INSTALLATION

A. Induction welded roofing installation at all roof areas except where adhered above Roof 1 natatorium environment, see drawings for extents. Refer to Section 012300 “Alternates” for bid alternate for adhered roofing at all roof areas.

B. Induction welded roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

1. Install sheet according to ASTM D 5082.
2. For in-splice attachment, install roofing with long dimension perpendicular to steel roof deck flutes where they occur.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Fasten or adhere roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.9 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.10 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in the locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components, and to furnish reports to Architect.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

E. Seam test welds twice daily.

3.12 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.13 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <Insert name of Owner>.
2. Address: <Insert address>.
3. Building Name/Type: <Insert information>.
4. Address: <Insert address>.
5. Area of Work: <Insert information>.
6. Acceptance Date: _____.
7. Warranty Period: <Insert time>.
8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speed exceeding <Insert mph ;>
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 54 19

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Formed roof-drainage sheet metal fabrications.
2. Formed wall sheet metal fabrications.
3. Formed equipment support flashing.
4. Formed overhead-piping safety pans.
5. Formed sheet metal copings.

B. Related Requirements:

1. Section 055000 “Metal Fabrications” for custom gutters, conductor heads and scuppers made of steel.
2. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
3. Section 075419 "Polyvinyl Chloride (PVC) Roofing " for materials and] installation of sheet metal flashing and trim integral with roofing.
4. Section 074633 "Exterior Solid Phenolic Rainscreen Siding" for sheet metal flashing and trim integral with phenolic siding.
5. Section 074646 "Fiber Cement Siding" for sheet metal flashing and trim integral with fiber cement siding.
6. Section 077200 "Roof Accessories" for hatches, vents, and other manufactured roof accessory units.
7. Sections 084113 (Aluminum-Framed Entrances and Storefronts” and 084413 “Glazed Aluminum Curtain Walls” for sheet metal flashing and trim integral with those systems.
8. Division 23 for set-on-type curbs, equipment supports.

1.3 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affects sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches .

C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual"] and] SMACNA's "Architectural Sheet Metal Manual"] requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings] tested according to SPRI ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. Recycled Content of Steel-Sheet Flashing and Trim: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint

sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F , material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping..

B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666], Type 316, dead soft, fully annealed; with smooth, flat surface.

1. Finish: 2D (dull, cold rolled).

C. Metallic-Coated Steel Sheet, Unpainted: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation.

1. Surface: Smooth, flat.
2. Finish: Galvanized, unpainted

D. Coated Steel Sheet, Painted: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation; prepainted by coil-coating process to comply with ASTM A 755/A 755M.

1. Material and exposed coil finish as specified in Section 074213.13 "Formed Metal Wall Panels "

E. PVC vinyl coated metal for use in conjunction with the PVC roofing.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder], protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item] unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item].

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

4. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:

1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. High Temperature Self-Adhering Membrane: Grace Vycor Ultra or equal. Product cannot come in contact with PVC, notify architect if application requires contact with PVC products.

E. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

F. Elastomeric Sealant: ASTM C 920, elastomeric silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

H. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

I. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.4 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

2. Use lapped expansion joints only where indicated on Drawings.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

G. Do not use graphite pencils to mark metal surfaces.

2.5 WALL SHEET METAL FABRICATIONS

A. Opening Flashings – not indicated to be by others: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams from:
1. 22 ga. material by fiber cement siding manufacturer at fiber cement siding
2. 22 ga. material by phenolic siding manufacturer at phenolic siding

2.6 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Galvanized Steel: 0.028 inch thick.

B. Overhead-Piping Safety Pans: Fabricate from the following materials:

1. Galvanized Steel: 0.040 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder], protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.
7. All horizontal flashing surfaces shall slope to drain, out to the exterior away from walls and openings, and back to the roof at parapets.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum] and] stainless-steel] sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 12 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.
3. See drawings for locations of expansion provisions at copings and other sheet metal flashing and trim.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F , set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F .
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel sheet.

2. Do not use torches for soldering.
3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

H. Rivets: Rivet joints in where necessary for strength.

3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant compatible with the substrate.

C. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and solder to scupper.
2. Loosely lock front edge of scupper with conductor head.
3. Solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

D. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper] or] gutter] discharge.

3.4 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION - 07 62 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Roof hatches.
   2. Roof ladders

B. Related Sections:

   1. Section 055000 "Metal Fabrications" for other project ladders.
   2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
   3. Section 110140 “Fall Protection” for roof-mounted fall protection systems.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Wind-Restraint Performance: As indicated on Drawings.

2.2 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and straight sides, and integrally formed deck-mounting flange at perimeter bottom.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Precision Ladders, LLC, PH(A) 3'-0" x 5'-0" or comparable product by one of the following:

a. Bilco Company
b. Dur-Red Products
c. Milcore Commercial Products
d. Other approved manufacturers.

B. Type and Size: Single-leaf lid, 3'-0" x 5'-0".

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Aluminum sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated.
2. Finish: Clear anodic.

E. Construction:

1. Insulation: Glass-fiber board Manufacturer's standard.

a. R-Value: 12.0 according to ASTM C 1363.

2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
4. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
5. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

1. Height: 42 inches above finished roof deck.
2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
5. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
6. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
9. Fabricate joints exposed to weather to be watertight.
10. Fasteners: Manufacturer's standard, finished to match railing system.
11. Finish: Manufacturer's standard Galvanized

H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
2. Height: 42 inches above finished roof deck.
3. Material: Aluminum.
4. Post: Manufacturer's standard diameter pipe.
5. Finish: Manufacturer's standard baked enamel or powder coat.

a. Color: As selected by Architect from manufacturer's full range.

2.3 MANUAL DISAPPEARING STARIWAY

A. Manual pull down disappearing 2-hour fire rated aluminum folding stairway.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Precision Ladders, LLC, Super Simplex Disappearing Stairway Model 1000 or comparable product by one of the following:

a. Bilco Company

b. Dur-Red Products
c. Milcore Commercial Products
d. Other approved manufacturers.

B. Performance Standard: Unit shall comply with ANSI A14.9, Commercial Type, for rough openings between 27 inches to 39 inches. Stairway capacity shall be rated at 500 lbs.

C. Fire Rating: 2 hour fire rating

D. Accessories:

1. Steel pole to aid opening and closing stairways.
2. Stairs for ceiling heights 9' -10" – 12' -0" shall be equipped with a patented Precision Fold Assist to aid in folding and unfolding of sections.
3. Keyed lock for door.

E. Components:

1. Ceiling Opening: 30" x 64"
2. Stairway Stringer: 6005-T5 Extruded aluminum channel 5" x 1" x 1/8"; tri-fold design; steel blade type hinges; adjustable feet with plastic Mar-guard. Pitch shall be 63°.
3. Stairway Tread: 6005-T5 extruded aluminum channel 5 3/16 inches by 1 1/4 inches by 1/8 inch. Depth is 5 3/16 inches. Deeply serrated top surface. Riser Height: 9-1/2 inches. Clear Tread Width for Standard Width: 18 inches.
4. Railing: Aluminum bar handrail riveted to stringers, upper section only.
5. Frame: 1/8" steel, 63° with built-in steps on the hinge end, 90° on the other end, custom depth to fill distance from ceiling to floor above. This custom frame will require a longer opening in the floor above than is required at the ceiling level.
6. Door Panel: On fire-rated models, the door panel shall be constructed of 20 gauge steel and have a 2 hour fire rating for use in fire-rated ceiling assemblies as issued by Warnock-Hersey or other appropriate independent testing/licensing agency.
7. Hardware:

    a. Steel blade type hinge connecting stringer sections. Zinc plated and chromate sealed.
    b. Steel operating arms, both sides. Zinc coat with clear trivalent chromate.
    c. Double acting steel springs and cable, both sides.
    d. Rivets rated at 1100 lb (499 kg) shear strength each.
    e. Steel section alignment clips at stringer section joints.
    f. Molded rubber guards at corners of aluminum door panel

8. Finishes: Mill finish on aluminum stairway components. Prime coat on frame.

2.4 ALUMINUM FIXED VERTICAL LADDER

A. Aluminum Fixed Vertical Ladder and Components: Ladder, fall arrest system, walk-thru, side rails, cage, rest platforms, floor mounting brackets, security doors, security gates and finishes.
1. Model: Model FL Aluminum Fixed Vertical Ladder as manufactured by Precision Ladders LLC.
2. Capacity: Unit shall support a 1,500 lb (680 kg) loading without failure.
3. Performance Standard: Units designed and manufactured to meet or exceed ANSI A14.3, OSHA 1910.23, OSHA 1910.28 and OSHA 1910.29.

B. Components:
1. Ladder Stringer: 2-1/2 inch by 1-1/16 inch by 1/8 inch (64 mm by 27 mm by 3 mm) extruded 6005-T5 aluminum channel. Pitch: 90 degrees.

2. Ladder Tread: 2-1/4 inch by 3/4 inch by 1/4 inch (57 mm by 19 mm by 6 mm) extruded 6005-T5 aluminum with deeply serrated top surface.
3. Ladder Mounting Bracket: 8-1/2 inch by 2 inch by 3 inch by 1/4 inch thick (216 mm by 51 mm by 76 mm by 6 mm) aluminum angle.
4. Walk-Thru: provide at exterior locations as shown on the drawings.
   a. Hand Rails: 1-1/4 inch (32 mm) aluminum square tube with rounded edges.
   b. Mounting Brackets: 4 inch by 4 inch by 1/4 inch (102 mm by 102 mm by 6 mm) aluminum.
   c. Side Rails: 42-inch (1067 mm) side rail extension for through ladder exits.
5. Floor Brackets: Floor bracket at foot of each stringer, 3 by 2 by 1/4 inch (76 by 51 by 6 mm).
6. Finishes:
   a. Standard: Mill finish on aluminum ladder components.
   b. Finishes
      1. Clear Anodized

2.5 METAL MATERIALS

A. Aluminum Sheet: ASTM B 209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
2. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

B. Aluminum Extrusions and Tubes: ASTM B 221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

C. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

D. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

E. Steel Tube: ASTM A 500/A 500M, round tube.

F. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

G. Steel Pipe: ASTM A 53/A 53M, galvanized.

2.6 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft. , thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F , thickness as indicated.

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Underlayment:

1. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.
3. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.
4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
5. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
6. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
7. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
8. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

E. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

F. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

H. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post according to manufacturer's written instructions.

D. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.
2. Penetrations in horizontal assemblies.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.

2.2 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. 3M Fire Protection Products.
b. A/D Fire Protection Systems Inc.
c. Grabber Construction Products.
d. Hilti, Inc
e. HOLDRITE;NUCO Inc.
f. Passive Fire Protection Partners.
g. Specified Technologies, Inc.
h. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.

D. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet .

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.6 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Penetration Firestopping Systems for Metallic Pipes, Conduit, or Tubing:

1. Provided product to meet all applicable codes.

2. F-Rating: 1 hour.
3. T-Rating: 1 hour.
4. Type of Fill Materials: As required to achieve rating.

END OF SECTION 07 84 13

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Polysulfide joint sealants.
3. Acoustical joint sealants.

B. Related Sections:

1. Section 088000 "Glazing" for glazing sealants.
2. Section 092900 "Gypsum Board" for sealing perimeter joints.
3. Section 093013 "Ceramic Tiling" for sealing tile joints.
4. Section 095123 "Acoustical Tile Ceilings" for sealing edge moldings at perimeters with acoustical sealant.
5. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in pavements, walkways, and curbing.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:

    a. Each kind of sealant and joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.
5. Primer type for each sealant and substrate combination.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

D. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and primers (if required) and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

E. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F .
2. When joint substrates are wet or when they have frost, dew or dirt
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.

1. Products: Subject to compliance with requirements, provide Dow Corning 795 or equal products from another manufacturer, including, but not limited to the following:

a. GE, Momentive SCS 2000 Silpruf
b. Tremco Incorporated, Spectrem 2

2. Products for Porous Substrates: Subject to compliance with requirements, provide Dow Corning 790 or equal products from another manufacturer, including, but not limited to the following:

a. GE, Momentive SCS 2700 Silpruf LM
b. Tremco Incorporated, Spectrem 1

3. Products for Air Barriers air seals at exterior windows and doors: If Dow Corning 795 (or equal) does not adhere properly at air barriers at windows, use Dow Corning 758 (or equal).

B. Multicomponent, non-sag Traffic-Grade, Neutral-Curing Polyurethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 50, for Use T.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Dynatrol II

b. Tremco Dymeric 240

2.3 POLYSULFIDE JOINT SEALANTS

A. Multicomponent, Nonsag, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following::

    a. BASF Corporation; Construction Systems.
    b. DAP Products Inc.
    c. ITW Polymers Sealants North America (formerly Pacific Polymers, Inc.)
    d. Pecora Corporation
    e. W. R. Meadows, Inc

B. Multicomponent, Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. BASF Corporation; Construction Systems.
    b. Pecora Corporation

C. Immersible, Multicomponent Nonsag, Traffic-Grade, Polysulfide Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T and Use I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Pecora Corporation

2.4 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Hilti, Inc
    b. Pecora Corporation
    c. Sherwin-Williams Company (The)
    d. USG Corporation

2.5 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin, Type O (open-cell material), Type B (bicellular material with a surface skin, or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Aluminum
    d. Phenolic cladding / siding.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces -JS-#1.

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.

2. Silicone Joint Sealant: Multicomponent, non-sag, traffic grade, neutral curing.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces JS-#2.

1. Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Joints between metal panels.
c. Perimeter joints between materials listed above and frames of doors, windows, and louvers.

2. Silicone Joint Sealant: single component, nonsag, neutral curing.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces JS-#3.

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.

2. Silicone Joint Sealant: Multicomponent, pourable, traffic grade, neutral curing except at pool, locker rooms, pool mechanical and associated spaces.
3. Polysulfide Joint Sealant: Multicomponent, nonsag, traffic grade at pool, locker room, pool mechanical and associated spaces
4. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#4.

1. Joint Locations:

a. Perimeter joints of exterior openings where indicated.
b. Tile control and expansion joints.
c. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.

2. Silicone Joint Sealant: Multicomponent, nonsag, neutral curing.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces JS-#5.

1. Joint Sealant Location:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.

2. Silicone Joint Sealant: Mildew resistant, single component, nonsag, neutral curing.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces JS-#6.

1. Joint Location:

a. Acoustical joints where indicated.

2. Joint Sealant: Acoustical.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

G. Joint-Sealant Application: joints at primary air seal if air/weather barrier cannot be achieved with Dow Corning 795, vertical and horizontal surfaces, JS-#7

1. Joint Locations:

a. Perimeter joints of exterior openings where indicated.
b. Perimeter joints between interior wall surfaces and frames of exterior doors and windows.

2. Silicone Joint Sealant: Dow Corning 758 (or equal).
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION - 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes hollow-metal work.

B. Related Requirements:
   1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
   2. Section 099123 “Interior Painting” for primer and paint system information for interior hollow metal doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. DKS Steel Door & Frame Systems, Inc.
4. Gensteel Doors, Inc.
5. Security Metal Products; a brand of ASSA ABLOY.
6. Steelcraft; an Allegion brand

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:

    a. Type: As indicated in the Door and Frame Schedule.
    b. Thickness: 1-3/4 inches .
    c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch .
    d. Edge Construction: Model 1, Full Flush.
    e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:

    a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch .
    b. Construction: Face welded.

4. Exposed Finish: Primer, compatible with specified paints in Section 099123 “Interior Painting.”

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch , and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.5 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

G. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

H. Grout: ASTM C 476, except with a maximum slump of 4 inches , as measured according to ASTM C 143/C 143M.

I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

J. Glazing: Comply with requirements in Section 088000 "Glazing."

K. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Fire Door Cores: As required to provide fire-protection ratings indicated.
2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
4. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
5. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
4. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Four anchors per jamb from 60 to 90 inches high.

2) Five anchors per jamb from 90 to 96 inches high.
3) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

5. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide fixed frame moldings on secure side of interior doors and frames.
2. Provide loose stops and moldings on inside of hollow-metal work.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.8 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.
3. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.
    b. Install door silencers in frames before grouting.
    c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    d. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    e. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.

4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch , measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch , measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch , measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch , measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

    a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch .
    b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch .
    c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch .
    d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch .

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION – 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Doors with glazing
3. Factory finishing flush wood doors.
4. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.

2. Section 084113 “Aluminum-Framed Entrances and Storefronts” for frames that flush wood doors are mounted within.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Stops for light openings, 6 inches long, for each material, type, and finish required.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Algoma Hardwoods, Inc.
2. Construction Specialties, Inc
3. Eggers Industries.
4. General Veneer Manufacturing Co.
5. Oregon Door
6. Vancouver Door Company.
7. VT Industries Inc.

B. Source Limitations: Obtain flush wood doors indicated to be blueprint matched with paneling from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.

C. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 700 lbf .
b. Screw Withdrawal, Edge: 400 lbf .

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors

1. Grade: Custom (Grade A faces).
2. Species: Select white maple
3. Cut: Quarter sliced.
4. Match between Veneer Leaves: Slip match.
5. Assembly of Veneer Leaves on Door Faces: Running match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical and Top Edges: Same species as faces - edge Type A.
8. Core: Either glued wood stave or structural composite lumber.
9. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Grade: Custom.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
3. Finish: WDMA TR-6 catalyzed polyurethane.
4. Staining: As selected by Architect from manufacturer's full range.
5. Effect: Semi-filled finish, produced by applying an additional finish coat to partially fill the wood pores.
6. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Access doors and frames for walls and ceilings.

B. Related Requirements:

1. Section 077200 "Roof Accessories" for roof hatches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, materials, individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges

1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Wall and ceiling.
3. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage.

    a. Finish: Factory prime.

4. Stainless-Steel Sheet for Door: Nominal 0.062 inch (1.59 mm), 16 gage.

    a. Finish: No. 4.

5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Manufacturer's standard.

7. Hardware: Lock.

D. Hardware:

1. Latch: Cam latch, verify lock operation method / tool with owner.
2. Lock: Cylinder.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.

D. Frame Anchors: Same type as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

2. At all location unless otherwise noted.

E. Stainless-Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. At tiled walls and kitchen walls
3. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
c. Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION - 08 31 13

SECTION – 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Storefront framing, at all interior relite / borrowed light conditions (unless noted otherwise)
2. Exterior storefront framing, where shown.
3. Exterior and interior manual-swing entrance doors.
4. Flashings indicated to be provided and installed by this section.
5. Breakshapes and sill flashings/pans at storefronts

B. Related Sections:

1. Section 088000 "Glazing" for glazing sealants and glass types
2. Section 084413 “Glazed Aluminum Curtain Walls” for curtain wall assemblies by same manufacturer of this section
3. Section 084523 “Insulated Translucent Fiberglass Panel Skylight and Wall System” for fiberglass panel clerestory windows and skylight.
4. Section 087100 “Door Hardware” for door hardware.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

1.5 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

B. Test Reports indicating compliance with air leakage and water penetration resistance as specified.

C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.
f. Water infiltration.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

C. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch , whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch , whichever is smaller.

    a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

D. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.

E. Air Infiltration, for exterior storefronts and entrances: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

    a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. .

2. Entrance Doors:

    a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. .
    b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. .

F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft.

G. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

H. Energy Performance: Refer to drawings for requirements. Certify and label energy performance according to NFRC.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 MANUFACTURERS

A. Basis-of-Design Product, Exterior Storefront and Entrances: Subject to compliance with requirements, provide Kawneer 451UT, thermally broken, or comparable product by one of the following:

1. CMI Architectural.
2. Commercial Architectural Products, Inc.
3. EFCO Corporation.
4. U.S. Aluminum; a brand of C.R. Laurence.
5. Vistawall Architectural Products.

B. Basis-of-Design Product, Exterior Storefront and Entrances: Subject to compliance with requirements, provide Kawneer 601UT at locations over 12' tall as noted on drawings, thermally broken, or comparable product by one of the following:

1. CMI Architectural.
2. Commercial Architectural Products, Inc.
3. EFCO Corporation.
4. U.S. Aluminum; a brand of C.R. Laurence.
5. Vistawall Architectural Products.

C. Basis-of-Design Product, Interior Storefront and Entrances: Subject to compliance with requirements, provide Kawneer Tri-Fab 400, non-thermally broken or comparable product by one of the following:

1. CMI Architectural.
2. Commercial Architectural Products, Inc.
3. EFCO Corporation.
4. U.S. Aluminum; a brand of C.R. Laurence.
5. Vistawall Architectural Products

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken and nonthermal based on specified products.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front and exterior, centered at interior
4. Finish: High-performance organic finish.
5. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

a. Sheet and Plate: ASTM B 209 .
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 .
c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
d. Structural Profiles: ASTM B 308/B 308M.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's glazed entrance doors for manual-swing operation.
1. Basis-of-Design Product, Exterior Doors: Subject to compliance with requirements, provide Kawneer 500T doors, or comparable product by one of the following:
a. CMI Architectural.
b. Commercial Architectural Products, Inc.
c. EFCO Corporation.
d. U.S. Aluminum; a brand of C.R. Laurence.
e. Vistawall Architectural Products.

2. Door Design:
a. Medium stile; 3-1/2-inch nominal width
b. Color: Match adjacent storefront or curtainwall color.
c. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
d. Thermally broken at exterior.

B. Entrance Doors: Manufacturer's glazed entrance doors for manual-swing operation.
1. Basis-of-Design Product, Interior Doors: Subject to compliance with requirements, provide Kawneer 500 doors, or comparable product by one of the following:
a. CMI Architectural.
b. Commercial Architectural Products, Inc.
c. EFCO Corporation.
d. U.S. Aluminum; a brand of C.R. Laurence.
e. Vistawall Architectural Products.

2. Door Design:
a. Medium stile; 3-1/2-inch nominal width
b. Color: Match adjacent storefront or curtainwall color.
c. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. Pivot Hinges: BHMA A156.4, Grade 1.

1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

2.6 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

D. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L.

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Exposed Flashing, Breakshapes, and Sill Flashing and Breakshapes: .063” thick aluminum sheet finished to match adjacent storefront and entrance doors. Size and design requirements per drawings.

E. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

F. Back dam angles finished to match storefront finish.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Storefront Framing: Fabricate components for assembly using screw-spline system.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

A. High-Performance Organic Finish: Four-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation. Where back dams will remain exposed, provide countersunk fasteners.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing: Test at least on area of 200 sf for water infiltration according to ASTM E1105 at a pressure of 2/3 of the specified lab pressure, but not less that 6.25 PSF using the static pressure method with results showing no evidence of water infiltration.

END OF SECTION – 08 41 13

SECTION – 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes
   1. Glazed aluminum curtain walls.
   2. Flashings indicated to be provided and installed by this section
   3. Breakshapes and sill flashings/pans at curtain walls.

B. Related Requirements:

   1. Section 088000 "Glazing" for glazing sealants and glass types
   2. Section 084113 “Aluminum Framed Storefront and Entrances” for storefront and entrances by same manufacturer of this section.
   3. Section 084523 “Insulated Translucent Fiberglass Panel Skylight” for fiberglass panel skylight.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:

      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.

d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

F. Delegated-Design Submittal: For glazed aluminum curtain walls indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and field-testing agency.

B. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

C. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.

D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.

E. Source quality-control reports.

F. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

C. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of curtain wall assemblies.

1.8 MOCKUPS

A. Mockups: Build mockup to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Testing shall be performed on mockup according to requirements in "Field Quality Control" Article. Testing of mockup shall occur prior to commencing the balance of the work.
3. Approval of mockup does not constitute approval of deviations from the Contract Documents contained in mockup unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockup may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 WARRANTY

A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazed aluminum curtain walls.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.
f. Water penetration.
g. Condensation over more than 5% of surface for more than 24 hours under interior and exterior design conditions.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

E. Structural: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.

3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:

a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.

G. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft.

H. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.

I. Energy Performance: Refer to drawings for requirements. Certify and label energy performance according to NFRC.

J. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

K. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.
2. Designed to produce tensile or shear stress of less than 20 psi.

L. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

M. ANSI/NFRC 500 Condensation Index rating greater than 60.

2.2 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer 1600 UT or comparable product by one of the following:

1. EFCO Corporation.

2. Oldcastle, Inc.
3. U.S. Aluminum; a brand of C.R. Laurence

B. Curtain Wall System:
1. 2 ½" x 6" frames at all locations except as noted below
2. 2 ½" x 7 ½" frames at locations south of the lap pool at the south end of the natatorium

C. Source Limitations: Obtain all components of curtain wall system, including framing venting windows, entrances, sun control supports and panels, and accessories, from single manufacturer.

2.3 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System Without Structural Glazing: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.
4. Finish: High-performance organic finish.
5. Fabrication Method: Either factory- or field-fabricated system.

B. Pressure Caps: Manufacturer's standard fiber glass components that mechanically retain glazing.

1. Include snap-on aluminum trim that conceals fasteners.
   a. 1 1/2" caps unless otherwise shown.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:

1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

   a. Sheet and Plate: ASTM B 209 .
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 .
   c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
   d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

   a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.4 ENTRANCES

A. Entrances: Comply with Section 084113 "Aluminum-Framed Entrances and Storefronts."

2.5 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Sealants: As recommended by manufacturer.

C. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less.

D. Weatherseal Sealants: ASTM C 920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.

1. Color: To be determined.

2.6 ACCESSORIES

A. Fasteners: Manufacturer's type 304 stainless steel, nonstaining, nonbleeding fasteners compatible with adjacent materials.

B. Accessories: Manufacturer's type 304 stainless steel corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

D. Concealed Flashing: Manufacturer's type 304 stainless steel corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

E. Exposed Flashing, Breakshapes, and Sill Flashing and Breakshapes: .063” thick aluminum sheet finished to match adjacent curtain wall.

F. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
7. Components curved to indicated radii.

D. Fabricate components to resist water penetration as follows:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.

F. Factory-Assembled Frame Units:

1. Rigidly secure nonmovement joints.
2. Prepare surfaces that are in contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion.
3. Preparation includes, but is not limited to, cleaning and priming surfaces.
4. Seal joints watertight unless otherwise indicated.
5. Install glazing to comply with requirements in Section 088000 "Glazing."

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. High-Performance Organic Finish: Four-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.9 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.3 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
7. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 "Glazing."

1. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

G. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

3.4 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet ; 1/4 inch in 40 feet .
2. Level: 1/8 inch in 20 feet ; 1/4 inch in 40 feet .
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on mockups.

1. Water Penetration: ASTM E 1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 10 lbf/sq. ft., and shall not evidence water penetration. 4 tests total not less than one floor tall by 2-glazing lites wide.

C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 084413

SECTION 08 45 23 – FIBERGLASS SANDWICH PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the insulated translucent sandwich panel skylight and accessories as shown and specified. Work includes providing and installing:

1. 2 ¾" flat factory prefabricated structural insulated translucent sandwich skylight and wall panels
2. Aluminum installation system
3. Aluminum flashing attached to skylights
4. Aluminum sill flashing for walls

B. Related Sections:

1. Rough Carpentry: Section 061000
2. Polyvinyl-Chloride (PVC) Roofing: Section 075419
3. Flashing and Sheet Metal: Section 076200
4. Sealants: Section 079200
5. Glazing: Section 088000

1.2 SUBMITTALS

A. Submit manufacturer's product data. Include construction details, material descriptions, profiles and finishes of skylight components.

B. Submit shop drawings. Include elevations and details.

C. Submit manufacturer's color charts showing the full range of colors available for factory-finished aluminum.

1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below. If finishes involve normal color variations, include sample sets consisting of two or more units showing the full range of variations expected.

a. Sandwich panels: 14" x 28" units
b. Factory finished aluminum: 5" long sections

D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

E. Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Reports required are:

a. International Building Code Evaluation Report

b. Flame Spread and Smoke Developed (UL 723) – Submit UL Card
c. Burn Extent (ASTM D 635)
d. Color Difference (ASTM D 2244)
e. Impact Strength (UL 972)
f. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037)
g. Bond Shear Strength (ASTM D 1002)
h. Beam Bending Strength (ASTM E 72)
i. Fall Through Resistance (ASTM E 661)
j. Insulation U-Factor (NFRC 100)
k. NFRC System U-Factor Certification (NFRC 700)
l. Solar Heat Gain Coefficient (NFRC or Calculations)
m. Condensation Resistance Factor (AAMA 1503)
n. Air Leakage (ASTM E 283)
o. Structural Performance (ASTM E 330)
p. Water Penetration (ASTM E 331)
q. Class A Roof Covering Burning Brand (ASTM E 108)
r. Daylight Autonomy

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope and location. At least three of the projects shall have been in successful use for ten years or longer.
2. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by an accredited agency.
3. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with AC177 “Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems” as issued by the ICC-ES.

B. Installer’s Qualifications: Installation shall be by an experienced installer, which has been in the business of installing specified skylight and wall systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

1.4 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete skylight panel system.

1. When requested, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Standard skylight shall have less than 0.01 cfm/ft² air leakage by ASTM E 283 at 6.24 PSF (50 mph) and no water penetration by ASTM E 331 at 15 PSF; and structural testing by ASTM E 330.
3. Structural Loads; Provide skylight and wall system capable of handling the loads as described in the Structural General Notes.

1.5 DELIVERY STORAGE AND HANDLING

A. Deliver panel system, components and materials in manufacturer's standard protective packaging.

B. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer's storage and handling instructions.

1.6 WARRANTY

A. Submit manufacturer's and installer's written warranty agreeing to repair or replace panel system work, which fails in materials or workmanship within 1 year of the date of delivery. Failure of materials or workmanship shall include leakage, excessive deflection, deterioration of finish on metal in excess of normal weathering, defects in accessories, insulated translucent sandwich panels and other components of the work.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The basis for this specification is for products manufactured by Kalwall Corporation. Other manufacturers that bid this project must prove compliance with all of the performance requirements of this specification and submit evidence thereof.

B. Kalwall Corporation, Tel: (800) 258-9777 – Fax: (603) 627-7905 – Email: info@kalwall.com

1. Local Contact: DeaMor Associates Inc. – Anthony Jensen,
   a. Tel: (206)-556-5524 – Email: anthony@deamor.com

2.2 PANEL COMPONENTS

A. Face Sheets

1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.

   a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
   b. Face sheets shall not deform, deflect or drip when subjected to fire or flame.

2. Interior face sheets:

   a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than 50 and smoke developed no greater than 250 when tested in accordance with UL 723.
   b. Burn extent by ASTM D 635 shall be no greater than 1”.

3. Exterior face sheets:

a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after 5 years outdoor South Florida weathering at 5° facing south, determined by the average of at least three white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4" diameter, 5 lb. free-falling ball per UL 972.

4. Appearance:
   a. Skylight
      1) Exterior face sheets: Smooth, .070" thick and white in color.
      2) Interior face sheets: Smooth, .045" thick and white in color.
      3) Face sheets shall not vary more than ± 10% in thickness and be uniform in color.

B. Grid Core

1. Thermally broken composite I-beam grid core shall be of 6063-T6 or 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16".
2. I-beam Thermal break: Minimum 1", thermoset fiberglass composite.

C. Laminate Adhesive

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives".
2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.
3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:

   a. 50% Relative Humidity at 68° F: 540 PSI
   b. 182° F: 100 PSI
   c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
   d. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

2.3 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

B. Skylight Panel Description

1. Thickness: 2-3/4"
2. Light transmission: 4%
3. Solar heat gain coefficient 0.11
4. Panel U-factor by NFRC certified laboratory: 2-3/4" thermally broken grid - 0.10

5. Complete insulated panel system shall have NFRC certified U-factor of 0.18
6. NFRC CPD #KWC-M-1-00076-00003
   Grid pattern: Nominal size 12 x 24 inch Shoji.

C. Standard panels shall deflect no more than 1.9” at 30 PSF in 10’ 0” span without a supporting frame by ASTM E 72.

D. Standard panels shall withstand 1200° F fire for minimum one hour without collapse or exterior flaming.

E. Thermally broken panels: Minimum Condensation Resistance Factor of 80 by AAMA 1503 measured on the bond line.

F. Skylight System:

1. Skylight system shall pass Class A Roof Burning Brand Test By ASTM E 108.

G. Skylight System shall meet the fall through requirements of OSHA 1910.23 as demonstrated by testing in accordance with ASTM E661, thereby not requiring supplemental screens or railings.

2.4 BATTENS AND PERIMETER CLOSURE SYSTEM

A. Closure system:

1. Extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.
2. Curved closure system may be roll formed.
3. Skylight perimeter closures at curbs shall be factory sealed to panels.

B. Sealing tape: Manufacturer's standard, pre-applied to closure system at the factory under controlled conditions.

C. Fasteners: 300 series stainless steel screws for aluminum closures, excluding final fasteners to the building.

D. Finish:

1. Manufacturer's factory applied finish, which meets the performance requirements of AAMA 2604. Color to be selected from manufacturer's 13 standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer shall examine substrates, supporting structure and installation conditions.

B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete, masonry or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

3.3 INSTALLATION

A. Install the skylight and panel system in accordance with the manufacturer's suggested installation recommendations and approved shop drawings.

1. Anchor component parts securely in place by permanent mechanical attachment system.
2. Accommodate thermal and mechanical movements.
3. Set perimeter framing in a full bed of sealant compound, or with joint fillers or gaskets to provide weather-tight construction.

B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturer's installation instructions.

3.4 FIELD QUALITY CONTROL

A. Water Test: Installer to test skylights according to procedures in AAMA 501.2.

B. Repair or replace work that does not pass testing or that is damaged by testing and retest work.

3.5 CLEANING

A. Clean the skylight and wall panel system interior and exterior, immediately after installation.

B. Refer to manufacturer's written recommendations.

END OF SECTION 08 45 23

SECTION 08 56 13 - FIBERGLASS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fixed and operable windows and doors of the following type:
   1. Fiberglass doors and frames

B. RELATED SECTIONS

   1. Division 5, Section “Cold Formed Metal Framing”
   2. Division 8, Section “Finish Hardware”

1.3 DEFINITIONS

A. Performance class designations according to AAMA/WDMA 101/I.S.2/NAFS:

   1. C: Commercial.

B. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:

   1. Design pressure number in pounds force per square foot (pascals) used to determine the structural test pressure and water test pressure.

C. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide fiberglass doors and frames capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size indicated below:

   1. Size indicated on Drawings.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of fiberglass window indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:

1. Joinery details.

C. Samples for Verification:

1. For fiberglass doors and components required, prepared on samples of size indicated below.
   a. Color Samples: For four colors, minimum 1x4 inch (25x100 mm) paint color chips on fiberglass substrate.

D. Maintenance Data

E. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to fiberglass window and door manufacturer for installation of units required for this Project.

1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of data for fiberglass windows, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A manufacturer capable of fabricating fiberglass windows and doors that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

C. Source Limitations: Obtain fiberglass windows and doors through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of fiberglass windows and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify fiberglass door openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fiberglass doors or frames that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
c. Faulty operation of movable sash and hardware.
d. Deterioration of fiberglass, metals, vinyl, other materials, and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Door and Frame Warranty Period:

a. Ten years from date of substantial completion.
b. Guarantee doors against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings by one of the following or approved equal:

1. Fiberglass Doors and Frames:
a. Tiger Doors LLC.

2.2 DOORS

A. Door and Frame Type: As indicated on Drawings.

1. Tiger Door Heavy Duty Fiberglass Door and Frame

B. Performance Requirements to meet or exceed the following ASTM standards:

1. Stiles, rails and frames

i. Impact, notched (D256) 25 ft-lb/in
ii. Fire Resistance (E-84) Class I

2. Core
i. Density (C271) 2.42 lb/ft3
3. Adhesives
i. Tensile Strength (D882-83A modified) minimum 2000 psi
ii. 8-day 25º C at 100% humidity Cross Peel (SAE J1553) minimum 330 psi
4. ANSI A250.4 1,000,000 cycle test
i. 4' x 8' door (up to a full light) and frame successfully tested in excess of 1,000,000 cycles with no failure of any of the design features of the door or frame.

C. Frame:
   2. High modulus pultruded structural fiberglass reinforced polyester shape.
   3. KD jambs and header shall be joined at corners with miter connections.
   4. Hardware reinforcements: Chemically welded to door frame material at required locations.
   5. Minimum screw pullout strength:

      a. 1100 lb #12 x 1” sheet metal screw.

   6. Finish: Factory applied two-part aliphatic polyurethane topcoat to match color and sheen of doors.

      a. Finish: Two colors, as selected from manufacturer full line.

   7. Bolt in Anchors:

      a. Recommended manufacturer.

   8. Overall Frame Depth: 5-3/4 inches minimum. Refer to details for conditions requiring deeper frames.

   9. Overall Frame Height: 2 inches typical, 4 inches at header if required to meet masonry openings.

D. Door Panel:

   1. Construction:

      a. Core: Phenolic resin impregnated.
      b. Stiles and Rails: high modulus fiberglass reinforced square tube subframe, mitered and joined internally at corners with solid polymer blocks. Provide midrail across width of door at lock height. Molded fiberglass reinforced edge strips, chemically bonded to subframe stiles.

   2. Select fiberglass, water-repellent, preservative treated in accordance with WDMA 1.s.04.
   3. Finish: Factory finished Chemical resistant thermosetting polyester resin system with fiber reinforcing layers.

      a. Finish: Two colors, as selected by architect from manufacturer full line.

   4. Thickness: 1-3/4 inches (45mm)

E. Weather Strip:

   1. Panel mounted, dual-durometer extruded polymer, one-piece design.

2.2 HARDWARE

A. Refer to Section 08 71 00 “Finish Hardware.”

2.3 FABRICATION

A. Fabricate fiberglass doors in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Weather Stripping: Provide full-perimeter weather stripping for doors and windows at each operable sash and ventilator, unless otherwise indicated.

C. Factory machine doors for openings and for hardware that is not surface applied. Coordinate with adjacent wall materials for anchoring door frames.

D. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.

1. Fiberglass Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors and windows, hardware, accessories, and other components.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

D. Grout frames solid.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust doors, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

B. Clean exposed surfaces immediately after installing. Avoid damaging protective coatings and finishes. Remove excess sealants, dirt, and other substances.

C. Protect door surfaces from contact with contaminating substances resulting from construction operations.

END OF SECTION - 08 56 13

SECTION 08 71 00 – DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, and hollow metal doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Thresholds.

E. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood door frames.

B. Section 07 92 00 - Joint Sealants: Sealants for setting exterior door thresholds.

C. Section 08 11 13 - Hollow Metal Doors and Frames.

D. Section 08 11 16 - Aluminum Doors and Frames.

E. Section 08 12 13 - Hollow Metal Frames.

F. Section 08 14 16 - Flush Wood Doors.

G. Section 28 10 00 - Access Control: Electronic access control devices.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

C. BHMA A156.1 - Standard for Butts and Hinges; 2021.

D. BHMA A156.2 - Bored and Preassembled Locks and Latches; 2022.

E. BHMA A156.3 - Exit Devices; 2020.

F. BHMA A156.4 - Door Controls - Closers; 2019.

G. BHMA A156.5 - Cylinders and Input Devices for Locks; 2020.

H. BHMA A156.6 - Standard for Architectural Door Trim; 2021.

I. BHMA A156.7 - Template Hinge Dimensions; 2016.

J. BHMA A156.16 - Auxiliary Hardware; 2018.

K. BHMA A156.18 - Materials and Finishes; 2020.

L. BHMA A156.21 - Thresholds; 2019.

M. BHMA A156.22 - Standard for Gasketing; 2021.

N. BHMA A156.25 - Electrified Locking Devices; 2023.

O. BHMA A156.26 - Standard for Continuous Hinges; 2021.

P. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems; 2018.

Q. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2016.

R. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

S. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.

T. DHI (KSN) - Keying Systems and Nomenclature; 2019.

U. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

V. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also, in WDHS-1/WDHS-5 Series, 1996.

W. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

X. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

Y. ISO 9001 - Quality Management Systems — Requirements; 2015.

Z. ITS (DIR) - Directory of Listed Products; Current Edition.

AA. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

BB. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

CC. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

DD. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

EE. UL (DIR) - Online Certifications Directory; Current Edition.

FF. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

GG. UL 294 - Access Control System Units; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following:
   1. Architect.
   2. Hardware Installer.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting:
   1. Attendance Required:
      a. Contractor.
      b. Owner.
      c. Installer's Architectural Hardware Consultant (AHC).
      d. Manufacturer Representative / Key System Specialist.
   2. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.
      d. Establish keying submittal schedule and update requirements.
   3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
      a. Access control requirements.
      b. Flow of traffic and extent of security required.

4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
5. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.
      a. Submit in vertical format.
   3. Include complete description for each door listed.

D. Shop Drawings - Electrified Door Hardware: Include diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Elevations: Include front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Supplier's qualification statement.

I. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

J. Keying Schedule:
   1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

K. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

L. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

M. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least five years of documented experience.

D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
   1. Closers: Thirty years, minimum.
   2. Exit Devices: Three years, minimum.
   3. Locksets and Cylinders: Five years, minimum.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Locks: Provide a lock for each door, unless it is indicated that lock is not required.
   1. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's Series. As indicated in hardware sets.
   2. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.
   3. Strikes:
      a. Finish: To match lock or latch.
      b. Curved-Lip Strikes: Provide as standard, with extended lip to protect frame, unless otherwise indicated.
      c. Center Strike At Pairs of Doors: 7/8 inch lip, where indicated in hardware sets.

D. Door Pulls and Push Plates:
   1. Provide door pulls and push plates on doors without a lockset, latch set, exit device, or auxiliary lock unless otherwise indicated.
   2. On solid doors, provide matching door pull and push plate on opposite faces.

E. Closers:
   1. Provide door closer on each exterior door, unless otherwise indicated.
   2. Provide door closer on each fire-rated and smoke-rated door.
   3. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.

F. Drip Guards: Provide at head of out swinging exterior doors unless protected by roof or canopy directly overhead.

G. Thresholds:
   1. Exterior Applications: Provide at each exterior door, unless otherwise indicated.

H. Weatherstripping and Gasketing:
   1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
   2. Provide door bottom sweep on each exterior door, unless otherwise indicated.

I. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

J. See Section 28 10 00 for additional access control system requirements.

K. Fasteners:
1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
   a. Aluminum fasteners are not permitted.
   b. Provide Phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
   a. Self-drilling (Tek) type screws are not permitted.
3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
4. Provide wall grip inserts for hollow wall construction.
5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
   a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
   b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 PERFORMANCE REQUIREMENTS

A. Provide door hardware products that comply with the following requirements:
1. Applicable provisions of federal, state, and local codes.
2. Accessibility: ADA Standards and ICC A117.1.
3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR) or ITS (DIR) as suitable for application indicated.
5. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
6. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
7. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

2.03 HINGES

A. Manufacturers: Conventional butt hinges.
1. BEST (BASIS OF DESIGN)
2. MCKINNEY
3. LAWRENCE

B. Properties:
1. Butt Hinges: As applicable to each item specified.
   a. Standard Weight Hinges: Minimum of two (2) permanently lubricated non-detachable bearings.
   b. Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
   c. Template screw hole locations.
   d. Bearing assembly installed after plating.
   e. Bearings: Exposed fully hardened bearings.
   f. Bearing Shells: Shapes consistent with barrels.
   g. Pins: Easily seated, non-rising pins.
      1) Fully plated hinge pins.
      2) Non-Removable Pins: Slotted stainless steel screws.
   h. UL 10C listed for fire-resistance-rated doors.
2. Continuous Hinges: As applicable to each item specified.

a. Geared Continuous Hinges: As applicable to each item specified.
1) Anti-spinning through-fastener.
2) UL 10C listed for fire-resistance-rated doors.
(a) Metal Door Installation: Rated up to 90 minutes.
(b) Wood Door Installation: Rated up to 60 minutes.
3) Sufficient size to permit door to swing 180 degrees

C. Sizes: See Door Hardware Schedule.
1. Hinge Widths: As required to clear surrounding trim.
2. Sufficient size to allow 180 degree swing of door.

D. Finishes: See Door Hardware Schedule.
1. Fully polished hinges; front, back, and barrel.

E. Grades:
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
2. Continuous Hinges: Comply with BHMA A156.26, Grade 1.

F. Material: Base metal as indicated for each item by BHMA material and finish designation.

G. Types:
1. Butt Hinges: Include full mortise hinges.
2. Continuous Hinges: Include geared hinges.

H. Quantities:
1. Butt Hinges: Three (3) hinges per leaves up to 90 inches in height. Add one (1) for each additional 30 inches in height or fraction thereof.
a. Hinge weight and size unless otherwise indicated in hardware sets:
1) For doors up to 36 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.134 inch and a minimum of 4-1/2 inches in height.
2) For doors from 36 inches wide up to 42 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.145 inch and a minimum of 4-1/2 inches in height.
3) For doors from 42 inches wide up to 48 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.180 inch and a minimum of 5 inches in height.
4) For doors greater than 1-3/4 inches thick provide hinges with a minimum thickness of 0.180 inch and a minimum of 5 inches in height.
2. Continuous Hinges: One per door leaf.

I. Applications: At swinging doors.
1. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

J. Products:
1. Butt Hinges:
a. Ball Bearing, Five (5) Knuckle. FBB Series
2. Continuous Hinges:
a. Aluminum geared hinges. 660 Series

2.04 BOLTS

A. Manufacturers:
1. ABH (BASIS OF DESIGN)
2. ROCKWOOD

B. Properties:
1. Flush Bolts:
a. Automatic Flush Bolts: Automatically latching upon closing of door leaf.

1) Bolt Throw: 3/4 inch, minimum.

b. Self-Latching Flush Bolts: Automatically latching upon closing of door; manually retracted; located on inactive leaf of pair.

1) Bolt Throw: 3/4 inch, minimum.

2. Dustproof Strikes: For bolting into floor, provide except at metal thresholds.

2.05 EXIT DEVICES

A. Manufacturers:
1. BEST / PRECISION

B. Properties:
1. Actuation: Push Pad
2. Chassis:
a. Construction: Investment cast steel, zinc dichromate plated.
b. Compatibility: Standard Stile and Narrow Stile doors.
3. Touchpads: 'T" style metal touchpads and rail assemblies with matching chassis covers end caps.
4. Latch Bolts: Stainless steel deadlocking with 3/4 inch projection using latch bolt.
5. Lever Design: Match project standard lockset trims.
6. Cylinder: Include where cylinder dogging or locking trim is indicated.
7. Strike as recommended by manufacturer for application indicated.
8. Sound dampening on touch bar.
9. Dogging:
a. Non-Fire-Resistance-Rated Devices: Cylinder dogging (except on MLR devices).
b. Fire-Resistance-Rated Devices: Manual dogging not permitted.
10. Touch bar assembly on wide style exit devices to have a 1/4 inch clearance to allow for vision frames.
11. All exposed exit device components to be of architectural metals and “true” architectural finishes.
12. Handing: Field-reversible.
13. Fasteners on Back Side of Device Channel: Concealed - exposed fasteners not allowed.
14. Vertical Latch Assemblies' Operation: Gravity, without use of springs.

C. Grades: Complying with BHMA A156.3, Grade 1.
1. Provide exit devices tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.

D. Standards Compliance:
1. UL Listed for Panic and Fire for Class II Circuitry.
2. Provide UL (DIR) listed exit device assemblies for fire-resistance-rated doors.
3. Comply with UL 10C.

E. Options:
1. Electrified Devices:
2. MLR: Motorized latch retraction.
3. Electrified Device Voltage: 24 VDC.

F. Products:
1. 2000.

2.06 MORTISE LOCKS

A. Manufacturers:
1. BEST (No Substitution)

B. Properties:

1. Mechanical Locks:
    a. Shall be tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, and be UL 10C.
    b. Door Thickness Fit: 1-3/8 inches to 2-1/4 inches thick doors.
    c. Cylinders:
        1) Cylinder Core Types: Locks capable of supporting manufacturers' cores, as applicable.
            (a) Small format interchangeable.
    d. Lever Trim:
        1) Style: See Door Hardware Schedule.
        2) Strength: Locksets outside locked lever designed to withstand minimum1,400 inch-lbs. of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.

C. Finishes: See Door Hardware Schedule.
    1. Core Faces: Match finish of lockset.

2.07 CLOSERS

A. Manufacturers:
    1. BEST
    2. dormakaba
    3. SARGENT

B. Properties:
    1. Surface Mounted Closers: Manufacturer's standard.
        a. Construction: R14 high silicon aluminum alloy.
        b. Maximum Projection from Face of Door: 2-7/16 inches.
        c. Mechanism: Separate tamper-resistant adjusting valves for closing and latching speeds.
            1) Include advanced backcheck feature.
            2) Include delayed action feature.
        d. Pinion: Stainless steel.
        e. Hydraulic Fluid: All-weather type.
        f. Arm Assembly: Standard for product specified.
            1) Material: Steel.
            2) Include hold-open, integral stop, or spring-loaded stop feature, as specified in Door Hardware Schedule.
            3) Parallel arm to be a heavy-duty rigid arm.
            4) Where “IS” or “S-IS” arms are specified in hardware sets, if manufacturer does not offer this arm provide a regular arm mount closer in conjunction with a heavy-duty overhead stop equal to a dormakaba 900 Series.
        g. Covers:
            1) Type: Standard for product selected.
                (a) Full.
            2) Material: Plastic.
            3) Finish: Painted.

C. Grades:
    1. Closers: Comply with BHMA A156.4, Grade 1.
        a. Underwriters Laboratories Compliance:
            1) Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.
                (a) UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.

b. Testing Standards Compliance: Meeting requirements of UL 10C for positive pressure.

D. Types:
1. Rack-and-pinion, surface-mounted. 1-1/2 inches minimum bore.

E. Options:
1. Delayed action, adjustable with an independent valve.
2. Advanced backcheck.

F. Installation:
1. Mounting: Includes surface mounted installations.
2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
3. At out swinging exterior doors, mount closer on interior side of door.
4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

G. Products:
1. Surface Mounted:
a. EHD 9000.

2.08 PROTECTION PLATES

A. Manufacturers:
1. DON-JO
2. TRIMCO
3. BURNS

B. Properties:
1. Plates:
a. Kick Plates: Provide along bottom edge of push side of each door, where indicated in hardware sets.
1) Size: 10 inches high by inches less than door width (LDW) on push side of door, or 1 inch LDW on pairs of doors without mullion.
b. Mop Plates: Provide along bottom edge of pull side of doors, where indicated in hardware sets.
1) Size: 6 inches high by 1 inch less than door width (LDW) on pull side of door.
c. Edges: Beveled, on four (4) unless otherwise indicated.

C. Grades: Comply with BHMA A156.6.

D. Material: As indicated for each item by BHMA material and finish designation.
1. Metal Properties: Stainless steel.
a. Metal, Standard Duty: Thickness 0.050 inch, minimum.

E. Installation:
1. Fasteners: Countersunk screw fasteners

F. Products:
1. K0050, KM050.

2.09 STOPS AND HOLDERS

A. Manufacturers:
1. ABH
2. DON-JO
3. BURNS

B. General: Provide overhead stop/holder when wall or floor stop is not feasible.

C. Grades:
   1. Wall Bumpers: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

D. Material: Base metal as indicated for each item by BHMA material and finish designation.

E. Types:
   1. Wall Bumpers: Bumper, concave, wall stop.

F. Installation:
   1. Non-Masonry Walls: Confirm adequate wall reinforcement has been installed to allow lasting installation of wall bumpers.

G. Products:
   1. Wall Bumpers. 1270WV

2.10 THRESHOLDS

A. Manufacturers:
   1. NATIONAL GUARD PRODUCTS
   2. REESE.
   3. ZERO.

B. Properties:
   1. Threshold Surface: Fluted horizontal grooves across full width.

C. Grades: Thresholds: Comply with BHMA A156.21.

D. Material: Base metal as indicated for each item by BHMA material and finish designation.

E. Types: As applicable to project conditions. Provide barrier-free type at every location where specified.
   1. Saddle Thresholds: Without thermal break.

F. Products:
   1. 425.

2.11 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
   1. NATIONAL GUARD PRODUCTS
   2. REESE.
   3. ZERO.

B. Properties:
   1. Weatherstripping Air Leakage Performance: Not exceeding 0.3 cfm/sq ft of door opening at 0.3 inches of water pressure differential for single doors, and 0.5 cfm/sq ft of door area at 0.3 inches of water pressure differential for double doors for gasketing other than smoke control, as tested according to ASTM E283/E283M; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
   2. Adhesive-Backed Perimeter Gasketing: Silicone gasket material applied to frame with self-adhesive.
   3. Rigid, Housed, Perimeter Gasketing: Sponge neoprene gasket material held in place by aluminum housing; fastened to frame stop with screws.
   4. Door Sweeps: Nylon brush gasket material held in place by flat Aluminum housing or flange; surface mounted to face of door with screws. Provide integral rain drip where indicated.
   5. Automatic Door Bottoms: Sponge neoprene gasket material held in place by aluminum housing that automatically drops to form seal when door is closed.

a. Mounting: Mortised into bottom of door.

C. Grades: Comply with BHMA A156.22.

D. Products:
1. Weatherstripping: See Door Hardware Schedule.
2. Smoke Seals: See Door Hardware Schedule.
3. Door Bottom Seals:
a. Door Sweeps: See Door Hardware Schedule.
b. Door Bottoms: See Door Hardware Schedule.
c. Automatic Door Bottoms: See Door Hardware Schedule.

2.12 ELECTRIFIED HARDWARE

A. Manufacturers:
1. RCI; dormakaba Group: www.dormakaba.com/us-en/#sle.

B. Properties:
1. Door Position Switches: Recessed devices with magnetic contacts.
a. Power Requirement: 50mA Max, 100 VDC.
b. SPDT configuration.
2. Power Supply Units: Manufacturer's standard.
a. Enclosures: Lockable NEMA Type 1, with hinged cover and knockouts.
b. Power: 120 VDC input; 24 VDC filtered, regulated output (2 Amps, minimum.)
1) Input circuit protection fuse.
c. Emergency Release Terminals: Designed to release devices upon activation of fire alarm system.
d. Auxiliary contacts for remote signaling.
e. User-selectable time delay from 0 to 4 minutes.
f. Fire Alarm System Interface: Standard.
1) Fire alarm terminal with green LED indicating power is available.
g. Output Distribution Board with indicator LEDs.
h. On/Off LED power indicator.
3. Power Transfers: Manufacturer's standard.
a. Mortised Type with Wires & Connectors:
1) Listed by UL and ULC.
2) Stainless steel housing and spring conduit.
3) Wire Harness: Pre-installed, twelve wire, equipped with ten (10) 24 gauge wires and two 18 gauge wires.
4) Accommodate 180 degree door swing.
5) Quick-Connect Plugs: Pre-installed.
4. Wire Harnesses: Of sufficient length, with quick connectors.
a. Wire Harness End Connection to Power Supply or Junction Box: One end with bare leads.

C. Products:
1. Door Position Switches:
a. 9540 Recessed Magnetic Contact/Door Position Switch.
2. Power Supplies:
a. RPSMLR2.
b. 9540 Series.
3. Power Transfers:
a. EPT 12-C
4. Wire Harnesses:
a. BEST WH Series.

2.13 KEYS AND CORES

A. Manufacturers:
   1. BEST (No Substitution)

B. Properties: Complying with guidelines of BHMA A156.28.
   1. Standard BEST Key System
   2. Provide small format interchangeable core.
   3. Provide keying information in compliance with DHI (KSN) standards.
   4. Keying Schedule: Arrange for a keying meeting, with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements.
   5. Keying: Grand master keyed.
   6. Include construction keying and control keying with removable core cylinders.
   7. Supply keys in following quantities:
      a. Grand Master Keys: 1 each.
      b. Construction Master Keys: 6 each.
      c. Construction Keys: 15 each.
      d. Construction Control Keys: 2 each.
      e. Control Keys if New System: 2 each.
   8. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
   9. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
   10. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
   11. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

2.14 AUTOMATIC DOOR OPERATORS

A. MANUFACTURER
   1. Dormakaba

B. Substitutions: Not Permitted

C. Model: DORMA, Series ED100-LE. An Integrated, self-learning automatic swing door operator with an advanced CPU, a multistage gearbox with real time adaptive software and available user interface.
   1. Automatic Door Configuration:
      a. Configuration: Single swing door or pair of doors swinging.
      b. Traffic Pattern: As shown on drawings
      c. Mounting: Surface applied

B. Control Features
   1. Power-hold Close
   2. Built in Lock Delay
   3. On-Off-Hold Open switch control to control door function, (Automatic-Hold Open- Exit Only)
   4. On-Off Power Switch
   5. Fire Alarm Integration
   6. Field Adjustable Handing
   7. Push and Go
   8. Power Assist Opening Activation
   9. Intergraded Connections for Monitored Safety Sensors and other accessories.
   10. Integrated access control

C. Door Control Features
   1. Wind Load and Stack Pressure microprocessor monitored with power boost to ensure secure opening and closing in changing conditions.
   2. Door Weight Max. ED100-LE 220 lbs.

D. Activation Device:
   1. Push Plate: Hard wired, 4.5” Square stainless steel push plate engraved with "Push to Open" with a handicap logo. DX3339-054

2.15 FINISHES

A. Finishes: Identified in Hardware Sets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Correct all defects prior to proceeding with installation.

C. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

D. Use templates provided by hardware item manufacturer.

E. Do not install surface mounted items until application of finishes to substrate are fully completed.

F. Wash down masonry walls and complete painting or staining of doors and frames.

G. Complete finish flooring prior to installation of thresholds.

H. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list, unless noted otherwise in Door Hardware Schedule or on drawings.
   1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
   2. For Steel Door Frames: See Section 08 12 13.
   3. For Aluminum-Framed Storefront Doors and Frames: See Section 08 43 13.
   4. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
   5. Flush Wood Doors: See Section 08 14 16.
   6. Mounting heights in compliance with ADA Standards:
      a. Locksets: 40-5/16 inch.
      b. Push Plates/Pull Bars: 42 inch.
      c. Exit Devices: 40-5/16 inch.

I. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal. Anchor thresholds with stainless steel countersunk screws.

J. Include in installation for existing doors and frames any necessary field modification and field preparation of doors and frames for new hardware. Provide necessary fillers, reinforcements, and fasteners for mounting new hardware and to cover existing door and frame preparations.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation activities.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

D. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

3.07 HARDWARE SETS

Set #1.0
Doors: 103, 104, 114A, 123

3.0	Hinge	CB1901R 45X45	26D	BES
1.0	Elec. Hinge	CE CB1901R 58 45X45 (POWER TRANSFER)	26D	BES
1.0	Elec Lock (Fail Secure x RQE)	45HW 7 DEU 14H STD S5 RQE	630	BES
1.0	Door Closer	EHD90 16 AF90P	689	BES
1.0	Wall Stop	1841	US32D	ABH
1.0	Latch Protector	Kickplate 90 x 10" x 1.5" LTD B4E 630	SL	D-J
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP
1.0	Wiring Harness	WH-(VERIFY LENGTH) P (HINGE-TO-LOCK)		BES
1.0	Wiring Harness	WH-(VERIFY LENGTH) P (POWER-TO-HINGE)		BES
1.0	Door Position Switch	9540	B	RCI
1.0	Card Reader	K-SMART3		DK

Set #1.1
Doors: 108A, 111A, 117A

3.0	Hinge	CB1901R 45X45	26D	BES
1.0	Elec. Hinge	CE CB1901R 58 45X45 (POWER TRANSFER)	26D	BES
1.0	Elec Lock (Fail Secure x RQE)	45HW 7 DEU 14H STD S5 RQE	630	BES
1.0	Door Closer	EHD9016 SDS90 (STOP ARM)	689	BES
1.0	Wall Stop	1841	US32D	ABH
1.0	Kickplate	90 x 10" x 1.5" LTD B4E 630	SL	D-J
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP
1.0	Wiring Harness	WH-(VERIFY LENGTH) P (HINGE-TO-LOCK)		BES
1.0	Wiring Harness	WH-(VERIFY LENGTH) P (POWER-TO-HINGE)		BES

1.0	Door Position Switch	9540	B	RCI
1.0	Card Reader	K-SMART3		DK

Set #1.2
Doors: 114B

3.0	Hinge	CB1901R 45X45	26D	BES
1.0	Elec. Hinge	CE CB1901R 58 45X45 (POWER TRANSFER)	26D	BES
1.0	Elec Lock (Fail Secure x RQE)	45HW 7 DEU 14H STD S5 RQE	630	BES
1.0	Door Closer	EHD90 16 AF90P	689	BES
1.0	Overhead Stop	910-S SERIES	626	DK
1.0	Kickplate	90 x 10" x 1.5" LTD B4E 630	SL	D-J
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP
1.0	Wiring Harness	WH-(VERIFY LENGTH) P (HINGE-TO-LOCK)		BES
1.0	Wiring Harness	WH-(VERIFY LENGTH) P (POWER-TO-HINGE)		BES
1.0	Door Position Switch	9540	B	RCI
1.0	Card Reader	K-SMART3		DK

Set #1.3
Doors: 122A

3.0	Hinge	CB1901R 45X45	26D	BES
1.0	Elec. Hinge	CE CB1901R 58 45X45 (POWER TRANSFER)	26D	BES
1.0	Elec Lock (Fail Secure x RQE)	45HW 7 DEU 14H STD S5 RQE	630	BES
1.0	Door Closer	EHD90 16 AF90P	689	BES
1.0	Overhead Stop	910-S SERIES	626	DK
1.0	Kickplate	90 x 10" x 1.5" LTD B4E 630	SL	D-J
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP
1.0	Wiring Harness	WH-(VERIFY LENGTH) P (HINGE-TO-LOCK)		BES
1.0	Wiring Harness	WH-(VERIFY LENGTH) P (POWER-TO-HINGE)		BES
1.0	Door Position Switch	9540	B	RCI

Set #2.0
Doors: 100

2.0	Hinge	661HD EPT12C 95IN	AL	BES
2.0	Power Transfer	EPT-12C		PRE
1.0	Keyed Removeable Mullion	KR822	689	PR
1.0	Exit Device	C MLR TS 2403 CD C 2003 S300	630	PRE
1.0	Exit Device	C TS 2402 CD 2002 C S300	630	PRE
1.0	Rim Cylinder	12E 7 2 S2 RP	626	BES
1.0	Rim Cylinder	RIM CYLINDER 12E-72 (KR MULLION)	626	BES
2.0	Mortise Cylinder	1E-74 (CYLINDER DOGGING)		BES
1.0	Door Closer	EHD90 16 PT90	689	BES
2.0	Overhead Stop	910-S SERIES	626	DK
1.0	Automatic Operator	ED100LE S TW SA 220 FH SE0 AA NS	CL	DKO
2.0	4.5" Square Push Plate	DX3339-054		DKO
1.0	Power Supply	RPSMLR2		PRE
2.0	Door Position Switch	9540	B	RCI
1.0	Card Reader	K-SMART3		DK

NOTE: WEATHERSTRIP PROVIDED BY ALUM DOOR & FRAME MANUFACTURER

Set #3.0
Doors: 101A

2.0	Hinge	661HD	AL	BES
2.0	Exit Device	2400 DUMMY RAIL x PULL 673 x 2001C	630	PRE
1.0	Door Closer	EHD90 16 PT90	689	BES
1.0	Automatic Operator	ED100LE S TW SA 220 FH SE0 AA NS	CL	DKO
2.0	Overhead Stop	910-S SERIES	626	DK
2.0	4.5" Square Push Plate	DX3339-054		DKO

NOTE: WEATHERSTRIP PROVIDED BY ALUM DOOR & FRAME MANUFACTURER

Set #4.0
Doors: 101B, 101C, 107

1.0	Hinge	661HD	AL	BES
1.0	Exit Device	2403 CD C 2003 S300 48"	630	PRE
2.0	Mortise Cylinder	MORTISE CYLINDER 1E-74 (CYLINDER DOGGING)		BES
1.0	Rim Cylinder	12E 7 2 S2 RP	626	BES
1.0	Door Closer	EHD90 16 PT90	689	BES
1.0	Overhead Stop	910-S SERIES	626	DK
1.0	Threshold	425 LAR (1/4-20 MS/EA) HD	A	NGP
1.0	Door Bottom Sweep	C699	A	NGP

NOTE: WEATHERSTRIP PROVIDED BY ALUM DOOR & FRAME MANUFACTURER

Set #5.0
Doors: 113, 117B, 123

4.0	Hinge	CB1900R 45X45	26D	BES
1.0	Mortise Lock	45H 7 D 14 H STD S5	626	BES
1.0	Door Closer	EHD90 16 AF90P	689	BES
1.0	Kickplate	90 x 10" x 1.5" LTD B4E 630	SL	D-J
1.0	Wall Stop	1841	US32D	ABH
3.0	Silencer	1229A	Gray	TRI

Set #6.0
Doors: 109, 119, 120, 121

4.0	Hinge	CB1900R 45X45	26D	BES
1.0	Mortise Lock	45H 0LT 14H VIT PRIVACY x INDICATOR	630	BES
1.0	Wall Stop	1841	US32D	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #7.0
Doors: 105, 106

4.0	Hinge	CB1900R 45X45	26D	BES
1.0	Mortise Lock	45H 7 R 14 H STD S5	626	BES
1.0	Overhead Stop	910-S SERIES	626	DK
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #8.0
Doors: 111B, 112B

4.0	Hinge	CB1901R 45X45	26D	BES
1.0	Mortise Lock	45H 7 R 14 H STD S5	626	BES
1.0	Door Closer	EHD90 16 AF90P	689	BES
1.0	Kickplate	90 x 10" x 1.5" LTD B4E 630	SL	D-J
1.0	Wall Stop	1841	US32D	ABH
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

Set #9.0
Doors: 108B, 116, 118, 122B

4.0	Hinge	CB1901R 45X45	26D	BES
1.0	Push / Pull Plate	1896-4B	630	TRI
1.0	Door Closer	EHD90 16 AF90P	689	BES
1.0	Kickplate	90 x 10" x 1.5" LTD B4E 630	SL	D-J
1.0	Wall Stop	1841	US32D	ABH
3.0	Silencer	1229A	Gray	TRI

Set #10.0
Doors: 111C

4.0	Hinge	CB1900R NRP 45X45	26D	BES
1.0	Mortise Lock	45H 7 D 14 H STD S5	626	BES
1.0	Overhead Stop	910-S SERIES	626	DK
3.0	Silencer	1229A	Gray	TRI

Set #10.1
Doors: 108C

8.0	Hinge	CB1900R NRP 45X45	26D	BES
2.0	Flush Bolt	1854	US32D	ABH
1.0	Dust Proof Strike	1870	US32D	ABH
1.0	Mortise Lock	45H 7 D 14 H STD 7/8 LTC	626	BES
2.0	Overhead Stop	910-S SERIES	626	DK
1.0	Astragal	139 LAR	A	NGP
4.0	Silencer	1229A	Gray	TRI

Set #11.0
Doors: 102, 124B, 124G

2.0	Hinge	661HD	AL	BES
1.0	Keyed Removeable Mullion	KR822	689	PRE
2.0	Exit Device	2402 CD 2002 C S300	630	PRE
2.0	Mortise Cylinder	MORTISE CYLINDER 1E-74 (CYLINDER DOGGING)		BES
2.0	Door Closer	EHD90 16 PT90	689	BES
2.0	Overhead Stop	910-S SERIES	626	DK
2.0	Door Bottom Sweep	C699	A	NGP

1.0	Threshold	425 LAR (1/4-20 MS/EA) HD	A	NGP

NOTE: WEATHERSTRIP PROVIDED BY ALUM DOOR & FRAME MANUFACTURER

Set #12.0
Doors: 124A

2.0	Hinge	661HD	AL	BES
2.0	Exit Device	2400 DUMMY RAIL x PULL 673 x 2001C	630	PRE
2.0	Door Closer	EHD90 16 PT90	689	BES
2.0	Overhead Stop	910-S SERIES	626	DK

NOTE: WEATHERSTRIP PROVIDED BY ALUM DOOR & FRAME MANUFACTURER

Set #13.0
Doors: 112A

4.0	Hinge	CB1900R NRP 45X45	26D	BES
1.0	Exit Device	2402 CD 2002 C S300	630	PRE
1.0	Door Closer	EHD90 16 AF90P	689	BES
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP
1.0	Kickplate	90 x 10" x 1.5" LTD B4E 630	SL	D-J
1.0	Wall Stop	1841	US32D	ABH
1.0	Mortise Lock	45H 7 R 14 H STD S5	626	BES

Set #14.0
Doors: 128A, 128B

4.0	Hinge	CB1901R NRP 45X45	P	BES
1.0	Exit Device	2403 C 2903 S300	630	PRE
1.0	Rim Cylinder	12E 7 2 S2 RP	626	BES
1.0	Door Closer	EHD9016 SDS90 (STOP ARM)	689	BES
1.0	Door Bottom Sweep	C699	A	NGP
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP
1.0	Threshold	425 LAR (1/4-20 MS/EA) HD	A	NGP

Set #15.0
Doors: 126A, 127, 127B

4.0	Hinge	CB1961R 45X45	32D	BES
1.0	Mortise Lock	45H 7 D 14 H STD S5	626	BES
1.0	Overhead Stop	910-S SERIES	626	DK
3.0	Silencer	1229A	Gray	TRI

Set #16.0
Doors: 130, 131, 132, 200, 201, 300

4.0	Hinge	CB1961R NRP 45X45	32D	BES
1.0	Mortise Lock	45H 7 R 14 H STD S5	626	BES
1.0	Lock Guard	5001	630	TRI
1.0	Overhead Stop	910-S SERIES	626	DK
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP

1.0	Door Bottom Sweep	C699	A	NGP
1.0	Threshold	425 LAR (1/4-20 MS/EA) HD	A	NGP

Set #18.0

Doors: 125, 126C

NOTE: ALL HARDWARE PROVIDED BY DOOR MANUFACTURER

Set #19.0

Doors: 126B, 129

8.0	Hinge	CB1961R NRP 45X45	32D	BES
2.0	Flush Bolt	1854	US32D	ABH
1.0	Dust Proof Strike	1870	US32D	ABH
1.0	Exit Device	2303 4903D S300	630	PRE
1.0	Rim Cylinder	12E 7 2 S2 RP 626 BES		
2.0	Overhead Stop	910-S SERIES	626	DK
1.0	Astragal	139 LAR	A	NGP
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP
1.0	Door Bottom Sweep	C699	A	NGP
1.0	Threshold	425 LAR (1/4-20 MS/EA) HD	A	NGP

Set #20.0

Doors: 117

4.0	Hinge	CB1901R 45X45	26D	BES
1.0	Mortise Lock	45H 7 D 14 H STD S5	626	BES
1.0	Electric Strike	F2164	32D	RCI
1.0	Door Closer	EHD90 16 AF90P	689	BES
1.0	Overhead Stop	910-S SERIES	626	DK
1.0	Kickplate	90 x 10" x 1.5" LTD B4E 630	630	D-J
1.0	Gasketing	2525 Head & Jambs (2)	C	NGP
1.0	Door Position Switch	9540	B	RCI
1.0	Automatic Operator	ED100LE S TW SA 220 FH SE0 AA NS	CL	DKO
2.0	4.5" Square Push Plate	DX3339-054		DKO

ACCESS CONTROL SYSTEM SOFTWARE AND HEAD END ITEMS

1 KEYSCAN AURORA ACCESS CONTROL MANAGEMENT SOFTWARE – PART NO: AURORA
2 K-SECURE 1K 50-PACK
4 ALTRONIX TP1640 PLUGIN TRANSFORMER, 16VAC @ 40VA
2 KEYSCAN NETWORK COMMUNICATION BOARD PART NO: NETCOM2P
2 8 DOOR CONTROLLERS: CA8500
2 DKPS-6A
6 BATTERY BACKUP: BB12-7

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Storefront framing.
4. Curtain wall framing.
5. Interior borrowed lites.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: As indicated on Drawings.
2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

    a. Wind Design Data: As indicated on Drawings.
    b. Exposure Category: B.

3. Design Snow Loads: As indicated on Drawings.
4. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass the following products; 12-inches square.

1. Coated glass.
2. Laminated glass with translucent interlayer.
3. Insulating glass.

C. Translucent Resin Glazing samples, for verification – manufacturer's standard sample size,

D. Glazing Accessory Samples: For gaskets and colored spacers, in 12-inch lengths.

E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers and manufacturers of insulating-glass units with sputter-coated, low-e coatings.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, and glazing gaskets.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Source Limitations for Glass: Obtain coated float glass, laminated glass, and insulating glass from single source from single manufacturer for each glass type.

D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

F. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened, glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass. Heat soaking required at tempered glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.3 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.4 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.

2. Spacer: Manufacturer's standard spacer material and construction. Provide stainless steel or "low-energy" spacers as needed to meet specified thermal and condensation resistance requirements.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in "Glass Products" Article and in "Laminated Glass" Article as indicated by designations in "Insulating-Glass Types" Article and in "Insulating-Laminated-Glass Types" Article.

2.5 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following, and compatible with silicone glazing sealants

1. Neoprene complying with ASTM C 864,
2. Silicone complying with ASTM C 1115.
3. Thermoplastic polyolefin rubber complying with ASTM C 1115.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.8 MONOLITHIC-GLASS TYPES

A. Glass Type GL-1 at interior conditions: Clear float glass and fully tempered float glass (where indicated to be tempered.)

1. Thickness: 6.0 mm.
2. Provide safety glazing labeling.

2.9 LAMINATED-GLASS TYPES

A. Glass Type GL-2, at interior conditions: Clear laminated glass with two plies of fully tempered float glass.

1. Thickness of Each Glass Ply: 3.0 mm.
2. Interlayer Thickness: 0.060 inch. Clear except where indicated to be “white laminate,” to be selected from manufacturer’s standard range.
3. Provide safety glazing labeling.

2.10 INSULATING-GLASS TYPES

A. Glass Type GL-3 at interior conditions: Clear insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Clear float glass and fully tempered float glass (where indicated to be tempered.)
4. Interspace Content: Air.
5. Indoor Lite: Clear float glass and fully tempered float glass (where indicated to be tempered.)
6. Provide safety glazing labeling.
7. Glass spacer shall be aluminum or stainless steel
8. Primary and secondary seal to be polyisobutylene and silicone.

B. Glass Type GL-4 at exterior conditions: Low-e-coated, clear insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Float glass and Fully tempered float glass (where indicated to be tempered).
4. Interspace Content: Argon.
5. Indoor Lite: Float glass and Fully tempered float glass (where indicated to be tempered).
6. Low-E Coating: Pyrolytic on second surface.
7. Visible Light Transmittance: 70 percent minimum.
8. Winter Nighttime U-Factor: As needed to meet overall glazing system performance requirements per drawings.
9. Summer Daytime U-Factor: As needed to meet overall glazing system performance requirements per drawings.
10. Solar Heat Gain Coefficient: .34 maximum.
11. Provide safety glazing labeling.
12. Glass spacer shall be aluminum or stainless steel or "low-energy" non-metal as required for energy compliance.
13. Primary and secondary seal to be polyisobutylene and silicone.

2.11 INSULATING-LAMINATED-GLASS TYPES

A. Glass Type GL-5 at interior conditions: insulating laminated glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Outdoor Lite: 6.0 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Air
5. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.

    a. Thickness of Each Glass Ply: 3.0 mm.
    b. Interlayer Thickness: 0.060 inch. Clear except where indicated to be “white laminate,” to be selected from manufacturer’s standard range.
6. Provide safety glazing labeling.

B. Glass Type GL-6 at exterior locations: Low-e-coated, insulating laminated glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Outdoor Lite: 6.0 mm.
3. Outdoor Lite: Fully tempered float glass.
4. Interspace Content: Argon.
5. Indoor Lite: Clear laminated glass with two plies of fully tempered float glass.

    a. Thickness of Each Glass Ply: 3.0 mm.
    b. Interlayer Thickness: 0.060 inch. Clear except where indicated to be “white laminate,” to be selected from manufacturer’s standard range.

6. Low-E Coating: Pyrolytic on second surface.
7. Visible Light Transmittance: 70 percent minimum.
8. Winter Nighttime U-Factor: As needed to meet overall glazing system performance requirements per drawings.
9. Summer Daytime U-Factor: As needed to meet overall glazing system performance requirements per drawings.
10. Solar Heat Gain Coefficient: .34 maximum.
11. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

C. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 08 83 00 - MIRRORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following types of silvered flat glass mirrors:

1. Film-backed glass mirrors qualifying as safety glazing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

D. Glazing Publications: Comply with the following published recommendations:

1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

E. Safety Glazing Products: For film-backed mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Avalon Glass and Mirror Company.
b. Head West.

B. Clear Glass: Mirror Select Quality.

1. Nominal Thickness: 6.0 mm.

2.2 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Laurence, C. R. Co., Inc.
b. Liquid Nails Adhesive.
c. Macco Adhesives.
d. OSI Sealants; Henkel Corporation.
e. Palmer Products Corporation.
f. Pecora Corporation.
g. Royal Adhesives & Sealants.
h. Sommer & Maca Industries, Inc.

2. Adhesive shall have a VOC content of not more than 70 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.3 MIRROR HARDWARE

A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.05 inch (1.3 mm).
2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.062 inch (1.57 mm).
3. Finish: Clear bright anodized.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

A. Mirror Sizes: To suit project conditions, cut mirrors to final sizes and shapes.

B. Cutouts: Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Rounded polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long at bottom channel.
2. Install mastic as follows:

    a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
    c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
B. Do not permit edges of mirrors to be exposed to standing water.
C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

SECTION 09 22 16 – NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

B. Related Requirements:

1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and ceiling joists.
2. Section 074213.13 “Formed Metal Wall Panels” for wood furring installed as part of that section’s work.
3. Section 092900 “Gypsum Board” for gypsum wallboard and tile backer board.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G60 hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:

a. Minimum Base-Metal Thickness: As indicated on Drawings, unless otherwise noted.
b. Minimum Base-Metal Thickness at walls with ceramic tile: 20 ga.
c. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: As indicated on Drawings.

E. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

F. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to

terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

B. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.
3. Trim accessories, joint treatment and auxiliary materials including acoustic insulation.

B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Gypsum
2. CertainTeed Corporation
3. Georgia-Pacific Building Products.
4. USG Corporation.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch .
2. Long Edges: Tapered.
3. Mold and moisture resistant where indicated

2.4 SPECIALTY GYPSUM BOARD

A. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Continental Building Products, LLC; Interior Weather Defense Platinum Interior Type X.
b. Georgia-Pacific Building Products; DensArmour Plus.
c. National Gypsum Company; eXP Interior Extreme AR

d. Temple-Inland Building Products by Georgia-Pacific; Green Glass Interior Gypsum Board.

2. Core: 5/8 inch , Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Gypsum Tile Backing Panels. ASTM C1178.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed; Diamondback Tile Backer Type X
b. Georgia-Pacific Building Products: Denshield Tile Backer.

2. Core: 5/8 inch, Type X.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. Expansion (control) joint.

3. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 , Alloy 6063-T5.
4. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

2. All screws to be non-corrosive type for use in wet environments. Use stainless steel drill screws or other approved screws at gypsum board products installed between grids D and J and 13 and 28 on the first floor, and between grids D and G and 15 and 25 on the second floor. For fastening gypsum backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
b. Grabber Construction Products; Acoustical Sealant GSC.
c. Hilti, Inc; CP 506 Smoke and Acoustical Sealant.
d. Pecora Corporation; AC-20 FTR
e. Specified Technologies, Inc; Smoke N Sound Acoustical Sealant.
f. USG Corporation; SHEETROCK Acoustical Sealant.

E. Vapor Retarder Membrane and Air and Vapor Control Membrane: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
1. Type X: As indicated on Drawings.

2. Abuse-Resistant Type: As indicated on Drawings.
3. Moisture- and Mold-Resistant Type: install at ceilings and walls west of gridline Pe, U.N.O.
4. Gypsum Tile Backer Panels: install at wall tile locations, unless otherwise noted.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) or horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

A. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for acoustical tile and back-of-house areas such as mechanical rooms, pool mechanical rooms, electrical rooms, and elevator machine rooms.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION – 09 29 00

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceramic tile

2. Aluminum trims

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for glass-mat, water-resistant tile backer board.

DEFINITIONS

C. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

D. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

E. Module Size: Actual tile size plus joint width indicated.

F. Face Size: Actual tile size, excluding spacer lugs.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 36 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Metal edge strips in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of product.

C. Product Test Reports: For tile-setting and -grouting products and certified ceramic tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of each type of wall tile installation.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Crack isolation membrane.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in swimming pools or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

A. Tile 1: Glazed ceramic wall tile at natatorium walls, 4 colors mosaic pattern, gloss finish

1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Global Collection (Contact United Tile, Lisa Anderson, 425-264-2952) or comparable product by one of the following:

a. Thompson Tile
b. American Marazzi Tile, Inc.
c. American Olean; a division of Dal-Tile Corporation
d. Daltile

2. Module Size: 6” x 6”
3. Thickness: nominal ¼”
4. Finish: Plain gloss
5. Tile Colors: Plain Mint Green 16730,, Plain Turquoise 16720, Plain Olive Green 16700, Plain Sevrese Blue 16760
6. Pattern: Random mix of 25% of each color
7. Grout Color: TBD- as selected by Architect from manufacturer's full range.
8. Trim Units: Provide shapes detailed and as follows, selected from manufacturer's standard shapes:

a. External Corners and Exposed Edges for Thinset Mortar Installations: Aluminum Jolly-A trim by Schluter or similar.
b. Internal Corners: Field-butted square corners.
c. Bottom edge trim to concrete stem wall

B. Tile 2: Glazed ceramic wall tile at natatorium walls, 4 colors mosaic pattern, gloss and satin finish (see below)

1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Global Collection (Contact United Tile, Lisa Anderson, 425-264-2952) or comparable product by one of the following:

a. Thompson Tile
b. American Marazzi Tile, Inc.
c. American Olean; a division of Dal-Tile Corporation.
d. Daltile

2. Module Size: 6” x 6”
3. Thickness: nominal ¼”
4. Finish: 2 different finishes -

a. Plain gloss (Plain Mint Green, Plain Turquoise, Plain Olive Green)
b. Satin (Plain Prussian Blue)

5. Tile Colors: Plain Mint Green 16730, Plain Turquoise 16720, Plain Olive Green 16700, Plain Prussian Blue 15120
6. Pattern: Random mix of 25% of each color
7. Grout Color: TBD - as selected by Architect from manufacturer's full range.
8. Trim Units: Provide shapes detailed and as follows, selected from manufacturer's standard shapes:
   a. External Corners and Exposed Edges for Thinset Mortar Installations: Aluminum Jolly-A trim by Schluter or similar
   b. Internal Corners: Field-butted square corners.
   c. Bottom edge trim to concrete stem wall

C. Tile 3: Glazed ceramic wall tile at locker room walls, 5 colors pattern per drawings, gloss

1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Colors Collection (Contact United Tile, Lisa Anderson, 425-264-2952) or comparable product by one of the following:

   a. Thompson Tile
   b. American Marazzi Tile, Inc.
   c. American Olean; a division of Dal-Tile Corporation.
   d. Daltile

2. Module Size: 6” x 6”
3. Thickness: nominal ¼”
4. Finish: Plain gloss
5. Tile Color: (3A) Aragon 19980, (3B) Peach Blossom 18970, (3C) Apricot Tan 18940, (3D) Pastel Yellow 18960, (3E) Accent White 16900
6. Pattern: Per drawings
7. Grout Color: TBD - as selected by Architect from manufacturer's full range.
8. Trim Units: Provide shapes detailed and as follows, selected from manufacturer's standard shapes:
   a. External Corners and Exposed Edges for Thinset Mortar Installations: Aluminum Jolly-A trim by Schluter or similar
   b. Internal Corners: Field-butted square corners.

D. Tile 4: Glazed ceramic wall tile, single color, gloss

1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Colors Collection (Contact United Tile, Lisa Anderson, 425-264-2952) or comparable product by one of the following:

   a. Thompson Tile
   b. American Marazzi Tile, Inc.
   c. American Olean; a division of Dal-Tile Corporation.
   d. Daltile

2. Module Size: 6” x 6”
3. Thickness: nominal ¼”
4. Finish: Plain gloss
5. Tile Color: Peach Blossom 18970
6. Pattern: Solid color, standard layout
7. Grout Color: TBD - as selected by Architect from manufacturer's full range.

8. Trim Units: Provide shapes detailed and as follows, selected from manufacturer's standard shapes:
   a. External Corners and Exposed Edges for Thinset Mortar Installations: Aluminum Jolly-A trim by Schluter or similar
   b. Internal Corners: Field-butted square corners.

E. Tile 5: Glazed ceramic wall tile, single color, gloss

1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Colors Collection (Contact United Tile, Lisa Anderson, 425-264-2952) or comparable product by one of the following:

   a. Thompson Tile
   b. American Marazzi Tile, Inc.
   c. American Olean; a division of Dal-Tile Corporation.
   d. Daltile

2. Module Size: 6” x 6”
3. Thickness: nominal ¼”
4. Finish: Plain gloss
5. Tile Color: Accent White 16900
6. Pattern: Solid color, standard layout
7. Grout Color: TBD - as selected by Architect from manufacturer's full range.
8. Trim Units: Provide shapes detailed and as follows, selected from manufacturer's standard shapes:
   a. External Corners and Exposed Edges for Thinset Mortar Installations: Aluminum Jolly-A trim by Schluter or similar
   b. Internal Corners: Field-butted square corners.

F. Tile 6: Glazed ceramic wall tile, single color, gloss

1. Basis-of-Design Product: Subject to compliance with requirements, provide Royal Mosa, Colors Collection (Contact United Tile, Lisa Anderson, 425-264-2952) or comparable product by one of the following:

   a. Thompson Tile
   b. American Marazzi Tile, Inc.
   c. American Olean; a division of Dal-Tile Corporation.
   d. Daltile

2. Module Size: 4” x 8”
3. Thickness: nominal ¼”
4. Finish: Gloss
5. Tile Color: Sage 0603
6. Pattern: Solid color, vertical stack bond layout
7. Grout Color: TBD - as selected by Architect from manufacturer's full range.

2.4 ALUMINUM BASE COVES

A. Cove base:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Schluter Dilex-AHKA.

B. Wall applications: For use at external corners, exposed edges, and transitions to other finishes.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Schluter, Schluter®-JOLLY, brushed stainless steel (EB).

2. Natatorium tile bottom trim

2.5 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D 226/D 226M, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.
3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

C. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F , respectively, and certified by manufacturer for intended use.

2.6 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F , respectively, and certified by manufacturer for intended use.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Waterproofing / Crack Isolation Membrane: (noted as “waterproof membrane” drawings):
1. RedGard by Custom Building Products, or equal
   a. RedGard as Waterproof Membrane:
      1 Gallon (3.78 L) 55 sq. ft. (5.1 M2)
      3.5 Gallon (13.2 L) 192 sq. ft. (17.8 M2)

C. Vapor-Retarder / Cleavage Membrane (noted as “cleavage membrane” on drawings):
   1. Polyethylene sheeting, ASTM D 4397, 4.0 mils thick.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

      a. Bonsal American, an Oldcastle company
      b. Custom Building Products
      c. Jamo Inc
      d. Southern Grouts & Mortars, Inc.
      e. Summitville Tiles, Inc

   2. Grout sealers shall comply with requirements of FloorScore certification.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
      b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

   3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped toward drains. Refer to drawings for slope direction and inches / foot.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

F. Joint Widths: As recommended by tile manufacturer.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated or, if not indicated, above joints in concrete substrates. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

I. Grout Sealer: Apply grout sealer to grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

J. Metal Edge Strips: Install at joint between thickset floor tile and adjacent floor finishes, unless otherwise shown.

3.4 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Ceramic Tile Installation - thickset floor tile at first floor: TCNA F114 and ANSI A108.1C; cement mortar bed (thickset) with cleavage membrane; epoxy grout.

a. Ceramic Tile Type #4, refer to finish schedule.
b. Bond Coat for Cured-Bed Method: Latex- portland cement mortar.
c. Grout: Water-cleanable epoxy grout.

B. Interior Wall Installations, Concrete:

1. Ceramic Tile Installation: TCNA W202(E); thinset mortar over waterproof/crack isolation membrane.

a. Ceramic Tile Types A and E, refer to drawings.
b. Thinset Mortar: Latex- portland cement mortar.
c. Grout: Water-cleanable epoxy grout.

C. Interior Wall Installations, Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W243, thinset mortar on gypsum backer boards, with waterproof membrane over backer board.

a. Ceramic Tile Types A, B, C, E, F, and G - refer to drawings.
b. Thinset Mortar: Latex-portland cement mortar.
c. Grout: Water-cleanable epoxy grout.

END OF SECTION 093013

SECTION 09 51 23 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Lay-in acoustical tiles for ceilings and cloud applications.
2. Extruded aluminum perimeter trim for cloud application.

B. Related Requirements:

1. Section 098433 “Sound Absorbing Wall Units” for suspended acoustic ceiling panels, planks, and pendants.

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
2. Exposed Moldings and Trim: Set of 6-inch-long Samples of each type and color.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling direct attach-system members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Minimum Drawing Scale: 1/8 inch = 1 foot.

B. Product Test Reports: For each acoustical tile ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size tiles equal to 5 percent of quantity installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to the National Voluntary Laboratory Accreditation Program (NVLAP) for testing indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, direct attach-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.

2.2 ACOUSTICAL TILES, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Tile: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.

C. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

D. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL TILES

A. Basis-of-Design Manufacturer: CertainTeed Architectural, 20 Moores Road, Malvern, PA 19355

B. Tile Product: Symphony *m* High NRC

C. Type: IV (per ASTM E1264)

D. Form: 2 (per ASTM E1264)

E. Pattern: E (per ASTM E1264)

F. Size: 2’x2’

G. Thickness: 7/8”

H. Edges: Square

I. Finished Surface: Laminated

J. Finish Surface Color: White

K. Core Composition: Wet-felted mineral fiber

L. Performance Criteria: Noise Reduction Coefficient (NRC) per ASTM C423 (E-400 mounting: 0.85

M. Accessories: Extruded Aluminum Perimeter Trim:
1. Basis of Design Manufacturer: Armstrong Axiom Classic, Curved Perimeter Trim
2. Location: Cloud application perimeters only
3. Height: 8”

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- diameter wire.

D. Seismic Struts: Manufacturer's standard compression struts designed to accommodate lateral forces.

E. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

2.5 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements Armstrong World Industries, USG Corporation or approved equal.

B. For ACT-1: Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.

1. Structural Classification: Intermediate-duty system.

2.6 ACOUSTICAL SEALANT

A. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.

2.7 MISCELLANEOUS MATERIALS

A. Acoustical Tile Adhesive: Type recommended by acoustical tile manufacturer, bearing UL label for Class 0-25 flame spread.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet . Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Arrange directionally patterned acoustical tiles as follows:

1. As indicated on reflected ceiling plans.

G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches o.c.
3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections of completed installations of acoustical tile ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion but no tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.

1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

B. Acoustical tile ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION – 09 51 23

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

B. Related Requirements:
1. Section 096813 “Tile Carpeting” for carpet tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 4 inches long.

D. Product Schedule: For resilient base and accessory products.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 300 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE – RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
2. Flexco.
3. Roppe Corporation, USA.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

1. Style and Location:

a. Style B, Cove

C. Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Colors: To be selected from manufacturer’s standards.

2.2 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Roppe Corporation, USA.
2. VPI Corporation.

B. Description: cap for cove resilient flooring, edge guards for resilient flooring, and edge guards for carpet

C. Profile and Dimensions: To be verified.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors: To be selected from manufacturer’s standards.

2.3 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

C. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Provide continuous silicone sealant at the base of gypsum drywall panels and cabinets, prior to installation of resilient base.

C. Apply resilient base to walls, casework, and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required. Do not apply to columns.

D. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

E. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

F. Do not stretch resilient base during installation.

G. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

H. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 09 65 16 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Rubber sheet flooring with backing
2. Resilient Tile Flooring
3. Adhesives

B. Related Requirements:

1. Section 033000 "Cast in Place Concrete"

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient sheet flooring.

1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Initial Selection: For each type of resilient sheet flooring indicated.

D. Samples for Verification: For each type of resilient sheet flooring, in manufacturer's standard size, but not less than 6-by-9-inch sections of each color, texture, and pattern required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

E. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RUBBER SHEET FLOORING WITH BACKING - noted as RSL-1 on drawings

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Ecore Balanced Motivate Class I 7mm by Ecore Athletic

B. Product Standard: ASTM F 1860.

1. Type: “post-consumer Vulcanized Composition Rubber granules encapsulated in a wear and water-resistant elastomeric network fusion bonded to a heterogeneous vinyl wear layer with a urethane topcoat.”
2. Wear-Layer Thickness: As standard with manufacturer.
3. Overall Thickness: 7 mm.
4. Interlayer Material: As standard with manufacturer.
5. Backing: Vulcanized composition rubber.
6. Hardness: Not less than required by ASTM F 1860 .

C. Sheet Width: As standard with manufacturer .

D. Seamless-Installation Method: Heat welded.

E. Color: Catalina

2.1 RESILIENT TILE FLOORING

A. LVT-1: Heavy Commercial Luxury Vinyl Tile.
   1. Manufacturers:
      a. Shaw Contract
   2. Minimum Requirements: Class III, Type B
   3. Heavy Duty
   4. Thickness: 0.100 inch (2.5 mm), minimum
   5. Tile Sizes: LVT -1: 24” x 24”
   6. Color and Patterns: To be selected from manufacturer’s standard line
   7. Warranty: 15 Year Commercial Limited Warranty

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
   a. Colors: As selected by Architect from manufacturer's full range to contrast with flooring .

D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.

4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.

1. Apply two coat(s).

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes modular, fusion-bonded carpet tile and carpet tile walk-off mat.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include installation recommendations for each type of substrate.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of face fiber, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE #1 - noted as CPT-1, located per drawings

A. Basis-of-Design Product: Subject to compliance with requirements, provide Shaw Contract, altered or comparable approved product by other manufacturers.

B. Color: from manufacturer’s standard line

C. Pattern: to be determined

D. Size: from manufacturer’s standard sizes

2.2 CARPET TILE #2 - noted as CPT-2, located per drawings

A. Basis-of-Design Product: Subject to compliance with requirements, provide Shaw Contract, altered or comparable approved product by other manufacturers.

B. Color: from manufacturer’s standard line

C. Pattern: to be determined

D. Size: from manufacturer’s standard sizes

2.3 WALK-OFF MAT - noted as WOM-1 on drawings

A. Basis-of-Design Product: Subject to compliance with requirements, provide Connexus by Mats Inc, Super NOP 52 or comparable approved product by other manufacturers. Products needed at interior and exterior locations, refer to plans.

B. Color: from manufacturer’s standard line

C. Size: from manufacturer’s standard roll sizes.

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

09 84 33 – SOUND-ABSORBING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes shop-fabricated, acoustical panel units tested for acoustical performance, including the following:

1. Sound-absorbing cementitious wood fiber plank acoustical wall panels. (Natatorium walls)
2. Sound-absorbing acoustical suspended ceiling panels. (Natatorium ceiling)
3. Sound-absorbing acoustical suspended ceiling planks. (Fitness ceiling)
4. Sound-absorbing acoustical suspended ceiling pendants. (Lobby ceiling)

B. Related Requirements:

1. Section 095123 “Acoustic Tile Ceiling” for:
   a. T-bar support framing to be used for sound-absorbing cementitious wood fiber plank acoustical ceiling panels
   b. Lay-in acoustical tiles for ceiling and cloud applications
   c. Extruded aluminum perimeter from for acoustical tile ceiling cloud

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include panel edge, core material, and mounting indicated.

B. Shop Drawings: For unit assembly and installation.

1. Include plans, elevations, sections, and mounting devices and details.
2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
3. Include details at cutouts and penetrations for other work.

C. Samples for Verification: For the following products:

1. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.
2. Core Material: 12-inch- square Sample at corner.
3. Mounting Devices: Full-size Samples.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of unit.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of unit to include in maintenance manuals. Include manufacturers' written cleaning and stain-removal instructions.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain sound-absorbing wall units from single source from single manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with sound-absorbing wall unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install sound-absorbing wall units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.

C. Air-Quality Limitations: Protect sound-absorbing wall units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Twenty years

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain sound absorbing units specified in this Section from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 SOUND-ABSORBING CEMENTITIOUS WOOD FIBER PLANK ACOUSTICAL WALL PANELS

A. Sound-Absorbing Acoustic Wall Panels: Manufacturer's standard panel construction consisting of cementitious wood fiber plank acoustical wall panels.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries, Inc. Tectum Direct-Attach Wall Panels.

1. Provide basis of design products or comparable products.

a. For comparable products, submit requests for substitution in accordance with Instructions to Bidders and Division 01 General Requirements.

C. Core Material: Cementitious wood fiber plank acoustical wall panel.

1. Acoustical Performance: Sound absorption NRC of according to ASTM C 423 for mounting Type C-20 according to ASTM E 795 (minimum NRC rating of 0.80).
2. Edge Profile: Beveled
3. Nominal Overall Panel Thickness: 2 inches.
4. Panel Width: As indicated on the Drawings.
5. Panel Height: As indicated on the Drawings.
6. Mounting: Direct-attach to pressure treated wood battens per Manufacturer’s standard fasteners and spacing.
7. Core Materials: Manufacturer’s Standard

2.4 SOUND-ABSORBING ACOUSTICAL SUSPENDED CEILING PANELS

A. Sound-Absorbing Acoustic Ceiling Panels: Manufacturer's standard panel construction consisting of non-woven needle-punched polyester fiber acoustical ceiling panels.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Acoufelt panels from Linear Ceiling Baffles line.

2. Provide basis of design products or comparable products.

a. For comparable products, submit requests for substitution in accordance with Instructions to Bidders and Division 01 General Requirements.

C. Core Material: Polyester Fiber acoustical ceiling panel.

1. Acoustical Performance: Acoustic testing is performed on all Acoufelt acoustic products and varies based on installation and configuration. ASTM E795-16 test reports can be downloaded from www.acoufelt.com

2. Fire Rating: ASTM E84, Class A; Flame spread index: 15; Smoke developed index: 200
3. Nominal Overall Panel Thickness: ½" (12mm)
4. Panel Length: 72"
5. Panel Height: 24"
6. Color: White
7. Mounting: Cable to deck mounting (per manufacturer requirements)
8. Hardware Spacing: 24" o.c. (per manufacturer requirements)
9. Core Materials: Manufacturer's Standard

2.5 SOUND-ABSORBING ACOUSTICAL SUSPENDED CEILING PLANKS

A. Sound-Absorbing Acoustic Ceiling Planks: Manufacturer's standard panel construction consisting of non-woven needle-punched polyester fiber acoustical ceiling panels.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Acoufelt panels from Fan Ceiling Baffles line.

3. Provide basis of design products or comparable products.

a. For comparable products, submit requests for substitution in accordance with Instructions to Bidders and Division 01 General Requirements.

C. Core Material: Polyester Fiber acoustical ceiling panel.

1. Acoustical Performance: Acoustic testing is performed on all Acoufelt acoustic products and varies based on installation and configuration. ASTM E795-16 test reports can be downloaded from www.acoufelt.com
2. Fire Rating: ASTM E84, Class A; Flame spread index: 15; Smoke developed index: 200
3. Nominal Overall Panel Thickness: ½" (12mm)
4. Panel Length: 90"
5. Panel Height: varies, 16" max.
6. Quantity of individual baffles: 69, to be confirmed in shop drawings
7. Pattern/ layout: to be selected from manufacturer standards and confirmed in shop drawings
8. Color: Sea Salt
9. Mounting: Cable to deck mounting (per manufacturer requirements)
10. Hardware Spacing: 24" o.c. (per manufacturer requirements)
11. Core Materials: Manufacturer's Standard

2.6 SOUND-ABSORBING ACOUSTICAL SUSPENDED CEILING PENDANTS

A. Sound-Absorbing Acoustic Ceiling Planks: Manufacturer's standard panel construction consisting of non-woven needle-punched polyester fiber acoustical ceiling panels.

B. Basis-of-Design Product: Subject to compliance with requirements, provide Acoufelt pendatns from Pendant Ceiling Clouds line.

4. Provide basis of design products or comparable products.

a. For comparable products, submit requests for substitution in accordance with Instructions to Bidders and Division 01 General Requirements.

C. Core Material: Polyester Fiber acoustical ceiling panel.

1. Acoustical Performance: Acoustic testing is performed on all Acoufelt acoustic products and varies based on installation and configuration. ASTM C423-17 test reports can be downloaded from www.acoufelt.com
2. Fire Rating: ASTM E84, Class A; Flame spread index: 15; Smoke developed index: 200
3. Nominal Overall Panel Thickness: ½" (12mm)
4. Panel Length: varies
5. Panel Height: varies, 48" max.
6. Quantity of baffles:
   a. 8"w x 24"h: 3
   b. 8"w x 36"h: 3
   c. 8"w x 48"h: 3
   d. 12"w x 36"h: 3
   e. 12"w x 48"h: 3
7. Pattern/ layout: to be confirmed in shop drawings
8. Color: varies, assume 3, to be confirmed in shop drawings
9. Mounting: Cable to deck mounting (per manufacturer requirements)
10. Hardware Spacing: per manufacturer requirements
11. Core Materials: Manufacturer's Standard

2.7 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated.

B. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine sound-absorbing wall units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units in locations indicated. Unless otherwise indicated, install units with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.

B. Variation of Joint Width: Not more than 1/16-inch variation from hairline in 48 inches, noncumulative.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 098433

SECTION 09 91 23 – INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Galvanized metal.
2. Gypsum board.
3. Acoustic panels.
4. Plaster.
5. Cotton or canvas insulation covering.
6. ASJ insulation covering.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming structural steel.
2. Section 055000 "Metal Fabrications" for shop priming and powder coating metal fabrications.
3. Section 099600 "High-Performance Coatings" for tile-like coatings.
4. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

B. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

   a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
   b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

   a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Behr Process Corporation
2. Benjamin Moore & Co
3. Coronado Paint; Benjamin Moore Company
4. Kelly-Moore Paint Company Inc.
5. PPG Architectural Coatings.
6. Pratt & Lambert.
7. Rodda Paint Co.
8. Rust-Oleum Corporation; a subsidiary of RPM International, Inc
9. Sherwin-Williams Company (The)

B. Products: Subject to compliance with requirements, provide product listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. Colors: See locations for paint on Room Finish and Color Schedules A10.2

2.3 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from

previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.
2. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Existing Wood Deck and Beams: Existing wood decking and beams are currently painted. Preparation required to bring material to a level of acceptance by paint manufacturer.

F. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

G. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in occupied spaces:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Metal conduit.
e. Plastic conduit.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates – low gloss, refer to drawings for locations

1. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:

a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

B. Steel Substrates – semi gloss, refer to drawings for locations

1. Institutional Low-Odor/VOC Latex System MPI INT 5.1S:

a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

C. Galvanized-Metal Substrates – low gloss, refer to drawings for locations

1. Institutional Low-Odor/VOC Latex System MPI INT 5.3N:

a. Prime Coat: Primer, galvanized, water based, MPI #134.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

D. Galvanized-Metal Substrates – semi-gloss, refer to drawings for locations

1. Institutional Low-Odor/VOC Latex System MPI INT 5.3N:

a. Prime Coat: Primer, galvanized, water based, MPI #134.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

E. Gypsum Board - low gloss, refer to drawings for locations

1. Institutional Low-Odor/VOC Latex System MPI INT 9.2M:

a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

F. Gypsum Board - semi-gloss, refer to drawings for locations

1. Institutional Low-Odor/VOC Latex System MPI INT 9.2M:
   a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
   b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
   c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #147.

G. Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings
1. Institutional Low-Odor/VOC Latex System MPI INT 10.1D:

   a. Prime Coat: Primer sealer, latex, interior, MPI #50.
   b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
   c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3), MPI #145.

END OF SECTION – 09 91 23

SECTION 09 93 00 – STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and application of wood stains and transparent finishes on the following substrates:

1. Exterior Substrates:

a. Wood-based panel products including new glu-lam beams and CLT structure.

2. Interior Substrates:

a. Wood-based panel products including glu-lam beams and CLT structure.

B. Related Requirements:

1. Section 099123 "Interior Painting"
2. Section 099600 "High-Performance Coatings"

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of finish system and in each color and gloss of finish required.

1. Submit Samples on representative samples of actual wood substrates, 8 inches square or 8 inches long.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Stains and Transparent Finishes: 5 percent, but not less than 2 gallons of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
b. Other Items: Architect will designate items or areas required.

2. Final approval of stain color selections will be based on mockups.

a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F above the dew point, or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated in wood finish systems schedules or comparable products by one of the following:

1. Behr Process Corporation
2. Benjamin Moore & Co.
3. Coronado Paint; Benjamin Moore Company.
4. Dulux (formerly ICI Paints); a brand of AkzoNobel.
5. Kelly-Moore Paint Company Inc.
6. Parker Paint; Comex Group.
7. Pratt & Lambert.
8. Rodda Paint Co.
9. Sherwin-Williams Company (The).

C. Products: Subject to compliance with requirements, provide product meeting MPI standards listed in wood finish systems schedules for the product category indicated.

2.2 MATERIALS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Stain Colors: To be selected from manufacturer's standard line.

2.3 SOURCE QUALITY CONTROL

A. Testing of Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.5 EXTERIOR AND INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Wood Substrates: Wood-based panel products.

1. Semitransparent Stain System:

a. Prime Coat: Stain, exterior, solvent based, semitransparent, matching topcoat.
b. Topcoat: Stain, exterior, solvent based, semitransparent.
c. Tint Color: To be determined.

1) Sherwin Williams WoodScapes Exterior Polyurethane Stain, Clear base, satin sheen.

END OF SECTION – 09 93 00

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:

   a. Steel.
   b. Galvanized metal.
   c. Concrete.

2. Interior Substrates:

   a. Steel.
   b. Galvanized metal.
   c. Gypsum board.
   d. Plaster.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
2. Section 055213 "Pipe and Tube Railings" for shop priming pipe and tube railings with coatings specified in this Section.
3. Section 099113 "Exterior Painting" for general field painting.
4. Section 099123 "Interior Painting" for general field painting.

1.3 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

B. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.

a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft.
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F .

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Behr Process Corporation
2. Benjamin Moore & Co
3. Coronado Paint; Benjamin Moore Company
4. Kelly-Moore Paint Company Inc.
5. PPG Architectural Coatings.
6. Pratt & Lambert.
7. Rodda Paint Co.
8. Rust-Oleum Corporation; a subsidiary of RPM International, Inc
9. Sherwin-Williams Company (The)
10. TNEMEC
11. Fabrikem

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. Colors: Match Architect's samples.

2.3 SOURCE QUALITY CONTROL

A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If

coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.

2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Gypsum Board: 12 percent.
2. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

F. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer. but not less than the following:

1. SSPC-SP 3 for steel not exposed to view to the public.
2. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning" for steel exposed to view to the public

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for coating and substrate indicated.
2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates – gloss, refer to drawings for locations

1. Epoxy System MPI EXT 5.1F:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
c. Topcoat: Epoxy, gloss, MPI #77.

B. Steel Substrates – low gloss, refer to drawings for locations

1. Epoxy System MPI EXT 5.1F:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
c. Topcoat: Epoxy, low gloss, MPI #108.

C. Galvanized-Metal Substrates – gloss, refer to drawings for locations

1. Epoxy System MPI EXT 5.3C:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

D. Galvanized-Metal Substrates – low gloss, refer to drawings for locations

1. Epoxy System MPI EXT 5.3C:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, low gloss, MPI #108.

F. Concrete Substrates – anti graffiti and sealer coating

E. Concrete and Concrete Masonry Unit Substrates – anti graffiti and sealer coating

1. Fabrishield Paint Repellent PR 60. Prep and apply per manufacturer's written instructions. Avoid excessive flooding which can lead to surface deposition and unsightly darkening.

3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates - gloss, refer to drawings for locations

1. High-Build Epoxy over Epoxy Zinc-Rich Primer System MPI INT 5.1P:

a. Prime Coat: Primer, zinc-rich, epoxy, MPI #20.
b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
c. Topcoat: Epoxy, high-build, gloss, MPI #77.

B. Steel Substrates – low gloss, refer to drawings for locations:

1. High-Build Epoxy over Epoxy Zinc-Rich Primer System MPI INT 5.1P:

a. Prime Coat: Primer, zinc-rich, epoxy, MPI #20.
b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108.
c. Topcoat: Epoxy, high-build, low gloss, MPI #108.

C. Galvanized-Metal Substrates: gloss, refer to drawings for locations

1. Epoxy over Epoxy Primer System MPI INT 5.3D:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #77.

D. Galvanized-Metal Substrates: low gloss, refer to drawings for locations

1. Epoxy over Epoxy Primer System MPI INT 5.3D:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal, MPI #101.
b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, gloss, MPI #108.

2.

E. Gypsum Board and Plaster Substrates - gloss, refer to drawings for locations

1. Epoxy, High-Build System MPI INT 9.2N:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Intermediate Coat: High-build epoxy, matching topcoat.
c. Topcoat: High-build epoxy, gloss, MPI #98.

F. Gypsum Board and Plaster Substrates: low gloss, refer to drawings for locations

1. Epoxy, High-Build System MPI INT 9.2N:

a. Prime Coat: Primer sealer, latex, interior, MPI #50.
b. Intermediate Coat: High-build epoxy, matching topcoat.
c. Topcoat: High-build epoxy, low gloss, MPI #108.

END OF SECTION – 09 96 00

SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Tackboards.

1.3 DEFINITIONS

A. Tackboard: unframed, tackable, visual display board, adhesive applied

B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of panel joints.
2. Include sections of typical trim members.

C. Samples for Verification: For each type of visual display surface indicated.

1. Visual Display Surface: Not less than 8-1/2 by 11 inches (215 by 280 mm), mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
2. Trim: 6-inch-(152-mm-) long sections of each trim profile.

1.5 INFORMATIONAL SUBMITTALS

A. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display surfaces vertically with packing materials between each unit.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Tackboard: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed with integral color throughout. Particleboard: ANSI A208.1, Grade M-1., made with binder containing no urea formaldehyde.

B. Fiberboard: ASTM C 208.

C. Extruded Aluminum Trim: ASTM B 221 (ASTM B 221M), Alloy 6063.

2.2 TACKBOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Forbo or equal
2. Mounting Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

2.3 FABRICATION.

A. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.5 VISUAL DISPLAY SURFACE SCHEDULE

A. Tackboard

1. Corners: Square.
2. Width: As indicated on Drawings.
3. Height: As indicated on Drawings.
4. Mounting: Wall, adhesive
5. Mounting Height: As indicated on Drawings.
6. Edges: Exposed, cut edge
7. Color: Verify.

PART 3 - EXECUTION

3.1 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

3.2 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Tackboard: Attach tackboard to wall surfaces with adhesive gobs at horizontal and vertical spacing recommended by manufacturer.

C. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.

3.3 CLEANING AND PROTECTION

A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION 101100

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast dimensional characters.
2. Cutout dimensional characters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least quarter scale.

C. Samples for Initial Selection: For each type of exposed finish.

1. Include representative Samples of available typestyles.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows: []

1. Exposed Accessories: Full-size Sample of each accessory type.

E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

A. Cast Characters Metal: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. A.R.K. Ramos.
b. ACE Sign Systems, Inc.
c. ASI Sign Systems, Inc.
d. Cosco.
e. Gemini Incorporated.
f. Matthews International Corporation; Bronze Division.
g. Metal Arts.
h. Metallic Arts.
i. Southwell Company (The).

2. Character Material: Cast aluminum.
3. Character Height: As indicated.
4. Thickness: Manufacturer's standard for size of character.
5. Finishes:
   a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
   b. Overcoat: Clear organic coating.
6. Mounting: Concealed studs.
7. Typeface: To be selected from manufacturer's range of typestyles.

2.2 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

D. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Concrete Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Panel signs.
2. Room-identification signs.

B. Related Requirements:

1. Section 220553 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
2. Section 230553 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
3. Section 260553 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Not less than 12 inches square, including corner.
2. Room-Identification Signs: Full-size Sample.

E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Accessibility Standard: Comply with applicable provisions in ICC A117.1 for signs.

2.2 SIGNS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Panel Signs (those with rules associated with the swimming pool): Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

    a. Allen Markings.
    b. APCO Graphics, Inc.
    c. Mohawk Sign Systems.
    d. Seton Identification Products

2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to manufacturer's standard backing sheet to produce composite sheet.

    a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
    b. Subsurface Graphics: Reverse halftone or dot-screen image. Image to be verified
    c. Color(s): As selected by Architect from manufacturer's full range.

3. Sign-Panel Perimeter: Finish edges smooth.

    a. Edge Condition: As indicated.
    b. Corner Condition in Elevation: As indicated.

4. Mounting: Surface mounted to wall with two-face tape.

5. Surface Finish
    a. Overcoat: Manufacturer's standard baked-on clear coating.

6. Text and Typeface:
    a. Accessible raised characters and Braille and as indicated on drawings. Finish raised characters to contrast with background color, and finish Braille to match background color.
    b. Typeface to be verified.
    c. Text as indicated on drawings.

7. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.

8. Locations: Per Drawings

C. Room-Identification Signs (those associated with doors to each room) and Building Accessibility and Elevator Signs: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

    a. Allen Markings.
    b. APCO Graphics, Inc.

c. Mohawk Sign Systems.
d. Seton Identification Products

2. Laminated-Sheet Sign: Photopolymer face Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated over subsurface graphics to manufacturer's standard backing sheet to produce composite sheet.

   a. Composite-Sheet Thickness: Manufacturer's standard for size of sign.
   b. Subsurface Graphics: Reverse halftone or dot-screen image. Image to be verified.
   c. Color(s): As selected by Architect from manufacturer's full range.

3. Sign-Panel Perimeter: Finish edges smooth.

   a. Edge Condition: As indicated.
   b. Corner Condition in Elevation: As indicated.

4. Mounting: Surface mounted to wall with two-face tape.
5. Text and Typeface:
   a. Accessible raised characters and Braille and as shown on drawings. Finish raised characters to contrast with background color, and finish Braille to match background color.
   b. Typeface to be verified
   c. For bidding purposes, text to match name of room shown on schedule. Final text to be verified during the submittal process.

6. Locations:
   a. Room Identifications Signs: Provide Room identification signs for each door listed on door schedule A7.2; ‘door name’ listed on schedule table is the room identification name.
   b. Maximum Occupancy: All Assembly use classification rooms with an occupant load of 15sf/occupant listed on the Occupant Load table on drawing T1.2.
   c. Accessibility Panel Signs: All Restroom and Shower Rooms.

D. Building Evacuation Signage:

1. Sign Panel
   a. Material: Clear Arcylic
   b. Thickness: ¼”
   c. Image: Sub-surface high resolution digital print, full bleed to outside edges of sign panel. Images provided by Architect.
2. Mounting: Manufacturer’s standard method for substrates indicated with two-face tape.
3. Content: Images to be provided by Architect
4. Quantity: 8

2.3 SIGN MATERIALS

A. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

C. Signs Mounted to Glass: provide blank panel at room-side, color to be verified, mount with two-face tape.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls according to accessibility standard.

C. Mounting Methods:

1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 10 21 13 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures , shower cubicles, and urinal screens.

B. Related Requirements:

1. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

D. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84, Class B; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.

2.2 SOLID-POLYMER UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Eclipse Partitions by Scranton Products or ASI Alpaco Classic/Alpaco Elegance by ASI Group, unless approved by Architect.

B. Toilet-Enclosure Style: Floor Mounted, Overhead braced, Standard Privacy (55”)

C. Urinal-Screen Style: Eclipse Partition Standard wall T-bracket.

1. Integral Hinges: Configure doors and stanchions to receive integral hinges.

2. Color and Pattern: Classic Color Collection: Black

D. Hinges: Eclipse Partition standard inswing pivot hinges, and outswing hinges

E. Stanchions: Eclipse Partition standard metal post, stanchion cap, corner caps, stanchion posts.

F. Head Rail: Eclipse Partition standard aluminum head rail

G. Latch: Eclipse Partition standard aluminum privacy latch with occupancy indicator.

H. Finish: Fossil Orange Peel (Classic Bold Color Collection)

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Clear-anodized aluminum, Stainless steel.
2. Hinges: Manufacturer's standard, allowing emergency access by lifting door.
3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Coat Hook: Refer to 102800 “Toilet and Bath Accessories.)
5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Aluminum Castings: ASTM B26/B26M.

B. Aluminum Extrusions: ASTM B221.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

D. Stainless Steel Castings: ASTM A743/A743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide out-swinging doors with a minimum 32-inch- wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:
   a. Pilasters and Panels: 1/2 inch.
   b. Panels and Walls: 1 inch.
2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13

SECTION 10 22 26 – OPERABLE PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Manually operated, paired panel operable partitions.

B. Related Sections include the following:
   1. Division 3 Sections for concrete tolerances required.
   2. Division 5 Sections for primary structural support, including pre-punching of support members by structural steel supplier per operable partition supplier's template.
   3. Division 6 Sections for wood framing and supports, and all blocking at head and jambs as required.
   4. Division 9 Sections for wall and ceiling framing at head and jambs.

1.3 SUBMITTALS

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of the opening shall conform to the criteria set forth per ASTM E557 *Standard Practice for Architectural Application and Installation of Operable Partitions*.

D. The operable wall must be manufactured by a certified ISO-9001-2015 company or an equivalent quality control system.

1.4 REFERENCE STANDARDS

A. ASTM International
   1. ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.
   2. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

3. ASTM C1036 - Standard Specification for Flat Glass.
4. ASTM C1048 - Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
5. ASTM E84 - Surface Burning Characteristics of Building Materials.
6. ASTM E413 - Classification for Rating Sound Insulation

B. International Standards Organization
1. ISO 14021 - Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labeling).
2. ISO 14025:2011-10, Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures.
3. ISO 14040:2009-11, Environmental Management - Life Cycle Assessment - Principles and Framework.
4. ISO 14044:2006-10, Environmental Management - Life Cycle Assessment - Requirements and Guidelines.
5. ISO 21930 – Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services.

C. Other Standards
1. ADA – Americans with Disabilities Act.
2. ANSI Z97.1 - Safety Glazing Materials Used in Buildings.
3. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
4. NEMA LD3 - High Pressure Decorative Laminates.

1.5 SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

B. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

C. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

D. Samples: Color samples demonstrating full range of finishes available by architect. Verification samples will be available in same thickness and material indicated for the work.

E. Reports: Provide a complete and unedited written sound test report indicating test specimen matches product as submitted.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.7 WARRANTY

A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.

B. Warranty period: Two (2) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:
   1. Modernfold, Inc.

B. Panels to be manufactured in the U.S.A.

C. Products: Subject to compliance with the requirements, provide the following product:
   1. Acousti-Seal Legacy – Paired Panel: Manually operated paired panel operable partition.

2.2 OPERATION

A. Acousti-Seal Legacy – Paired Panel: Series of paired flat panels hinged together in pairs, manually operated, top supported with operable floor seals.

B. Final Closure:
   1. Enclosure

2.3 PANEL CONSTRUCTION

A. Nominal 3-inch (76mm) thick panels in manufacturer's standard 48-inch (1220mm) widths. All panel horizontal and vertical framing members fabricated from minimum 18-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.

B. Panel Skin Options:
   1. 1/2-inch (13mm) tackable 100% recycled gypsum board, class "A" rated single material or composite layers continuously bonded to panel frame. Acoustic ratings of panels with this construction:
      a. 50 STC

C. Hinges for Closure Panels, Pass Doors, and Pocket Doors shall be:

1. Full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.

D. Panel Trim: No vertical trim required or allowed on edges of panels; minimal groove appearance at panel joints.

E. Panel Weights:
1. 50 STC – 8lbs./square foot

2.4 PANEL FINISHES

A. Panel face finish shall be:
1. Reinforced heavy-duty vinyl with woven backing weighing not less than 30 ounces (850 g) per lineal yard.

B. Panel trim: No exposed panel trim required or allowed; seals and hardware to be of one color.
1. Color to be selected from manufacturer's full line

2.5 SOUND SEALS

A. Vertical Interlocking Sound Seals between panels: Roll-formed steel astragals, with reversible tongue and groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals or astragals in only one panel edge are not acceptable.

B. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.

C. Horizontal Bottom Seals:
1. SM2 - Manually activated seals providing nominal 2-inch (51 mm) operating clearance with an operating range of +1/2-inch (13 mm) to –1-1/2-inch (38 mm). Seal shall be operable from panel edge or face. Extended seal shall exert nominal 120 pounds (54 kg) downward force to the floor throughout operating range.

2.6 SUSPENSION SYSTEM

A. #30 Suspension System
1. Suspension Tracks: Track shall be structural aluminum. Track shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 3/8-inch (9.5 mm) diameter threaded rods.
   a. Exposed track soffit: Track soffit to be integral to track shape and shall be powder-coated off white paint finish. Track must accommodate termination of plenum sound barriers on both sides of track for maximum sound control.
2. Carriers: One trolley per panel with 3-inch (76 mm) diameter glass-reinforced nylon all steel precision-ground ball-bearing wheels. Steel-wheeled or reinforced polymer trolleys on aluminum track not permitted. Trolleys shall attach to panels with 1/2-inch (13 mm) diameter pendent bolt mounted to welded steel mounting plate.
3. Warranty period: Two (2) years.

B. Modernfold Truss System: Prefabricated, self-supporting header system for the support of operable partitions.

2.7 OPTIONS

A. Work Surfaces:
1. Tackboard: Minimum 1/4-inch (6.35 mm) natural cork, covered with vinyl or fabric, with horizontal trim without exposed fasteners. Trim is not acceptable on vertical edges.

B. Available Accessories/Options:
1. Intersecting partition interface.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.

B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

3.2 CLEANING AND PROTECTION

A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and Installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.3 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.4 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 DEMONSTRATION

A. Demonstrate proper operation and maintenance procedures to Owner's representative.

B. Provide Operation and Maintenance Manual to Owner's representative.

END OF SECTION 10 22 26

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Corner guards.
2. Impact-resistant wall coverings.

B. Related Sections:

1. Section 087100 "Door Hardware" for metal armor, kick, mop, and push plates.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Corner Guards: 12 inches (300 mm) long.
2. Impact-Resistant Wall Covering: 6 by 6 inches (150 by 150 mm) square.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.6 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Corner-Guard Covers: four, 4-foot long units.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 014000 "Quality Requirements."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic sheet material out of direct sunlight.
3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).

a. Store corner-guard covers in a vertical position.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 (ASTM B 221M) for Alloy 6063-T5.

B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

C. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 40 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards corner guards: Fabricated from one-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Floor Products Co., Inc.
b. Arden Architectural Specialties, Inc.
c. Balco, Inc.
d. Boston Retail Products.
e. Construction Specialties, Inc.
f. IPC Door and Wall Protection Systems; Division of InPro Corporation.
g. Korogard Wall Protection Systems; a division of RJF International Corporation.
h. Pawling Corporation.
i. Tepromark International, Inc.
j. WallGuard.com.

2. Material: Extruded aluminum, minimum 0.080 inch (1.6 mm) thick, with clear anodic finish.
3. Wing Size: Nominal 2-1/2 by 2-1/2 inches (65 by 65 mm).
4. Height: 4 feet.
5. Corner Radius: 1/8 inch (3 mm).
6. Mounting: Adhesive.

2.3 IMPACT-RESISTANT WALL COVERINGS (FRP)

A. Impact-Resistant Sheet Wall Covering: Fabricated from plastic sheet wall-covering material.

A. Manufacturers: Subject to compliance with requirements: Alpar Architectural Products, LLC, or approved equal.

1. Size: As indicated.
2. Sheet Thickness: 0.04 inch
3. Color: As selected by Architect from manufacturer's full range of standard colors.
4. Texture: Smooth
5. Height: Full height (floor to ceiling) at rooms and walls indicated to receive FRP, unless otherwise shown on drawings.
6. Trim and Joint Moldings: Extruded rigid plastic that matches sheet wall covering color.
7. Mounting: Adhesive.

2.4 IMPACT-RESISTANT WALL COVERINGS (FRL) AT EAST RESTROOMS

A. Impact-Resistant Sheet Wall Covering: Fabricated from fiber reinforced laminate panels.

B. Manufacturers: Subject to compliance with requirements: Panolam Surface systems, or approved equal.

1. Size: As indicated.
2. Sheet Thickness: 0.04 inch
3. Color: As selected by Architect from manufacturer's full range of standard colors.
4. Texture: Smooth
5. Height: as shown on drawings.
6. Trim and Joint Moldings: Shluter or similar alum trims at top edges.
7. Mounting: Adhesive.

2.5 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Remove tool and die marks and stretch lines, or blend into finish.
2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
3. Run grain of directional finishes with long dimension of each piece.
4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

a. Provide anchoring devices to withstand imposed loads.
b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 24” (305 mm).
c. Adjust end and top caps as required to ensure tight seams.

B. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 10 28 00 - TOILET AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Toilet accessories, including coat hooks throughout building.

B. Related Sections include the following:
   1. Division 9 Section "Ceramic Tile".
   2. Division 10 Section "Toilet Compartments" for compartments and screens.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.

B. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

B. Product Options: Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specific products indicated in the Toilet and Bath Accessory Schedule.
   1. Other manufacturers' products with equal characteristics may be considered. See Division 1 Section "Substitutions."
   2. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required by ADA requirements ANSI 117.1 for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. General Warranty: Provide a 1-year warranty on all accessories from the date of Physical Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide accessories by one of the following:
   1. Toilet and Bath Accessories:
      a. Bobrick Washroom Equipment, Inc.
      b. Bradley Corp.
      c. American Accessories, Inc.

B. Products: Subject to compliance with requirements, provide products indicated for each designation in the Toilet and Bath Accessory Schedule at the end of Part 3 and the drawings.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).

D. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.

E. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q2, nominal 6.0 mm thick, with silvering, electroplated copper coating, and protective organic coating complying with FS DD-M-411.

F. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.

C. Framed Glass-Mirror Units: Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.
   1. Provide galvanized steel backing sheet, not less than 0.034 inch (0.85 mm) and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

D. Mirror-Unit Hangers: Provide mirror-unit mounting system that permits rigid, tamper- and theft-resistant installation, as follows:
   1. One-piece, galvanized steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
   2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

E. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. For items not shown specifically in the drawings, field verify locations with Project Engineer. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.

C. Provide solid blocking in walls for securing all accessories.

D. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.3 TOILET AND BATH ACCESSORY SCHEDULE

A. Combo Paper Towel Dispenser: Provide (1) surface mounted paper towel dispenser in each of the following rooms: 109, 116, 118, 119, 120, and 121.
   1. Products: Bobrick B-4262 Contura Series surface mounted

B. Electric Hand Dryer: Provide surface mounted automatic hand dryer complying with the following as shown in the drawings:
   1. World Dryer, VMAX Vertical Hand dryer, high impact ABS Silver # V-629A

C. Surface Toilet Tissue Dispenser: Provide toilet tissue dispenser at each toilet and complying with the following:
   1. Bobrick B-27460 – 2 roll dispensers. Mount under the grab bars to meet ADA code.

D. Surface Mounted Toilet Seat Cover Dispenser: Provide seat cover dispenser at each toilet and complying with the following:
   1. Bobrick B-4221, Contura Series surface-mounted toilet seat cover dispenser.

E. Soap Dispenser: Provide a soap dispenser at each sink and as shown on the drawings complying with the following:
   1. Products: Bobrick B-4112 Contura Series surface mounted.

F. Grab Bars: Provide stainless-steel grab bar as shown in the drawings and complying with the following:
   1. Products: Bobrick B-6806 series in lengths indicated on drawings and as required by ANSI 117.1
   2. Stainless-Steel Nominal Thickness: 18 gage.
   3. Mounting: concealed mounting with stainless steel set screws
   4. Gripping Surfaces: Smooth, satin finish
   5. Outside Diameter: 1-1/2 inches (38 mm)

G. Sanitary Napkin Disposal Unit: Provide stainless-steel sanitary napkin disposal unit complying with the following, at each toilet stall at women’s restrooms or locker rooms.
   1. Products: Bobrick B-270 Contura Series, surface mounted. Provide one set of disposal paper liners Bobrick Part No. 270-12.

H. Mirror Unit: Provide mirror unit above each sink and as shown on the drawings complying with the following: (see Section 08 83 00 “Mirror” for mirrors in locker rooms)
   1. Products: Bobrick B-165 series with concealed hanger, provide in sizes as indicated on drawings.

I. Baby Changing Table as shown in the drawings
   1. Products – Koala Kare – KB200, granite white or gray, verify with architect.

J. Adult Changing Table as shown in the drawings
   1. Products – Koala Kare – KB3000, granite white or gray, verify with architect.

K. Utility Shelf with mop/broom holders and rag hooks. Provide one above each mop sink.
   1. Products – Bobrick B-239 x 34.

L. Coat Hooks
   1. Products – Umbra Brella 2 Hook, Nickel finish.
   2. Quantity and locations – 9 total hooks, one per toilet compartment or individual restroom, located on the interior face of doors

M. Suit Spinners as shown in the drawings
   1. Products – Suitmate, 115v and 230v.

N. ADA Fold-Down Shower Bench in each ADA shower, quantity (4)
   1. Products – Seachrome – Model #SSB

O. RR Fold-Down Bench in each ADA Changing Room, quantity (2)
   1. Products – Seachrome – Model #SHAF

END OF SECTION 10 28 00

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguishers.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing semi-recessed method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 FIRE-PROTECTION CABINET <FEC>

A. Cabinet Type: Suitable for fire extinguisher.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. American Specialties, Inc.
b. Fire-End & Croker Corporation.
c. GMR International Equipment Corporation.
d. Guardian Fire Equipment, Inc.
e. JL Industries, Inc.; a division of the Activar Construction Products Group.

f. Kidde Residential and Commercial Division.
g. Larsens Manufacturing Company.
h. MOON American.
i. Nystrom, Inc.
j. Potter Roemer LLC.
k. Strike First Corporation of America.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Aluminum sheet.

D. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Rounded-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.

E. Cabinet Trim Material: Extruded-aluminum shapes.

F. Door Material: Aluminum sheet.

G. Door Style: Center glass panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide recessed door pull and friction latch.
2. Provide concealed hinge permitting door to open 180 degrees.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.

K. Materials:

1. Aluminum: ASTM B 221 (ASTM B 221M), with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet. ASTM B 221 (ASTM B 221M) for extruded shapes.

a. Finish: Clear anodic.

2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.

2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.3 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below:

1. Fire-Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Provide inside latch and lock for break-glass panels.
   2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

B. Related Requirements:

1. Section 104413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with drawings to ensure proper fit and function.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type: For use at all other locations. UL-rated, 5 lb. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 10 51 29 - PHENOLIC LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes phenolic lockers and related benches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker and bench.

B. Shop Drawings: For phenolic lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of cutouts and holes for items installed in lockers.
4. Show locker fillers, trim, base, sloping tops, and accessories.
5. Show locker identification system and numbering sequence.

C. Samples for Initial Selection: For each type of locker.

1. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Phenolic panels, not less than 3 by 3 inches, for each type, color, pattern, and surface finish.
2. Exposed locker hardware and accessories, one unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1. Include recommendations for periodic cleaning and maintenance of each component.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Operation and Maintenance Data.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installers certified by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store lockers in manufacturer’s original unopened packaging until ready for installation.

B. Do not deliver lockers until painting and similar operations that could damage lockers have been completed in installation areas. If lockers must be stored in other-than-installation areas, store only in areas where environmental conditions are the same as those in final installation location, and comply with requirements specified in "FIELD CONDITIONS" Article.

C. Deliver master and control keys, combination control charts, and End-User manual to Owner.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install lockers until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F during the remainder of the construction period.

B. Field Measurements: Where lockers are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where lockers are indicated to fit to other construction, establish dimensions for areas where lockers are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.10 COORDINATION

A. Coordinate sizes and locations of support bases with curbs as shown on floor and slab plan.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that lockers can be supported and installed as indicated.

C. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087100 "Door Hardware" to fabricator of lockers; coordinate Shop Drawings and fabrication with hardware requirements.

1.11 SEQUENCING

A. Ensure that lockers are supplied to affected trades in time to avoid interruption of the construction process.

B. Ensure locating templates and other information required for locker installation are provided to affected trades in time to prevent interruption of the construction process.

1.12 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to replace phenolic locker components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain phenolic lockers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction and ICC A117.1 .

B. Surface-Burning Characteristics: Comply with ASTM E 84, Class B; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 75 or less.
2. Smoke-Developed Index: 450 or less.

C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 19 percent.

D. Regional Materials: Lockers shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

E. Regional Materials: Lockers shall be manufactured within 500 miles of Project site.

F. Accessibility Requirements: Comply with requirements of ADA and requirements of authorities having jurisdiction.

2.3 PHENOLIC LOCKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Partition Systems International of South Carolina®; Phenolic Lockers or comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.
3. Columbia Lockers®, a division of PSiSC.
4. Design Tec.
5. Ideal Products, Inc.

B. Construction Style: Manufacturer's standard mortise and tenon. Butt joints are unacceptable.

C. Final Assembly: Manufacturer's standard factory assembly.

D. Configuration: Per drawings.

E. Fire Rating: Class B fire-rated.

F. Locker Body: Fabricated from solid phenolic panels.

1. Side Panels: 5/16 inch thick.
2. Back Panel: 5/16 inch thick.
3. Top Panel: 3/8 inch thick.

4. Bottom Panel: 3/8 inch thick.

G. Doors: 1/2-inch thick, solid phenolic panel fabricated to full width of locker; frameless with perimeter ventilation.

H. End Panels: 1/2-inch thick, solid phenolic matching door style, material, construction, and finish.

I. Shelves: 3/8-inch thick, solid phenolic.

J. Slope Tops: 1/2-inch- thick, solid phenolic panel matching door faces.

K. Colors: As selected by Architect from manufacturer's full range of standard colors.

1. Edge Color: Black Core

2.4 MATERIALS

A. Phenolic: Solid phenolic with same color throughout material. Laminated surfaces are unacceptable.

B. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

C. Anchors: Material, type, size, and finish as required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.5 HARDWARE

A. Mechanical Day-Use Lock at Lifeguards Room (assume 6): Lock to secure with any user-selected four-digit code, is reprogrammable, and has no batteries or wires.

B. Hasp-Only at all Public Locker Rooms (all others): Hasp only for users to bring their own locks.

C. Concealed Type Hinges: 0.078-inch, 14-gauge, Type 304 stainless steel, five-knuckle hinges with satin finish. Concealed hinge to allow door to open 90 degrees.

D. Hooks: Manufacturer's standard, 0.125-inch, 11-gauge, Type 304 stainless steel with satin finish. Attach hooks with minimum two fasteners.

1. Provide hooks as indicated on Drawings.

2.6 ACCESSORIES

A. Number Identification Plates: Provide a number plate for each door or opening, in sequence indicated on Drawings. Number plate made from black, impact-acrylic-multipolymer ABS, and engrave from back side to prevent accumulation of dirt and grime.

2.7 BENCHES

A. ‘Basis-of-Design Product: Subject to compliance with requirements, provide Composite Recycling Technology Center in Port Angeles, WA (phone = (360) 819-1210); recycled carbon fiber slatted benches.

1. Basis of design product at free-standing benches: provide Trident bench double arm backless benches by CRTC.

a. For comparable products, submit requests for substitution in accordance with Instructions to Bidders and Division 01 General Requirements.

2. Basis of design product at locker cubbies bench toppers: provide Trident Bench carbon fiber bench slats and aluminum shims per drawings by CRTC.'

2.8 FABRICATION

A. Fabricate and provide factory preassembled lockers, complete with hardware and accessories.

B. Fabricate each locker with shelves, a single door and frame, a single top, bottom, and back, and with common intermediate uprights separating compartments.

1. Fabricate lockers to dimensions, profiles, and details indicated.

C. Fabricate lockers square, rigid, without warp, and with finished faces flat and free of scratches, and chips. Factory machine components to suit attachments. Make joints tight and true.

1. Fabricate lockers using manufacturer's standard mortise and tenon construction.
2. Provide slope tops and end panels as required to complete installation as indicated by Drawings.

D. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above finished floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above finished floor.

E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Use only manufacturer's brackets, nuts, bolts, screws, and other anchoring devices for assembly.

F. Shop cut openings, to maximum extent possible, to receive hardware, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify that furring is attached to concrete and masonry walls receiving lockers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Condition lockers to average prevailing humidity conditions in installation areas before installation.

B. Before installing lockers, examine factory-fabricated work for completeness and complete work as required, including removal of packing.

C. Thoroughly clean surfaces prior to installation.

3.3 INSTALLATION

A. Install lockers in accordance with manufacturer's written instructions.

B. Install lockers level, plumb, and true; use concealed shims.

C. Connect groups of lockers together with manufacturer's standard stainless steel, theft proof fasteners, through predrilled holes in locker interior. Fit lockers accurately together to form flush, tight, hairline joints.

D. Install lockers without distortion for doors and drawers to fit and align with openings. Adjust hardware to center doors and drawers in openings, and provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Installation Tolerance: Maximum 1/8- in 96-inch sag, bow, or other variation from a straight line. Shim as required with concealed shims.

E. Locker Anchorage: Fasten lockers through back, near top and bottom, at ends with anchoring devices furnished, and spaced not more than 16 inches o.c.

F. Scribe and cut corner and filler panels to fit adjoining work using fasteners concealed where practical. Repair damaged finish at cuts.

G. Attach sloping-top units to lockers, with end panels covering exposed ends.

H. Install number identification plates after lockers are in place.

1. Attach number identification plate on each locker door, mounted behind locker pull handle or lock.
2. Attach name identification plate holder on each locker door, centered, with a minimum two screws with finish matching name identification plate holder.
3. Insert name identification plate into matching nameplate holder on each door.

I. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 60 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.4 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

3.5 PROTECTION

A. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Clean exposed surfaces of lockers and hardware.

C. Touch up marred finishes, or replace lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10 51 29

SECTION 11 01 40 FALL RESTRAINT / FALL PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Design / Build fall restraint systems mounted at roof

B. Related Requirements:

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Engineering calculations, provided and stamped by a structural engineer licensed in the Washington State.

C. Shop Drawings: Show layouts and types of fall protection components and accessories. Include the following:

1. Anchorage details, including connection to supporting structure for suspended units.
2. Details of juncture of exposed surfaces with adjacent finishes.
3. Accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in the manufacture, design/engineering and install of fall protection systems and maintenance equipment with at least 10 years of successful documented experience and twenty installations similar in size and type proposed for this project.

1. The design design/engineering and installation of the specific fall protection system for the project may be provided by a separate company provided they have been trained and are authorized by the manufacturer to design, engineer and install the manufacturer’s fall protection systems; and the separate company does not subcontract any part of the design/engineering and installation to a third party.

2. Manufacturer shall have specific liability insurance (products and completed operations insurance in the amount of $2,000,000). This insurance must cover the failure of the safety anchor itself.

B. Design/Engineering and Installation Company (Designer/Installer): If not the manufacturer, shall be a single, self-contained company specializing in both the design and installation of fall protection systems and maintenance equipment (subcontracting the design and/or installation functions to a separate company is not acceptable and will not be considered.)

1.6 PERFORMANCE

A. Comply with OSHA and WISHA requirements for fall arrest and fall restraint systems.
1. Design fall arrest anchor system to all free movement of persons over entire roof while attached to full body harness, retractable life line, or vertical life line to catenary lines attached to D-ring or eye at each fall arrest anchor. Include quick release attachments.
2. Design upright anchors as instructed by manufacturer in layout indicate or otherwise acceptable to architect. Equally space uprights as shown or between 16’ and 20’ on center so that only one catenary line is needed to connect to D-rings or eyes at each row of uprights.
3. Design fall arrest system for one person and fall restraint system for up to four persons on roof.
4. Design fall arrest anchors with permanent attachments to roof sheathing and structure to resist 5000 pounds pull-out force. Include design as necessary to transfer design loads.
5. Design fall arrest system to limit fall distance to 6’ and go limit arrest force to 1800 pounds or less.

1.7 COORDINATION

A. Coordinate layout and installation of fall restraint / fall arrest systems with adjacent construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND INSTALLERS

A. Source Limitations: Obtain all parts and products of fall restraint and fall arrest system from single manufacturer, including but not limited to Guardian Fall Protection.

B. Installer Qualifications
1. Company specializing in work of the Section with minimum three years documented experience
2. Either same as manufacturer, or certified by manufacturer as qualified to perform work of the Section.
3. Able to document successful installations of manufacturer’s fall arrest/fall restraint system

2.2 PRODUCTS.

A. Fall restraint / fall arrest systems and all associated accessories required for complete installation and system.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Guardian Fall Protection (1(800) 672 7892)

    b. Coordinate length of posts with roof assembly including thickness of assembly and size of waterproof boot around post.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
    1. Install fall arrest system in accordance with manufacturer's directions and contract documents. Where these may be in conflict in the more stringent requirements govern.
    2. Lay out fall arrest system in accordance with accepted shop drawings.
    3. Isolate dissimilar metals to prevent contact.
    4. Weld fall arrest anchors directly to structural steel as required by manufacturer and to comply with design requirements and as necessary for watertight, secure, permanent attachment.

END OF SECTION 110140

SECTION 11 31 00 - APPLIANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Refrigeration appliances.
2. Washer and Dryer

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.

1.4 INFORMATIONAL SUBMITTALS

A. Warranties: Sample of manufacturer’s special warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintains, within 25 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

B. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

C. Regulatory Requirements: Comply with the following:

1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with ICC/ANSI A117.1.

1.6 WARRANTY

A. Special Warranties: Manufacturer’s standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period except as qualified below:

1. Warranty Period: Two years from date of Substantial Completion.

B. Refrigerator/Freezer, Sealed System: Full warranty including parts and labor for on-site service on the product.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.0 MANUFACTURERS

Basis-of-Design Product: Appliance selections are based on the manufacturer and products indicated. See drawings for locations and quantities. Subject to compliance with requirements, provide the named product or approved equal as determined by Architect.

2.1 APPLIANCE SCHEUDLE

A. Refrigerator (REF)
1. Manufacturer: GTE18ISHSS, GE Energy Star 18.2 Cu. Ft. Top-Freezer Refrigerator
2. Icemaker Option: Add IM4D Icemaker
3. Color: Stainless Steel

B. Washing Machine and Dryer (WM/D)
1. Manufacturer: General Electric (GE®)
2. Product: GFW450SPMDG
3. Color: As selected from standardly available options

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Examine walls, ceilings, and roofs for suitable conditions where overhead exhaust hoods will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written instructions.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

C. Utilities: Comply with plumbing and electrical requirements.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safety. Replace damaged and malfunctioning controls and components.

C. An appliance will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 113100

SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.

B. Related Requirements:

1. Section 22 40 00 "Plumbing Fixtures" for sinks and plumbing fittings.
2. Section 06 41 16 “Plastic Laminate-Faced Architectural Cabinets” for mounting surfaces and knee braces.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:

1. Countertop material, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in- service performance.

B. Installer Qualifications: Fabricator of countertops.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Basis-of-Design Products:
   a. SS-1 Solid Surface 1
      1) Manufacturer: Corian Solid Surface
      2) Color/Pattern: Stonique
      3) Thickness: 12mm
   b. SS-2 Solid Surface 2
      1) Manufacturer: Corian Solid Surface
      2) Color/Pattern: Verdant
      3) Thickness: 12mm

B. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium

B. Configuration:

1. Front: Straight, slightly eased at top
2. Backsplash: Straight, slightly eased at corner
3. End Splash: Matching backsplash

C. Counter Perimeter Frame: Ensure ½” thick, moisture resistant cores for counter tops in wet areas having sinks or lavatories are 3/4" thick exterior grade plywood with waterproof adhesive, Fir or Poplar plywood, veneer core only.

D. Adhesive: Product recommended by solid surface material manufacturer.

E. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

I. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.16

13 11 00 – SWIMMING POOL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The scope of the work included under this Section of the Specifications shall include swimming pool(s) as illustrated on the Drawings and specified herein. The General and Supplementary Conditions of the Specifications shall form a part and be included under this Section of the Specifications. The Swimming Pool Subcontractor shall provide all supervision, labor, material, equipment, machinery, plant and any and all other items necessary to complete the work. ALL OF THE WORK IN SECTIONS 13 11 00 - 13 11 09 IS TO BE THE RESPONSIBILITY OF ONE EXPERIENCED SWIMMING POOL SUBCONTRACTOR PRIMARILY ENGAGED IN THE CONSTRUCTION OF COMMERCIAL PUBLIC-USE SWIMMING POOLS. A SWIMMING POOL SUBCONTRACTOR SHALL BE CONSIDERED PRIMARILY ENGAGED AS REQUIRED HEREIN IF THE SUBCONTRACTOR DERIVED 50% OF ITS ANNUAL REVENUE FROM PUBLIC-USE SWIMMING POOL CONSTRUCTION FOR EACH OF THE LAST FIVE YEARS. THE SUBCONTRACTOR MUST HAVE ALSO, IN THE LAST FIVE YEARS CONSTRUCTED AT LEAST FIVE (5) COMMERCIALLY DESIGNED MUNICIPAL AND PUBLIC-USE SWIMMING POOLS, EACH OF WHICH SHALL HAVE INCORPORATED A MINIMUM SIZE OF 6,000 SQUARE FEET OF WATER SURFACE AREA WITH A CONCRETE AND CERAMIC TILE PERIMETER OVERFLOW GUTTER AND SELF-MODULATING BALANCE TANK. The Swimming Pool Subcontractor shall furnish and install the swimming pool structures, finishes, swimming pool mechanical and electrical systems, and all accessories necessary for a complete, functional swimming pool system, as herein described. Work shall include start-up, instruction of Owner’s personnel, as-built drawings and warranties as required.

1.2 CODES, RULES, PERMITS, FEES

A. The swimming pools shall be constructed in strict accordance with the applicable provisions set forth by authorities having jurisdiction over swimming pool construction and operation in the State of Washington.

B. The Swimming Pool Subcontractor shall give all necessary notices, obtain all permits, and pay all government sales taxes, fees, and other costs in connection with their work; file all necessary plans, prepare all documents and obtain all necessary approvals of governmental departments having jurisdiction; obtain all required certificates of inspection for their work and deliver same to the Designated Representative before request for acceptance and final payment for the work.

C. The Swimming Pool Subcontractor shall include in the work any labor, materials, services, apparatus, or drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on Drawings and/or specified.

D. The Contractor shall submit all required documents and materials to all Governmental Departments having jurisdiction for any deferred approval items or substituted materials or products to obtain final approval to installation.

1.3 DESCRIPTION OF WORK

A. Furnish and perform supervision, coordination, all layout, formwork, excavation, hand trim, disposing off-site of all unused material or debris to complete the swimming pool excavation to the dimensions shown on the plans.

B. Furnish and install complete swimming pool structures, including manufactured pool wall panels, buttresses, reinforcing steel and cast-in-place or pneumatically placed concrete walls and floors.

C. Furnish and install swimming pool finishes, including ceramic tile or other waterproof finishes.

D. Furnish and install complete swimming pool mechanical system(s), including, but not limited to, circulation systems, filtration systems, pool water heating systems, water chemistry control systems, domestic water fill line systems, booster pump and special effects systems, and all pumps, piping, valves, and connections between system(s) and swimming pool(s).

E. Furnish and install complete swimming pool electrical system(s) from P.O.C. in Mechanical Room, including, but not limited to, underwater lighting systems, water level control systems, timing systems, scoreboards, special effects systems, control circuitry, motor starters, time clocks, bonding, and all conduits, conductors, contactors, and switches between the system(s) and swimming pool(s).

F. Furnish and install all swimming pool, deck equipment and required anchors and inserts for the specified equipment as required by code, shown on the Drawings and specified herein.

G. After the initial filling of the swimming pool system(s), should any repairs, continuing work, or other Subcontractor responsibility require drainage or partial drainage of the swimming pool systems, the Swimming Pool Subcontractor shall be responsible for any subsequent refilling and shall complete the project with the swimming pool system(s) full of water, water in chemical balance, complete in every way, and in full operation.

1.4 ASSIGNED RESPONSIBILITIES AND RELATED WORK

A. It is the intent of this section of the Specifications to clarify Work responsibilities of the trades directly and indirectly involved in construction of the pool systems. All labor, equipment, materials and supplies furnished by the Swimming Pool Subcontractor and other Subcontractors per the contractual agreement with the General Contractor and Owner and shall be as directed by the Owner through their Designated Representative.

B. THE SWIMMING POOL SUBCONTRACTOR SHALL NOT SUBCONTRACT ANY PORTION OF THE SWIMMING POOL CONSTRUCTION OR SWIMMING POOL EQUIPMENT INSTALLATION TO ANYONE OTHER THAN A SUBCONTRACTOR THAT SATISFIES THE REQUIREMENTS OF SECTION 13 11 00

C. References to “swimming pool systems” shall include the swimming pools, equipment, and accessories.

D. The Owner will provide one complete water filling of the swimming pool(s), but will not assume any responsibility for the swimming pool system(s) until they have been proved fully operational, complete in every way and accepted by the Designated Representative.

1.5 RESPONSIBILITIES OF THE CONTRACTOR

A. The Contractor shall grade the swimming pool site(s), establish benchmarks, cut and fill as necessary to provide as level an area as possible at swimming pool deck elevation before swimming pool layout.

B. The Contractor shall be responsible for horizontal dimensions and grade elevations accurately from established lines and benchmarks (as indicated on the Drawings) and be responsible for those grades.

C. The Contractor shall provide adequate temporary light, electric power, heat and ventilation per Federal and State OSHA requirements to construct the swimming pool system(s).

D. The Contractor shall not permit any heavy equipment activity over any area or within five (5) feet of any area under which swimming pool piping is buried. There shall be no exceptions to this requirement.

E. The Contractor shall keep the swimming pool excavation(s) and swimming pool structure(s) free of construction residue and waste materials of their workmen or Subcontractors, removing said material from the swimming pools as required.

F. The Contractor shall protect the swimming pool(s) from damage caused by their construction equipment and /or workmen and Subcontractors.

G. The Contractor shall provide a representative at time of swimming pool start-up to coordinate all trades related to swimming pool system(s).

1.6 RESPONSIBILITIES OF THE MECHANICAL SUBCONTRACTOR

A. The Mechanical Subcontractor shall be licensed in the State of Washington and provide written notifications to Swimming Pool Subcontractor and contractor when necessary to excavate and backfill within the swimming pool construction site.

B. The Mechanical Subcontractor shall not utilize any swimming pool piping trench for installation of any sanitary sewer, storm sewer, domestic water, hot water, chilled water or natural gas line.

C. The Mechanical Subcontractor shall furnish and install all sanitary sewer piping, including vent stacks (if necessary), for backwash pits, floor drains and floor sinks as required by code, shown on Drawings, and herein specified.

D. The Mechanical Subcontractor shall furnish and install all storm sewer piping and site drainage systems as required by code, shown on the Drawings, and herein specified.

E. The Mechanical Subcontractor shall provide a minimum 75 psi water supply for swimming pool construction work within fifty (50) feet of the swimming pool construction site(s).

F. The Mechanical Subcontractor shall furnish and install reduced pressure backflow protected domestic water lines to P.O.C. within swimming pool Mechanical Room as required by code, shown on the Drawings, and herein specified.

G. The Mechanical Subcontractor shall furnish and install natural gas piping, pressure regulation and valving to P.O.C. within swimming pool Mechanical Room as required by code, shown on the drawings, and herein specified.

H. The Mechanical Subcontractor shall furnish and install all ductwork, louvers, and all HVAC equipment within swimming pool Mechanical Room as required by code, shown on the Drawings, and herein specified.

I. The Mechanical Subcontractor shall provide a representative at time of swimming pool start-up to coordinate work related to swimming pool system(s).

1.7 RESPONSIBILITIES OF THE ELECTRICAL SUBCONTRACTOR

A. The Electrical Subcontractor shall be licensed in the State of Washington and shall furnish and install electrical service to swimming pool Mechanical Room sized to accommodate all necessary swimming pool equipment as shown on the Drawings and herein specified.

B. The Electrical Subcontractor shall furnish any temporary power needed by the Swimming Pool Subcontractor within fifty (50) feet of the swimming pool construction site(s).

C. The Electrical Subcontractor shall furnish and install all conduits, conductors, starters/disconnects, panels, circuits, switches and equipment as required for lighting, ventilation and HVAC equipment within swimming pool Mechanical Room as required by code, shown on the Drawings, and herein specified.

D. The Electrical Subcontractor shall furnish and install all conduits, conductors, panels, circuits, switches and equipment for area lighting as required by code, shown on the Drawings, and herein specified.

E. All equipment, material and installation shall be as required under Division 16 of the Specifications and shall conform to NEC Article 680 (latest revision), State and Local Codes, and as may be required by all authorities having jurisdiction over swimming pool construction within the State of Washington.

F. The Electrical Subcontractor shall provide a representative at time of swimming pool start-up to coordinate work related to swimming pool system(s).

1.8 INTENT

A. It is the intention of these specifications and Drawings to call for finished work, tested and ready for operation. Wherever the word “provide” is used, it shall mean “furnish and install complete and ready for use.”

B. Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the work, the same as if herein specified or shown.

1.9 SCHEDULE OF VALUES

A. Provide a Schedule of Values for all work specified in each of the technical specifications listed in the table below, regardless of whether the work is performed by the swimming pool contractor or others. Values listed shall be fully burdened, with contractor general conditions, overhead, profit and bonds included. Payments for swimming pool work completed shall not be approved until Schedule of Values has been submitted to and approved by Architect.

SWIMMING POOL SCHEDULE OF VALUES			
No.	**Section #**	**Description**	**Value**
1.	131101	Swimming Pool Excavation	
2.	131102	Swimming Pool Concrete	
3.	131104	Swimming Pool Ceramic Tile	
4.	131105	Swimming Pool Waterproofing	
5.	131106	Swimming Pool Equipment	
6.	131107	Swimming Pool Mechanical	
7.	131108	Swimming Pool Electrical	
8.	131109	Prefabricated Swimming Pool	
Total			

1.10 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Subcontractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing submittals with performance construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for schedules performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for re-submittals as follows. Time for review shall commence on Architect's receipt of submittal.

1. Initial Review: Allow fifteen (15) days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contract when a submittal being processed must be delayed for coordination.
2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow twenty-one (21) days for initial review of each submittal.
3. Direct Transmittal to Consultant: Where the Contract Documents indicate that submittals may be transmitted directly to Architect's consultants, provide duplicate copy of transmittal to Architect. Submittal will be returned to Architect before being returned to Subcontractor.
4. If intermediate submittal is necessary, process it in same manner as initial submittal.
5. Allow fifteen (15) days for processing each submittal.
6. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

E. Identification: Place a title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on title block.
2. Provide a space on title block to record Subcontractor's review and approval markings and action taken by Architect.
3. Include the following information on title block for processing and recording action taken: (See Attached Sample)
    a. Project name.
    b. Date.
    c. Name and address of Subcontractor.
    d. Name of Subcontractor.
    e. Name of Supplier.
    f. Name of Manufacturer.
    g. Unique identifier, including revision number.
    h. Number and title of appropriate Specification Section.
    i. Drawing number and detail references, as appropriate.
    j. Other necessary identification.

SUBMITTAL FOR:	SUBMITTAL TO:	SUBCONTRACTOR:

Item Number: _____
Section Number: _____
Section Description: _____
Subcontractor: _____
Supplier: _____
Manufacturer: _____
Product Code: _____
Quantity: _____

Subcontractor Certification:

It is hereby certified that the equipment or material designated in this submittal is proposed to be incorporated in the above named project and is in compliance with the contract drawings and / or specifications and is submitted for approval.

Certified by: _____

Date: _____

Job Superintendent: _____

Revisions: _____

Contractor's Submittal Stamp:

Architect's Review Stamp and Comments

F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract documents on submittal.

G. On all catalogue or cut sheets identify which model or type is being submitted.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Product data and shop drawings shall be packaged within a three ring binder and colored samples shall be packaged on a heavy cardboard. Transmit each submittal using a transmittal form.

1. On an attached separate sheet, prepared on Subcontractor's letterhead, record relevant information, request for data, revisions other than those requested by Architect on previous submittals and deviations from requirements of the Contract documents, including minor variations and limitations. Include the same label information as the related submittal.
2. Include Subcontractor's certification stating that information submitted complies with requires of the Contract Documents.
3. Transmittal Form: Provide locations on form for the following information:
   a. Project name.
   b. Date.
   c. Destination (To:).
   d. Source (From:).
   e. Names of Subcontractor, manufacturer, and supplier.
   f. Category and type of submittal.
   g. Submittal purpose and description.
   h. Remarks.

I. Distribution: Furnish copies of final submittals to manufacturers, Subcontractors, suppliers, fabricators, installers, authorities having jurisdiction and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

1.11 SUBSTITUTIONS

A. To obtain approval to use unspecified products, bidders shall submit requests for substitution at least ten (10) days prior to bid date. Requests shall only be considered if they clearly describe the product for which approval is asked, including all data necessary to demonstrate acceptability. All unspecified products and equipment will be considered on an “or equal” basis at the discretion of the Designated Representative. Requests for substitution received after the specified deadline will not be considered. Where a conflict exists between the requirements of the General Conditions / Special Conditions / Division 1 concerning substitutions and the requirements of this Article, this Article (Section 13 11 00, Article 1.10) shall govern.

B. Where the Swimming Pool Subcontractor proposes to use an item of equipment other than that specified or detailed on the Drawings which requires any redesign of the structure, partitions, foundations, piping, wiring, or any other part of the architectural, mechanical, or electrical layout, all such redesign and all new drawings (stamped by Washington Licensed Engineer) and detailing required shall be prepared by the Swimming Pool Subcontractor, at their own expense, submitted for review and approval by the Designated Representative prior to bid.

C. Where such approved deviation requires a different quantity and arrangement of piping, supports and anchors, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Swimming Pool Subcontractor shall furnish and install any such piping, structural supports,

controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

1.12 SURVEYS AND MEASUREMENTS

A. The Swimming Pool Subcontractor shall base all measurements, both horizontal and vertical, from benchmarks established by the Contractor. All work shall agree with these established lines and levels. The mechanical Drawings do not give exact details as to elevations of piping, exact locations, etc. and do not show all offsets, control lines, pilot lines and other installation details. Verify all measurements at site and check the correctness of same as related to the work.

1.13 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of the systems and work included in the Subcontractor. Drawings are not to be scaled. The architectural drawings and details shall be examined for exact dimensions. Where they are not definitely shown, this information shall be obtained from the Designated Representative.

1.14 SWIMMING POOL SUBSUBCONTRACTOR

A. The swimming pool construction work as herein described and specified in Division 13 of the Project Manual shall be the complete responsibility of a qualified and specifically licensed (C-53 license classification within the State of Washington) Swimming Pool Subcontractor with extensive experience in commercial public use swimming pool installations.

B. The Contractor shall require the Swimming Pool Subcontractor to furnish to the Contractor performance and payment bonds in the amount of 100% of the Swimming Pool Subcontractor's bid written by a surety Company properly registered in the State of Washington and listed by the U.S. Treasury. The expense of the bond(s) is to be borne by the Subcontractor. The Contractor shall clearly specify the amount and requirements of the bond(s) in the Contractor's written or published request for subbids. The Contractor's written or published request for subbids shall also specify that the bond(s) expense is to be borne by the Subcontractor.

C. Subcontractor certifies that it meets the qualifications and experience requirements established in Swimming Pool General Requirements, Section 13 11 00, as follows:

1. Subcontractor has derived 50% of its annual revenue from public-use swimming pool construction for each of the last five (5) years.
2. Subcontractor has, in the last five (5) years, constructed at least five (5) commercially designed municipal and public-use swimming pools, each of which have incorporated a minimum size of 6,000 square feet of water surface area with a concrete and ceramic tile perimeter overflow gutter and self-modulating balance tank.
3. The following list of projects meet the requirements of section (b) above and the contact as reference by the Contractor, the Awarding Authority of their agent or designee.

a. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

b. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

c. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

d. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

e. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

D. Swimming Pool Deck Subcontractor other than the swimming pool Subcontractor certifies that it meets the qualifications and experience requirements established in Swimming Pool General Requirements, Section 13 11 00, as follows:

1. Subcontract has, in the last five (5) years, constructed at least five (5) commercially designed cantilevered pool decks over perimeter gutters, each of which have incorporated a minimum size of 6,000 square feet of water surface area of the swimming pool.
2. The following list of projects meet the requirements of section (b) above and the contact as reference by the Contractor, the Awarding Authority of their agent or designee.

SWIMMING POOL DECK SUBCONTRACTOR

a. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

b. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

c. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

d. Owner: _____

Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

e. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

1.15 OPERATING INSTRUCTIONS

A. The Swimming Pool Subcontractor shall determine from actual samples of pool water supplied by the Owner, the proper water management program necessary for maximum operating efficiency and comfort. The Swimming Pool Subcontractor shall provide the services of experienced personnel familiar with this type of pool system operation, in conformance with Section 13 11 05 of the Specifications.

1.16 MAINTENANCE MANUALS

A. The Swimming Pool Subcontractor shall provide six (6) bound sets for delivery to the Designated Representative of instructions for operating and maintaining all systems and equipment included in this Contract. Manufacturer's advertising literature or catalog pictures will not be acceptable for operating and maintenance instructions.

B. Bound in ring binders shall be all parts lists, periodic maintenance instructions and troubleshooting guidelines for all pool equipment, including but not limited to filters, pumps, controllers, water chemistry control equipment, etc.

1.17 SECURE FROM THE OWNER

A. A complete Owner-furnished filling of the swimming pools.

B. The Owner's assistance, as specified herein, from the time of start-up until final written acceptance of the swimming pool system(s).

C. Chemicals as required for swimming pool operation after Swimming Pool Subcontractor completes initial water chemistry balance and water treatment during the maintenance period described in Section 13 11 05 of the Specifications.

1.18 WARRANTY

A. The Swimming Pool Subcontractor shall warrant all swimming pool structures, finishes and systems against defects in material and workmanship for a period of one year after the date of acceptance by the Owner. Any repair or replacement required due to defective material or workmanship will be promptly corrected by the Swimming Pool Subcontractor.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 13 11 00

13 11 01 – SWIMMING POOL EXCAVATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Finish and fine grading to bring the surface of the ground to the required grades and elevations as indicated on the Drawings.

B. Subgrade improvements and placing of compacted fills.

C. Excavation and backfill for all swimming pools, including footings, foundations, slabs and walls.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Conform with requirements of the General Conditions, and more specifically the following:

1. Comply with International Building Code, 2022 edition.
2. Comply with applicable construction safety orders, latest edition, Federal and State OSHA.
3. Comply with applicable trench safety provisions, latest edition, Federal and State OSHA.

B. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

C. Project/Site Conditions:

1. Be familiar with site and subsurface conditions.
2. Excavation is unclassified and includes excavation to sub-grade elevations indicated or necessary, regardless of character of materials and obstructions encountered.
3. Provisions for mitigation of wet soils due to seepage or rain shall be made during excavation and throughout construction. If wet soils are encountered within the swimming pool excavations, de-watering shall be provided and the Geotechnical Engineer shall make recommendations for moist soil mitigation.
4. Where slope instability is encountered, all excavations within those areas shall be 1:1 or flatter. Forming of vertical walls may be necessary, and all soil conditions shall be field verified by the Geotechnical Engineer.
5. Contractor shall review the Geotechnical Investigation Report as furnished by the Owner to determine the suitability of the soils.
6. Refer to General Conditions, Articles 3.17 and 3.18.

D. Adverse Weather Conditions:

1. During the periods when site soil moisture content is substantially in excess of moisture content required for optimum compaction, do not perform fill compaction.
2. When unfavorable weather conditions necessitate interrupting filling and grading operations, prepare areas by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with requirements of Section 01 33 00. Requests for substitution shall conform to requirements of Article 1.10.A of Section 13 11 00.

B. Required submittals include:

1. Offsite fill material, if applicable.

C. Submit proof of qualifications as specified in Article 1.2.B of this Section.

1.4 EXCAVATING & TRENCHING, GENERAL REQUIREMENTS

A. Refer to Section 01 50 00, Temporary Facilities and Controls.

B. All trenches, holes, etc. are to be completely protected using solid barricades, steel plates, and plywood both during construction and during off hours, including night time.

C. Flashing warning light barricades are required on sidewalks, roads, and any other critical areas that require night time protection.

D. Roads, paths and sidewalks shall not be blocked at any time or in any way. Trenching across roads, paths or sidewalks involves special instructions and review of the construction procedure by the Owner at least three (3) days prior to the Work actually being started.

E. Construction equipment, including all trucks, cars, etc. shall not be parked or driven on roads, paths or sidewalks. Items not allowed on roads, paths or sidewalks include hoses, power cords, ropes, construction materials, dirt and debris, etc.

F. All roads, paths and sidewalks must remain clear and the Contractor shall maintain temporary safe and effective pedestrian access at all times.

G. Drawings show existing major underground utilities using the best information available. The Contractor shall also fully check public works reference drawings prior to excavation. Call local Dig Alert to locate utilities to ensure safety.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill Material, General: All material shall be subject to the review of the Geotechnical Engineer to determine acceptability.

B. All vegetation, trees and roots larger than ¼-inch diameter or any accumulation of organic matter that will result in an organic content of more than 3 percent should be removed and not used as engineered fill. Roots larger than ¼-inch diameter should not be disced into the soils. These materials should be raked and hand-picked, as necessary, to ensure proper removal of organic materials.

C. On-site Fill Material: The on-site native soil may not be suitable for use as structural fill. Due to the variability of fines content, our experience, and laboratory testing, the on-site soil will be sensitive to small changes in moisture content and may be difficult, if not impossible, to compact adequately during wet weather or when its moisture content is more than a few percentage points off optimum. However, this soil may require extensive wetting if it is used as structural fill. We recommend using imported granular material for structural fill if the appropriate moisture content of the on-site soil cannot be achieved. A determination must be made before their use by the Geotechnical Engineer.

D. Imported Fill Material: Imported material can be used as structural fill. Pool slab underlayment shall consist of Crushed Surfacing Base Course or Crushed Surfacing Top Course as outlined in the most recent edition of the State of Washington Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications), or approved equal verified by the geotechnical engineer of record.

E. Trenches and other areas proposed for the waterline should be backfilled utilizing material that conforms to Section 9-03.12(3) Gravel Backfill for Pipe Zone Bedding as outlined in the most recent edition of WSDOT Standard Specifications.

F. All granular material must be durable such that there is no degradation of the material during and after installation as structural fill. The percentage of fines can be increased to 12 percent if the fill is placed during dry weather and provided the fill material is moisture conditioned, as necessary for proper compaction. The material should be placed in lifts with a maximum uncompacted thickness of 8 inches and compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D 1557. During the wet season or when wet subgrade conditions exist, the initial lift should have a maximum thickness of 15 inches and should be compacted by rolling with a smooth-drum, non-vibratory roller.

G. Gravel Back Fill at Pool Structure

1. All backfill in contact with or within the clear zone of the Myrtha structure, as defined by the area pool side of a vertical plane at the furthest structural support, will consist of material, be placed and compacted per the manufacture's specifications. This associated material shall be what is commonly referred to as a self-compacting pea gravel with the following basic characteristics.
   a.
   b. Well drained
   c. Cohesionless material
   d. Average grain size of less than 1"
   e. Consistently even distribution
   f. Self-compacting in nature
   g. Clean and washed
   h. Smooth non-angular surface

2. Approval of suitable contractor selected materials for this specialized backfill will be the sole discretion of the manufacturer. The material shall be placed in one-foot lifts around the perimeter of the structure in such a manner that the grains naturally compact. No heavy vibratory or mechanical compaction shall occur within the aforementioned "clear zone". Walk behind skid compactors or similar apparatus are permissible. Special

attention should be taken *to ensure the backfill does not sluff* away from the panel at horizontal protrusions such as gutters, skimmer boxes, buttresses, etc. Refer to structural engineering drawings and specifications; as well as all geotechnical recommendations for other backfill and compaction procedures and requirements for the project. Any conflicts between this specialized requirement and the general earthwork specifications and drawings will be brought to the attention of the engineer of record during the bidding process. No perceived conflicts will be considered justification to a change to the base contract unless specifically expressed during the bidding process. The installing contractor is responsible for any damage or misalignment of the panels or structure resulting from the improper installation of these specific backfill requirements.

3. The intent of this specification on the backfill is to ensure the following:
   a. To ensure that mechanical compaction does not occur in proximity to the panel
   b. To guaranty that unclean or angular fill is not utilized that could damage the panels
   c. To provide a well-drained porous material behind the panels so that undue water pressure does not develop
   d. To reduce the potential for deformation of the struts/buttresses; as well as dislodging of the bolted connections

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify drawing dimensions and elevations with actual field conditions. Inspect related Work and adjacent surfaces and report discrepancies and conditions which prevent proper execution of the Work to the Owner's Representative.

3.2 SUBGRADE IMPROVEMENTS

A. Clearing: Strip site area (as defined within the Drawings) of any topsoil containing vegetation, trees and roots, organic matter, and other debris, and dispose of as specified.

B. Placement of Fills: Place fill, consisting of approved soils, clean and free of all vegetation, debris, and rocks larger than three (3) inches, in uniform six (6) inch lifts. Fill to be compacted at optimum moisture to ninety-five percent (95%) maximum density with approved mechanical compaction equipment.

3.3 EXCAVATION

A. Checking Layout: Contractor shall, before commencing the excavation work, check all lines, stakes and levels for dimensions, angles, elevations and grades with the survey.

B. Over-Excavation:

1. Any overexcavation that may be required shall be per Geotechnical Engineering Report and subject to Geotechnical observation for any onsite conditions. Prior to placing fill, the subgrade exposed by the overexcavation should be scarified to a depth of at least eight (8) inches, moisture-conditioned to at least three percent (3%) above optimum moisture content, and compacted to at least ninety percent (90%) relative compaction.
2. Excavate for footings, foundations, grade beams and slabs to depths indicated on Drawings. Elevations and depths of excavations shown on the Drawings shall govern and will be basis for bidding and execution of work except as otherwise may be directed by the

Owner's Representative. Greater or lesser quantities of excavation and backfill required by authorized instructions shall be adjusted in accordance with the General Conditions.

3. In areas where proposed swimming pool decking is anticipated, the site should be excavated to a depth of one (1) foot below existing grade and backfilled with compacted engineered fill. The intent of this recommendation is to remove soils susceptible to compressibility.
4. Except where extra excavation is directed by the Owner's Representative or Geotechnical Engineer, excavations made to a greater depth or size than indicated or required shall be filled with concrete or shotcrete as specified in Sections 13 11 02 / 13 11 03.

C. Dimensions: Excavate to proper dimensions as shown, cut square and smooth with firm level bottoms. Prepared excavations shall be approved by Geotechnical Engineer. Excavations shall be free of loose or disturbed materials.

D. Excess Water Control: Keep all excavations free from standing water by pumping, draining or providing proper protection against water intrusion. If soil becomes soft, soggy or saturated, perform additional excavation to firm soil not affected by water.

E. Form Removal: Make all excavations of sufficient size to permit installation and removal of forms and all other required work.

F. Alternate Forming: Sides of structures may be formed by neat excavations where banks will stand without caving. If banks cave, provide forming as required and widen excavation to permit forming, bracing and inspection. Provide forming in conformance with Section 13 11 02 and all recognized safety standards. Form all grade beams.

3.4 SLAB AND POOL UNDERLAYMENT

A. Structural slabs and pool areas should have select fill placed and compacted prior to concrete placement.

B. To provide better long-term performance the pool areas shall be over-excavated 12 inches and 12 inches of structural fill conforming to WSDOT standard specifications.

3.5 BACKFILLING

A. Method: After concrete has been placed, forms removed and concrete work approved, backfill the excavations with earth to indicated or required grades. Carry on backfilling simultaneously on each side of walls or grade beams. Remove all rubbish and wood from the excavations before placing backfill.

B. Concrete Protection: Prior to placing any backfill, adequately cure all concrete and provide any bracing required to ensure the stability of the structure. Protect waterproofing and dampproofing against damage in a manner acceptable to the Owner's Representative. Remove bracing as backfill operations progress.

C. Material: Use the material from the excavations for backfilling, subject to approval by Soils Testing Agency. The earth shall be free from debris, large clods or stones.

D. Lifts: Place backfill in six (6) inch loose layers, bring to optimum moisture content and compact to ninety percent (90%) of maximum density, sloping down and away from the structures being backfilled.

E. Moisture: Rigidly control the amount of water used to insure optimum moisture conditions for the type of fill material used. Excessive amounts of water causing saturation of earth will not be permitted. Compaction by flooding or jetting is prohibited.

F. Placing Gravel Back Fill at Pool Structure

1. The material shall be placed in one foot lifts around the perimeter of the structure in such a manner that the grains naturally compact.
2. No heavy vibratory mechanical compaction equipment shall be used within the aforementioned “clear zone”.
3. Walk behind skid compactors or similar apparatus are permissible. Special attention should be taken to ensure the backfill does not sluff away from the panel at horizontal protrusions such as gutters, skimmer boxes, buttresses, etc. Use of compaction equipment must be coordinated with the pool manufacturer and Geotechnical Engineer.
4. Refer to Aquatics structural engineering drawings and specifications; as well as all geotechnical recommendations for other backfill and compaction procedures and requirements for the project.
5. Any conflicts between this specialized requirement and the general earthwork specifications and drawings will be brought to the attention of the engineer of record during the bidding process.
6. No perceived conflicts will be considered justification to a change to the base contract unless specifically expressed during the bidding process.
7. The installing contractor is responsible for any damage or misalignment of the panels or structure resulting from the improper installation of these specific backfill requirements

3.6 GRADING

A. Slopes: Grade to finish grades indicated on Drawings, with uniform slopes between all points.

B. Subgrades: Blade to required grade and roll or tamp subgrades for exterior slabs, decks and paving.

3.7 CLEAN-UP

A. Disposal: Haul away rubbish, debris, and rocks from site promptly and dispose of legally. Burning rubbish on site is prohibited.

B. Dust and Noise Abatement: During entire period of construction keep area and material being loaded sprinkled to reduce dust in air and annoyance to premises and surrounding property.

END OF SECTION 13 11 01

13 11 02 – SWIMMING POOL CONCRETE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Forming for cast-in-place concrete and shotcrete associated with swimming pools.

B. Reinforcement for cast-in-place concrete and shotcrete associated with swimming pools.

C. Cast-in-place concrete for swimming pool structures. Do not use waterproofing admixture of any kind.

D. Provide labor, materials and equipment as required to install sealant for all pool deck expansion joints, or any other caulking, as indicated on the aquatic Drawings and herein specified.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years' experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years' experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards:

1. In addition to complying with the International Building Code, latest edition, ACI-318-19, comply with all pertinent recommendations contained in "Guide to Formwork for Concrete" Publication ACI 347R-14 of the American Concrete Institute.
2. In addition to complying with the International Building Code, latest edition, comply with all pertinent recommendations contained in "Guide to Presenting Reinforcing Steel Design Details," Publication ACI 315R-18 of the American Concrete Institute.
3. In addition to complying with all local codes and regulations, comply with all pertinent recommendations contained in American Society for Testing and materials (ASTM); ASTM C 920 "Standard Specification for Elastometric Joint Sealants."

C. Tolerances: Construct all swimming pool concrete straight, true, plumb and square within a tolerance horizontally and vertically of 1/8" in total distance.

1.3 SUBMITTAL AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00. Requests for substitution shall conform to requirements of Article 1.10.A of Section 13 11 00.

B. Samples and Certificates, Concrete Reinforcement:

1. Provide all data and access required for testing as described in Section 01 45 00 of the Specifications.
2. All material shall bear mill tags with heat number identification. Mill analysis and report shall be made available upon request.
3. Material not so labeled and identifiable may be required by the Owner to be tested by the testing laboratory selected by the Owner and at no additional cost to the Owner, in which case random samples will be taken for one series of tests from each 2-1/2 tons or fraction thereof of each size and kind of reinforcing steel.
4. Design mix from batch plant demonstrating previous use history and associated strengths at 28 days.
5. The Contractor shall submit a mix design stamped and signed by a licensed engineer for approval by the Owner's Representative prior to any placement of concrete.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

D. Submit reinforcing shop drawings for pool walls, floors and dike walls, etc. as shown on the construction drawing.

1.4 PRODUCT HANDLING

A. Delivery: Deliver materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project Site.

C. Protection: Use all means necessary to protect the swimming pool concrete before, during, and after installation and to protect the installed Work specified in other Sections.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner.

PART 2 - PRODUCTS

2.1 CONCRETE FORMWORK

A. Form Materials:

1. Form Lumber: All form lumber in contact with exposed concrete shall be new except as allowed for reuse of forms in Part 3 of this Section, and all form lumber shall be one of the following, a combination thereof, or an equal approved in advance by the Owner's Representative.
   a. "Plyform," Class I or II, bearing the label of the Douglas Fir Plywood Association; "Inner-Seal" Form as manufactured by Louisiana-Pacific, or approved equal.
   b. Douglas Fir-Larch, number two grade, seasoned, surfaced four sides.
2. Form Release Agent: Colorless, non-staining, free from oils; chemically reactive agent that shall not impair bonding of paint or other coatings intended for use.

B. Ties and Spreaders:

1. Type: All form ties shall be a type which do not leave an open hole through the concrete and which permits neat and solid patching at every hole.

2. Design: When forms are removed, all metal reinforcement shall be not less than two (2) inches from the finished concrete surface.
3. Wire Ties and Wood Spreaders: Do not use wire ties or wood spreaders.

C. Alternate Forming Systems: Alternate forming systems may be used subject to the advance approval of the Owner's Representative.

2.2 CONCRETE REINFORCEMENT

A. Bars: Bars for reinforcement shall conform to "Specifications for Deformed Billet Carbon-Steel Bars for Concrete Reinforcement," ASTM A-615, Grade 60.

B. Wire Fabric: Wire fabric shall conform to "Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete", ASTM A1064.

C. Tie Wire: Tie wire for reinforcement shall conform to "Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete", ASTM A1064 black annealed 16-gauge tie wire.

2.3 CAST-IN-PLACE CONCRETE

A. Concrete:

1. All concrete, unless otherwise specifically permitted by the Owner's Representative, shall be transit-mixed in accordance with ASTM C94. Concrete for water retaining structures that do not receive a waterproofing finish such as ceramic tile or swimming pool plaster shall receive a topical waterproofing finish.
2. The control of concrete production shall be under the supervision of a recognized testing agency, selected by the Owner in accordance with Section 01 25 00 of the Specifications.
3. Quality: All concrete shall have the following minimum compressive strengths at twenty-eight (28) days and shall be proportioned within the following limits
   a. 4,000 psi minimum compressive strength for cast-in-place swimming pool structures.
   b. 1" maximum size aggregate.
   c. 6.0 minimum sacks of cement per cubic yard. *
   d. Maximum water to cement ratio of 0.40 minimum-0.45 maximum.
   e. 4" maximum slump.
   *For estimate only: to be determined by mix design.
4. Cement: All cement shall be Portland Cement conforming to ASTM C-150, Type II or V and shall be the product of one manufacturer.
5. Aggregates:
   a. Shall conform to "Standard Specifications for Concrete Aggregates," ASTM C33, except as modified herein.
   b. Coarse Aggregate: Clean sound washed gravel or crushed rock. Crushing may constitute not more than 30% of the total coarse aggregate volume. Not more than 5% flat, thin, elongated or laminated material nor more than 1% deleterious material shall be present. 1" aggregate graded from 1/4" to 1", fineness modulus 6.90 to 7.40. 1-1/2" graded from ½" to 1-1/2", fineness modulus 7.80 to 8.20.
   c. Fine Aggregate: Washed natural sand of hard, strong particles and shall contain not more than 1% of deleterious material, fineness modulus 2.65 to 3.05.
   d. Aggregate must be certified, non-expansive from a "known" good source.
6. Water: ASTM C1602 Clean, fresh, free from acid, alkali, organic matter or other impurities liable to be detrimental to the concrete (potable).

7. Admixtures: Admixtures shall be used upon approval of the Owner's Representative.
   a. Air-entraining admixture: Conform to ASTM C260.
   b. Water-reducing admixture: Conform to ASTM C494.

B. Construction Joints: Use keyform for slab pour joints. Either preformed galvanized or PVC construction joint forms of a standard manufacturer may be used. Install per manufacturer's recommendations and tool edges of slabs.

C. Waterstops: PVC bulb-type for use between concrete pours / lifts, conforming with ASTM D 570, D 624, and D 638. Provide in configuration(s) as recommended by manufacturer for specific application. Greenstreak, W.R. Meadows, or approved equal.

D. Curing Materials:

1. Liquid Membrane (covered slab): Chlorinated rubber membrane forming, curing-sealing compound conforming to ASTM C309.
2. Liquid Membrane (exposed slab): Clear methyl and butyl methacrylate non-staining, membrane forming, curing-sealing compound conforming to ASTM C309.

E. Cement Grout and Drypack:

1. Cement Grout: Mix 1 part by volume of Portland Cement, 1/2 part by volume of water and fine aggregate enough to make mixture flow under its' own weight.
2. Drypack: Mix 1 part by volume of Portland Cement, 1/2 part by volume of water and fine aggregate enough to make a stiff mix that will mold into a ball. Mix no more than can be used in 30 minutes.

2.4 JOINT SEALANT MATERIALS

A. Caulking: Multipart, non-sag gun grade polyurethane based sealant meeting the requirements of ASTM C920-02, Type S or M, Mamemco International, Pecora, Sika Corp., Sonneborn Building Products, Tremco or approved equal. Self-leveling caulking materials are not allowed.

B. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

C. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

D. Sealant Backer Rod: Provide compressible polyethylene or polyurethane backer rod as recommended by the sealant manufacturer.

E. Bond Breaker Tape: Provide polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant.

F. Sand: Cover the surface of the caulking with #30 silica sand.

2.5 OTHER MATERIALS

A. All other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by the Contractor subject to the advance review by the Owner’s Representative.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to all Work of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that all Work may be constructed in accordance with all applicable codes and regulations, the referenced standards, the original design, and in accordance with site specific Geotechnical Report.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive work.

3.2 CONCRETE FORMWORK

A. Construction of Forms:

1. General: Construct all required forms to be substantial, sufficiently tight to prevent leakage of concrete paste, and able to withstand excessive deflection when filled with wet concrete.
2. Layout:
   a. Form for all required cast-in-place concrete to the shapes, sizes, lines and dimensions indicated on the Drawings.
   b. Exercise particular care in the layout of forms to avoid necessity for cutting concrete after placement.
   c. Make proper provisions for all openings, offsets, recesses, anchorages, blocking and other features of the Work as shown or required.
   d. Perform all forming required for Work of other trades and do all cutting and repairing of forms required to permit such installation.
   e. Carefully examine the Drawings and Specifications and consult with other trades as required relative to providing for pipe and conduit penetrations, reglets, chases and other items in the forms.
3. Imbedded Items: Set all required steel frames, angles, bolts, inserts and other such items required to be anchored in the concrete prior to concrete being placed.
4. Bracings:
   a. Properly brace and tie the forms together so as to maintain position and shape and to ensure safety to workmen.
   b. Construct all bracing, supporting members and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.
   c. Properly space the forms apart and securely tie them together, using metal spreader ties that give positive tying and accurate spreading.
5. Wetting: Keep forms sufficiently wetted to prevent joints from opening up before concrete is placed.

B. Plywood Forms:

1. Design: Nail the plywood panels directly to studs and apply in a manner to minimize the number of joints.
2. Joints: Make all panel joints tight butt joints with all edges true and square.

C. Footing Forms:

1. Wood Forms: All footing forms shall be wood unless otherwise specifically approved by the Owner's Representative, or as specified in paragraph 3.2(C)(2).
2. Earth Forms:
   a. Side walls for footings may be of earth provided the soil will stand without caving and the sides of the bank are made with a neat cut to the minimum dimensions indicated on the Drawings.
   b. For excavation and backfill of earth forms, conform with applicable provisions of Section 13 11 01.

D. Reuse of Forms:

1. Reuse of forms shall be subject to advance approval of the Owner's Representative.
2. Except as specifically approved in advance by the Owner's Representative, reuse of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.
3. Except as specifically approved in advance by the Owner's Representative, reuse of forms shall in no way impart less structural stability to the forms nor less acceptable appearance to finished concrete.

E. Removal of Forms:

1. General:
   a. In general, side forms of footings may be removed seven (7) days after placement of concrete, but time may be extended if deemed necessary by the Owner's Representative.
   b. Forms for footings, foundations, grade beams, slabs, walls, and other formed concrete may be removed fourteen (14) days after placement of concrete.
2. Removal:
   a. Use all means necessary to protect workers, passersby, the installed Work of other trades and the complete safety of the structure.
   b. Cut nails and tie wires or form ties off flush, and leave all surfaces smooth and clean.
   c. Remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surface and pointing up and rubbing the resulting pockets to match the surrounding areas.
   d. Flush all holes resulting from the use of spreader ties and sleeve nuts using water, and then solidly pack throughout the wall thickness with cement grout applied under pressure by means of a grouting gun; grout shall be one part Portland Cement to 2-1/2 parts sand; apply grout immediately after removing forms.

3.3 CONCRETE REINFORCEMENT

A. Bending:

1. General:
   a. Fabricate all reinforcement in strict accordance with the Drawings.
   b. Do not use bars with kinks or bends not shown on the Drawings.

c. Do not bend or straighten steel in a manner that will injure the material. (When opposite end is already encased in concrete.)

2. Design:
   a. Bend all bars cold.
   b. Make bends for stirrups and ties around a pin having a diameter of not less than two (2) times the minimum thickness of the bar.
   c. Make bends for other bars, including hooks, around a pin having a diameter of not less than six (6) times the minimum thickness of the bar.

B. Placing:

1. General: Before the start of concrete placement, accurately place all concrete reinforcement, positively securing and supporting by concrete blocks, metal chairs or spacers, or by metal hangers.
2. Clearance:
   a. Preserve clear space between bars of not less than one and one-half (1-1/2) times the nominal diameter of the round bars.
   b. In no case let the clear space be less than one and one-half (1-1/2) inches nor less than one and one-third (1-1/3) times the maximum size of the aggregate.
   c. Provide the following minimum concrete covering of reinforcement:
      1) Concrete deposited against earth: three (3) inches minimum.
      2) Concrete below grade deposited against forms: two (2) inches minimum.
      3) Concrete elsewhere: As indicated on Drawings or otherwise approved by the Owner's Representative.
3. Splicing:
   a. Horizontal Bars:
      1) Place bars in horizontal members with minimum lap at splices sufficient to develop the strength of the bars.
      2) Bars may be wired together at laps except at points of support of the member, at which points preserve clear space described above.
      3) Whenever possible, stagger the splices of adjacent bars.
      4) Splice forty (40) bar diameters minimum.
      5) Provide non-contact lap slices for shotcrete.
   b. Wire Fabric: Make all splices in wire fabric at least one and one-half (1-1/2) meshes wide.
   c. Other Splices: Make only those other splices that are indicated on the Drawings or specifically approved by the Owner's Representative.
4. Dowels: Place all required steel dowels and securely anchor them into position before concrete is placed.
5. Obstructions: In the event conduits, piping, inserts, sleeves and other items interfere with placing reinforcement as indicated on the Drawings or otherwise required, immediately consult with the Owner's Representative and obtain approval of a new procedure prior to placing concrete.

C. Cleaning Reinforcement: Steel reinforcement, at the time concrete is placed around it, shall be free from rust scale, loose mill scale, oil, paint and all other coatings which will destroy or reduce the bond between steel and concrete. Bend down all tie wire away from the top of the pool concrete. Maintain a 2" clear from top of concrete to the tie wire.

3.4 SHOTCRETE REINFORCEMENT

A. Shotcrete reinforcement shall be in accordance with the requirements of ACI 318-19, along with the provisions of ACI 506R and ACI 506.2. For parallel nonprestressed reinforcement in shotcrete members, the clear spacing between bars shall be at least the greater of 6 bar diameters and 2-

1/2 in. Where two curtains of reinforcement are provided, the clear spacing between bars in the curtain nearer the nozzle shall be at least 12 bar diameters; the clear spacing between bars in the remaining curtain shall be at least the greater of 6 bar diameters and 2-1/2 in. Adequate encasement of bars larger than No. 5 shall be demonstrated by a preconstruction test shotcrete mockup panel.

B. Subject to the approval of the building official, it shall be permitted to use a clear spacing that does not meet the clear spacing provisions listed above provided that shotcrete mockup panels are used to demonstrate the proper reinforcement encasement in accordance with the following:

1. The shotcrete mockup panels shall be representative of the most complex reinforcement configurations to be encountered.
2. The licensed design professional shall specify the shotcrete mockup panel quantity, frequency of shooting per nozzleman and member type, and panel thickness to verify reinforcement encasement.

C. Non-contact lap splices for reinforcement in shotcrete shall have clear spacing in accordance with the following:

1. For No. 6 and smaller bars, the clear spacing between bars shall be at least greater of 6 bar diameters and 2-1/2” in.
2. For No. 7 and larger bars, the clear spacing shall be established using a shotcrete mockup panel to demonstrate that the reinforcement is properly encased.
3. Subject to the approval of the building official, contact lap splices for reinforcement in shotcrete shall be oriented with the plane of the spliced bars perpendicular to the surface of the shotcrete and approved by the licensed design professional based on a shotcrete mockup panel to demonstrate that the reinforcement is properly encased.

3.5 CAST-IN-PLACE CONCRETE

A. Conveying and Placing Concrete:

1. Before placing concrete, mixing and conveying equipment shall be well cleaned, and the forms and space to be occupied by concrete shall be thoroughly cleaned and wetted. Ground water shall be removed until the completion of the work.
2. No concrete shall be placed in any unit of work until all formwork has been completely constructed, all reinforcement has been secured in place, all items to be built into concrete are in place, and form ties at construction joints tightened.
3. Concrete shall be conveyed from mixer to place of final deposit in such a way to prevent the separation or loss of ingredients. It shall be placed as nearly as practicable in its’ final position to avoid rehandling or flowing. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six (6) feet. Use tremies, spouts and dump boxes in deep sections. Vibrators are not acceptable for facilitating concrete transport.
4. Concrete shall be tamped and spaded to insure proper compaction into all parts of forms and around reinforcement. A mechanical vibrator shall be used to thoroughly compact the concrete. Vibration must be by direct action in the concrete and not against forms or reinforcement.
5. Mixing and transport time as indicated in ASTM C94 is required. If air temperatures are between 85° and 90° F the delivery time is to be reduced to 75 minutes. When air temperatures are in excess of 90° F the delivery time should be reduced to 60 minutes.
6. Truck mixes without batch certificates will be rejected.

B. Construction Joints / Expansion Joints: Construction joints and expansion joints shall be provided at locations and in the manner shown on the Drawings. With exception of existing concrete / new shotcrete joints, use PVC bulb-type waterstops appropriate for design condition between all concrete pours / lifts to avoid cold joints. Waterstops shall be placed in such a way to protect reinforcing steel from rust and oxidation. All expansion joints must be the full depth of the concrete section in which they are located.

C. Slab Finishes: Concrete slabs shall be compacted and screeded uniformly to grades shown. Push large aggregates below the surface with a screen tamper, screed and bull float. As soon as the surface becomes workable, it shall be wood floated, then finished as indicated on the Drawings to a uniform smooth, true surface in a neat and workmanlike manner. Carefully coordinate slab finish requirements with other trades (ceramic tile, pool plaster) to insure concrete finish is appropriate substrate for final finish material.

1. Pool Floor Slab: Heavy Wire Broom Finish.

D. Protection and Curing:

1. Concrete shall be protected from injurious action of the elements and defacement of any nature during construction.
2. All forms must be kept wet to prevent drying out of the concrete.
3. All concrete surfaces including footings must be kept wet for at least seven (7) days after concrete is placed.
4. Apply the appropriate curing materials, as specified in 2.3 of this Section, immediately after finishing slabs. Application shall be as specified by the manufacturer.

E. Form Removal:

1. Take care in removing forms so that surfaces are not marred or gouged and that corners are true, sharp and unbroken.
2. No steel spreaders, ties or other metal shall project from or be visible on any concrete surfaces.

F. Defective Work:

1. Should the strength of any concrete for any portion of the work indicated by tests of molded cylinders and core tests fall below minimum 28 days strength specified or indicated, concrete will be deemed defective work and shall be replaced.
2. Concrete work that is not formed as indicated, is not true to intended alignment, not plumb or level where so intended, not true to intended grades or elevations, not true to specified or selected finish, contains sawdust shavings, wood, or embedded debris, which exhibits cracks or contains fine or coarse sulfide particles, or expansive aggregates detrimental to performance or appearance of the concrete shall be deemed defective.
3. Promptly perform work required to replace and properly clean (by sandblasting if necessary) any defective concrete panels (control joint or expansion joint to control joint or expansion joint), at Contractor's expense, including all expense of additional inspection, tests, or supervision made necessary as a result of defective concrete.

3.6 EXPANSION JOINTS

A. Temperatures: Do not install sealants when air temperature is less than 40°F.

B. Tooling: Tool exposed joints to a slightly concave surface using slicking materials recommended by the manufacturer. The tooling procedure shall press sealant against the sides of the joint. No

materials shall be left “feathered” out or smeared on the abutting materials. Completed joints shall have a uniform professional appearance.

C. Joint Construction: Sealant joint width, thickness and cross-sectional profile to be constructed in strict accordance with the sealant manufacturer’s recommendations.

D. Sand: At the appropriate time cover the sealant with sand to provide a sanded finish.

3.7 CLEAN-UP

A. Upon completion of the Work of this Section, immediately remove all swimming pool concrete materials, debris and rubbish occasioned by this Work to the approval of the Owner’s Representative.

END OF SECTION 13 11 02

13 11 03 – SWIMMING POOL SHOTCRETE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials and equipment as required to install structural wet mix shotcrete for swimming pool structures as indicated on the Drawings and herein specified.

1.2 QUALITY ASSURANCE

A. A. ualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards: Except as otherwise indicated, provide shotcrete per American Concrete Institute Standard ACI 506R, ACI 506.2, ACI 318-19 and the International Building Code (latest edition).

C. Mix Design: The Contractor shall submit a mix design stamped and signed by a licensed engineer for approval by the Owner's Representative prior to any placement of shotcrete. Mix design shall indicate source of aggregate and brands of cement and admixtures used. All mix designs shall take character of locally available aggregate into consideration and make adjustments as necessary to conform with specified design criteria.

D. Testing and Inspection: A test panel shall be shot, cured, cored or sawn, examined and tested (representing the most congested and difficult project scenario) prior to commencement of the project in accordance with ASTM C1140. All project conditions and personnel shall be represented in the test panel. Additionally, one test panel shall be provided for each 50 yards (or portion thereof) of shotcrete placed for each day or each nozzleman, whichever is greater. The size of the strength test panel shall be per the direction of the Special Shotcrete Inspector. At least three (3) cores shall be taken from each test panel. (At least three (3) cores shall be taken from the completed work for each day of shotcrete operation.) Testing shall be performed by the Owner's designated Testing Lab and comply with Section ACI 318.Continuous inspection of the shotcrete operation by a deputy inspector provided by the Owner shall be required.

E. Tolerances: Construct all swimming pool shotcrete straight, true, plumb and square within a tolerance horizontally of one in 200 and a tolerance vertically of one in 2000.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00 and ACI 506.2. Requests for substitution shall conform with requirements of Article 1.10.A of Section 13 11 00.

B. Materials List: Within thirty (30) days after issuance of Notice to Proceed, and before shotcrete materials are delivered to the project site, submit to the Owner a complete list of materials proposed to be used in this portion of the Work, showing manufacturer's name and catalog number of all items such as admixtures and curing membranes, and the name and address of the supplier of cement and aggregate to be used.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

A. Protection: Use all means necessary to protect shotcrete materials before, during and after installation and to protect the installed Work specified in other Sections.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: Cement shall be Type 1 Portland Cement conforming to ASTM C150. Cement type shall be the same for all shotcrete work.

B. Aggregate: ASTM C33, washed hard dense durable clean sharp sand from approved pit, free of organic matter and opaline, feldspar, or silicous magnesium substances and containing not more than 3% by weight of deleterious substances. Maximum size aggregate for shotcrete is ¾" per ACI 318-19. When tested for organic impurities by ASTM C40 method, fine aggregate color not darker than reference standard color. When tested for soundness by ASTM C88 method, grading No. 2 of ASTM C1436, loss after 5 cycles not over 10% of fine aggregate.

C. Water: Potable, clean, fresh, free from acid, alkali, organic matter or other impurities liable to be detrimental to the shotcrete.

D. Admixtures: Admixtures shall conform to ASTM C1141 and only be used upon approval of the Owner's Representative.

PART 3 - EXECUTION

3.1 EXECUTION

A. Inspection:

1. Prior to all Work of this Section carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that items to be imbedded in shotcrete are in place and that shotcrete may be placed to the lines and elevations shown on the Drawings, with all required clearance from reinforcement.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive the Work.

3.2 PREPARATION

A. General:

1. Thoroughly clean all areas where shotcrete is to be placed to insure proper bonding of shotcrete.
2. Where shotcrete is to be placed against smooth surfaces (i.e., cast-in-place concrete), sandblast surfaces to receive shotcrete to provide clean aggregate surface, thereby insuring proper bond between materials.

B. Ground Wires: Adequate ground wires, to be used as screeds, shall be installed to establish the thickness and surface planes of the shotcrete work. Ground wires shall be placed so that they are tight and true to line and grade and in such a manner that they can be easily tightened.

3.3 PROPORTIONING AND MIXING

A. Accurately control proportion of water to Portland cement to produce thorough and uniform hydration of the shotcrete that, when shot, forms a homogeneous mass containing neither sags nor dry sand formation. Proportion by mass per ASTM C94 or by volume per ASTM C685.

B. Shotcrete shall have a minimum compressive strength of 4,000 PSI at 28 days. Shotcrete material shall have a water/cement ratio of 0.40 minimum-0.45 maximum per ACI 506R, Chapter 6, Proportioning and Preconstruction Testing; Section 6.3.3, Wet Mix Process.

C. Discontinue shotcrete work if the time between the addition of mixing water to cement and aggregate, or cement to aggregates, and placement of shotcrete exceeds ninety (90) minutes when the ambient temperature is below 85 degrees Fahrenheit, or exceeds sixty (60) minutes when the ambient temperature is above 85 degrees Fahrenheit. Batch, mix and deliver wet-mixture shotcrete per ASTM C94 or C685.

D. Hot Weather Shotcreting – Unless otherwise specified, do not place shotcrete when shotcrete temperature is above 95°F, unless prequalification testing shows that the required quality of materials can be achieved at high temperatures. The temperature of reinforcement and receiving surfaces shall be below 90°F prior to shotcrete placement.

E. Cold Weather Shotcreting – Unless otherwise specified, shooting may proceed when ambient temperature is 40°F and rising. Stop shooting when ambient temperature is 40°F and falling, unless measures are taken to protect the shotcrete. Shotcrete material temperature, when shot, shall not be less than 50°F. Do not place against frozen surfaces.

3.4 SHOTCRETE PLACING, FINISHING, AND CURING

A. Operations: Utilize a standard type of air compressor, capable of providing a minimum of 250 cubic feet of air per minute per nozzle.

B. Placing: Except when shooting reinforcing, hold the nozzle perpendicular to and 2-1/2 to 3 feet from surface. At reinforcing bars, hold the nozzle so as to direct shotcrete behind the bars, and shoot each side of each bars separately. A nozzleman's helper equipped with an air jet shall precede the nozzle and blow out rebound or sand lodged behind bars, on forms, or placed shotcrete. Placing shotcrete horizontal members from the top is not allowed unless approved methods are employed to eliminate all rebound. Material shall emerge from the nozzle in a uniform flow. If flow becomes intermittent for any reason, direct the nozzle away from the surface until the flow is again steady and constant. Do not reuse rebound or loose sand for any purpose.

C. Puddled Shotcrete: Use of "puddled shotcrete" in which the air pressure is reduced and the water content is increased to facilitate placing in difficult locations is not allowed. Do not place shotcrete where nozzle stream cannot impinge directly on the involved surface. Where difficult shooting conditions occur, obtain proper results by maintaining correct air pressure and water ratio and reduce supply of material.

D. Construction Joints: Form joints with sloping beveled edges. Clean and dampen the hardened joint surfaces before placing additional shotcrete. Square edged construction joints are not allowed. The film of laitance which forms on the surface of the shotcrete shall be removed within approximately two hours after application by brushing with a stiff broom. If this film is not removed within two hours, it shall be removed by thorough wire brushing or sand blasting. Construction joints over eight hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.

E. Finishing: Rod exposed surfaces to true planes and lines on reaching the thickness and plane established by forms and ground wires. Tamp and wood float surfaces level and provide a rough raked finish. Carefully coordinate finish requirements with other trades (ceramic tile, pool plaster) to insure shotcrete finish is appropriate substrate for final finish material.

F. Curing: Keep shotcrete continuously damp for not less than seven (7) days after placing. Use sealed curing sheeting or other approved curing method where water curing is not feasible. Do not use curing compound of any kind.

3.5 DEFECTIVE WORK

A. Cut out, remove and replace, or repair to the satisfaction of the Owner's Representative, shotcrete not meeting minimum strength, not true, plumb or level, not to required elevations, containing cracks detrimental to performance or appearance, containing shavings, debris or with honeycombs or voids.

B. Promptly perform Work required to repair, patch, replace, render properly cleaned surfaces (by sandblasting if necessary) or otherwise make good any defective shotcrete at Contractor's expense, including all expense of additional inspection, tests, or supervision made necessary as a result of defective shotcrete.

3.6 CLEAN-UP

A. Upon completion of the Work of this Section, immediately remove all swimming pool shotcrete materials, debris and rubbish occasioned by this work to the approval of the Owner's Representative.

END OF SECTION 13 11 04

13 11 04 – SWIMMING POOL CERAMIC TILE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Swimming pool ceramic tile detailed on the Drawings, including, but not limited to, the following:

1. Dyke Wall and Exterior Pool Wall Tile
2. Depth / Caution Marker Tile. (At Pool Deck)
3. No Diving Tile
4. Depth Markers on Coping
5. Pre-Cast Coping

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards: In addition to complying with all pertinent codes and regulations:

1. Manufacture of all tile shall be in accordance with ANSI A-137.1-1976.
2. Install ceramic tile in accordance with the recommendations contained in the 2024 “Handbook for Ceramic Tile Installation” of the Tile Council of America, Inc.

C. Tolerances: Install all swimming pool ceramic tile straight, true, plumb and square within a tolerance horizontally and vertically of 1/8”. Waterline and gutter bullnose tile shall be level to 1/8” (+/- 1/16”) around entire perimeter of swimming pools.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00. Requests for substitution shall conform to requirements of Article 1.10.A of Section 13 11 00.

B. Samples: Submit samples of each color and pattern in the specified groups. Character samples can be representative for review prior to screening of actual tile.

C. Master Grade Certificate: Prior to opening ceramic tile containers, submit a Master Grade Certificate, signed by the manufacturer of the tile used and issued when the shipment is made, stating the grade, kind of tile, identification marks for the tile containers, and the name and location of the Project.

D. Specifications: Submit manufacturer's recommended installation specifications for the Work.

E. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

A. Delivery: Deliver all materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store all materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project site.

C. Protection: Use all means necessary to protect swimming pool ceramic tile before, during and after installation and to protect the installed Work specified in other Sections.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner.

PART 2 - PRODUCTS

2.1 TILE

A. Dyke Wall and Exterior Pool Wall Tile

1. Material: Group 4 quality, frost proof unglazed ceramic mosaic tile with absorption rate of less than 1% as manufactured by Dal-Tile or approved equal.
2. Size: 1 x 1 inches.
3. Color: Dal-Tile #D-621, 'Nautical Blue'.
4. Trim: Furnish trim pieces as indicated on the Drawings.

B. Depth / Caution Marker Tile (at pool deck):

1. Material: Group 3 quality, frost proof unglazed ceramic mosaic tile with absorption rate of less than 1% as manufactured by Dal-Tile or approved equal.
2. Size: 1 x 1 inches.
3. Color: Dal-Tile #D-311, 'Black' letters and numbers on #DK-317, 'White Field'.

C. "No Diving" Tile (at pool deck):

1. Material: Frost proof unglazed non-slip ceramic mosaic tile as manufactured by Dal-Tile or approved equal.
2. Size: 6 x 6 inches.
3. Color: International "No Diving" symbol over white background. Inlays #C621500, 'White' field.

D. Depth / Caution Marker Tile on Pre-Cast Coping:

1. Material: Sandblast text into precast coping or stone to a depth of 1/8" max. and fill with contrasting color epoxy flush with finish surface. Text font style and epoxy color to be approved by Owner prior to installation. Final location of markers to be approved by Owner prior to installation. Color as specified by Landscape Architect.

E. Pre-Cast Coping:

1. Han-Crete, Inc. (909) 947-1543, Federal Stone, Western Pre-Cast, Cast Kay Tee, Inc. or equal. (301) 271-7121

2.2 MORTAR (Provide typical stainless steel pool mortars for tile to PVC liner and stainless steel surfaces).

A. All tile grout shall be waterproof high performance epoxy grout meeting high durability and stain protection performance requirements of ANSI A118.3 providing a 25yr warranty. Grout color shall be grey for dark backgrounds, white for light backgrounds (verify colors with Architect and Owner).

B. Material: Mapei Kerapoxy CQ Premium two component Epoxy Grout as recommended by Myrtha

2.3 GROUT

A. All tile grout shall be waterproof high performance epoxy grout meeting high durability and stain protection performance requirements of ANSI A118.3 providing a 25yr warranty. Grout color shall be grey for dark backgrounds, white for light backgrounds (verify colors with Architect and Owner

B. Material: Mapei Kerapoxy CQ Premium two component Epoxy Grout with color coated quartz as recommended by Myrtha.

2.4 OTHER MATERIALS

A. All other materials, not specifically described but required for a complete and proper installation of ceramic tile as indicated on the Drawings, shall be new, first quality of their respective kinds, and subject to the approval of the Owner's Representative.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to all Work of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that ceramic tile can be installed in accordance with the original design and all referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive its Work.

3.2 INSTALLATION

A. Method:

1. Install all ceramic tile in strict accordance with installation method P601-90 of the 2024 Handbook for Ceramic Tile Installation of the Tile Council of America, Inc.
2. Be certain to install all ceramic tile perfectly level, flush, plumb, and to the finish grades and elevations indicated on the Drawings.

B. Interface:

1. Carefully establish and follow the required horizontal and vertical elevations to insure proper and adequate space for the work and materials of other trades.
2. Coordinate and cooperate as required with other trades to insure proper and adequate interface of ceramic tile Work with the Work of other trades.

3.3 GROUTING

A. Follow grout manufacturer's recommendations as to grouting procedures and precautions.

B. Remove all grout haze, observing grout manufacturer's recommendations as to use of acid and chemical cleaners.

3.4 EXTRA STOCK

A. Provide one (1) unopened box of extra tile for 2.1A, 2.1B, 2.1C and 2.1E for Owners use at a future time.

3.5 CLEAN-UP

A. Upon completion of the swimming pool ceramic tile installation, thoroughly clean and polish the exposed surfaces of tile work. Completely clean work area of debris and rubbish occasioned by this Work and dispose of to the approval of the Owner’s Representative.

END OF SECTION 13 11 04

13 11 05 – SWIMMING POOL WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish all labor, materials, tools and equipment as necessary to perform Cement Waterproofing on new and existing structures as shown on drawings and as specified in this section. This section applies to gutter, pump pit, backwash pit & surge chamber waterproofing.

B. Related Sections:

1. Division 13, Section 13 1102 “Cast-in-Place Concrete.”

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards:

1. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 1999.
2. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
3. ASTM C 267 - Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes; 1997.
4. ASTM C 321 - Standard Test Method for Bond Strength of Chemical-Resistant Mortars.
5. ASTM C 348 - Standard Test Method for Flexural Strength of Hydraulic Cement Mortars.
6. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials.
7. ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction; 1998a.
8. COE CRD-C 48 - Standard Test Method for Water Permeability of Concrete; 1992.
9. NSF 61 - Drinking Water System Components - Health Effects; 2000a.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 45 00.

B. Product Data: Manufacturer’s printed data sheet, for specified products.

C. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

1. Testing Agency: Independent laboratory meeting the requirements of ASTM E 329 and certified by the United States Bureau of Standards.

D. Certificates: Product certificates signed by manufacturer certifying that:

1. Materials comply with specified performance characteristics and physical requirements.
2. Installer is qualified and approved by manufacturer.

E. Manufacturer’s installation instructions.

F. Manufacturer's report on field inspection of substrates, prior to installation.

G. Executed warranties.

1.4 PRODUCT HANDLING

A. Deliver and store in a dry area between 40ºF (5ºC) and 90ºF (32ºC). Handle and protect from freezing and direct sun light in accordance with manufacturer's instructions.

B. Deliver materials in manufacturer's unopened containers, fully identified with brand, type, grade, class and all other qualifying information. Provide Material Safety Data Sheets for each product.

C. Take necessary precautions to keep products clean, dry and free of damage.

1.5 SYSTEM REQUIREMENTS

A. Coordinate waterproofing installation with other trades.

B. Provide materials and accessories in timely manner so as not to delay Work.

1.6 PROJECT CONDITIONS

A. Maintain surfaces to be waterproofed and surrounding air temperature at not less than 40ºF (5ºC). Apply only when temperatures are steady or rising.

B. Do not apply materials to frozen or frost-filled surfaces.

C. Exercise caution when temperatures exceed 90ºF (32ºC).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers:

1. Xypex Chemical Corporation; 13731 Mayfield Place, Richmond, BC V6V 2G9. ASD. Tel: (800) 961-4477 or (604) 273-5265. Fax: (604) 270-0451. E-mail: info@xypex.com. www.xypex.com.
2. Miracote Miraflex Membrane C 3000 E. Harcourt St. Rancho Dominguez, CA 90221 Phone: (310) 631-6594, Fax: (310) 886-9119
3. Hycrete, Inc.; 462 Barrell Ave, Carlstadt, NJ, 07072. Phone: (201) 386-8110. Fax: (201) 386-8155. www.hycrete.com

B. Requests for substitutions will be considered only if submitted to the architect/engineer in writing and must include substantiation of product performance, 10 days prior to the original bid date.

2.2 MATERIALS

A. Waterproofing Material - Acrylic Modified Cement Waterproofing: Cementitious, two-component, acrylic emulsion based, highly flexible, crack bridging waterproof membrane barrier against positive water pressure, with the following characteristics:

1. Product: Miracote Miraflex Membrane C r Xypex two coat crystalline waterproofing or Hycrete W500.
2. Color: Gray
3. Dry Component-A: Precise blend of cementitious material
4. Liquid Component-B: White acrylic emulsion and admixtures
5. Working Time: Approximately 45 minutes
6. Shore A Hardness: > 90
7. Bond/Adhesion: (ASTM C-321) 215 psi (1.5 MPa) @ 28 days
8. Tear Resistance: 190 psi (1.3 MPa) at 68oF (20oC)
9. Elongation: (%) 60 (gray); 40 (white) at 68oF (20oC)
10. Elongation: (mils) 40 (gray); 25 (white)
11. Crack bridging capacity: (inch) 1/16 (gray) (1.5 mm)
12. Vapor Permeability: (US Perms) 1.2 (ASTM E-96)
13. Waterproofing: (CRD C 48-92) Withstands 200 psi = 460 feet (14 bar = 140 m) hydrostatic pressure (positive side) at 3/32 (2.4 mm) thickness.
14. Penetration: At least 2 inches (50 mm) penetration of crystal-forming material, evidenced by scanning electron microscope photographs.
15. Chemical Resistance: No detrimental effects when tested using 4000 psi (27.6 MPa) compressive strength concrete in accordance with ASTM C 267 using hydrochloric acid (pH of 3.5), brake fluid, transformer oil, ethylene glycol, toluene, and caustic soda as test mediums for duration of 84 days each; minimum of 14 percent increase in concrete compressive strength when tested in accordance with ASTM C 39/C 39M.
16. Potable Water Contact Approval: NSF certification for use on structures holding potable water, based on testing in accordance with NSF 61.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all construction substrates and conditions under which waterproofing materials are to be installed. Do not proceed with the waterproofing application until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Substrate preparation:

1. Remove oil, grease, dirt, loose particles, remains of form oils, water repellents, rust or other coatings by high-pressure water blasting (>3000 psi), wet or dry sand blasting, or other mechanical means to produce surfaces suitable for application of waterproofing.
2. Follow manufacturer's instructions to clean and prepare surfaces and seal cracks and joints.
3. Voids in concrete substrates: 1/4-inch (6 mm) diameter and larger, pre-treat with a cementitious mortar. Less than 1/4-inch (6 mm) diameter can be filled with a scratch coat of two-component waterproofing material.

C. Rinse surfaces to be waterproofed (excluding drywall or similar) with clean water to saturated surface dry (SSD) condition, with no standing water on horizontal surfaces.

3.3 INSTALLATION

A. Mix two-component waterproofing material in proportions recommended by manufacturer.

B. Taping:

1. Apply two-component waterproofing material by brush in a six to seven inch (15 – 18 cm) wide strip coat centered over all joints, cracks, penetrations and changes of plane to be taped.
2. While this coat is still wet, unroll joint sealing tape into the coating and apply a coat of two-component waterproofing material over the tape, smoothing out wrinkles and fish mouths.

C. Positive Side Waterproofing:

1. Apply two-component waterproofing material in quantities as per manufacturer's specifications and recommendations:
   a. Apply at 60 mils or 1/16” (1.5 mm) total thickness for water levels up to 2-feet (0.60 m).
   b. Apply at 90 mils (2.4 mm) total thickness for water depth greater than 2-feet (>0.60 m).

D. Application considerations:

1. Apply, using stainless steel trowel, tampico brush, short nap roller, or appropriate compressed-air spray equipment.
2. If needed, such as in zones posed to movement or cracking, plaza decks, the waterproofing material can be additionally reinforced with a reinforcing mesh (supplied by waterproofing manufacturer), embedded between two waterproofing layers.
3. Apply only when surface and ambient temperatures are 40oF (5oC) and rising. At high temperatures i.e. 86oF (30oC) and above) protect application from direct sun and wind to prevent premature surface drying and shrinkage cracks. Apply material in two coats minimum.
4. Application thickness should not exceed 1/8-inch (120 mils (3 mm)).
5. Do not bridge cracks greater than 1/16-inch (1.5 mm).
6. Bridge dynamic cracks or joints with elastomeric joint sealing tape, as supplied by waterproofing manufacturer.
7. Do not overcoat waterproofing material with solvent-based materials.

8. Prime and protect alkali sensitive metals such as copper, aluminum, galvanized or zinc treated metal before over-coating with waterproofing material. Follow manufacturer's recommendations for primer material.

3.4 CURING

A. Follow manufacturer's general instructions for curing and hardening of waterproofing material. Do not use water for curing. Waterproofing material is self-curing.

B. Protect surfaces from rain, frost and premature dehydration.

3.5 ACCEPTANCE

A. Remove left over materials and any foreign material resulting from the work from the site.

B. Clean adjacent surfaces and materials occasioned by this Work to the approval of the Owner.

END OF SECTION 13 11 05

13 11 06 – SWIMMING POOL EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Swimming pool equipment items required for this Work as indicated on the Drawings and specified herein.

1.2 QUALITY ASSURANCE

1. Qualifications of Workers:
2. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
3. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
4. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. All equipment supplied or work performed shall comply with regulations governing public swimming pools and spas as contained within the International Building Code, 2022 edition.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00. Requests for substitution shall conform with requirements of Article 1.10.A of Section 13 11 00.

B. Required submittals include:

1. Swimming Pool Fittings as specified in Article 2.1 of this Section.
2. Swimming Pool Deck and Mechanical Equipment as specified in Article 2.2 of this Section.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

D. The equipment shown on the plans represent the first listed items in the technical specifications. The Contractor shall be responsible for all required field coordination and installation of any approved equal product to provide a fully working and warranted system. The Contractor shall submit detailed shop drawings for any products used other than the first listed specified items. Contractor provided shop drawings shall include details and quality equal to the original plans and construction documents. The Contractor shall provide any and all required engineering including but not limited to structural and anchorage requirements for any proposed equipment other than the first listed specified equipment. The Contractor is responsible to provide a factory certified representative(s) to start-up and provide on-site training for all swimming pool mechanical equipment provided.

1.4 PRODUCT HANDLING

A. Protection: Use all means necessary to protect swimming pool equipment items before, during and after installation and to protect the installed work specified in other Sections.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative.

PART 2 - PRODUCTS

2.1 SAFETY EQUIPMENT

A. First Aid Kit for 50 Persons with two (2) wool blankets: Marine Rescue or approved equal. Quantity as required by the Department of Health, two (2) minimum.

B. Rescue Tubes (minimum 49" long) and Life Ring Buoy (minimum 24" in diameter) U.S. Coast Guard Approved: Marine Rescue or approved equal. Quantity as required by the Department of Health, three (3) minimum.

C. Throw Rope (3/16" diameter) complete with lemon foot, for use with Life Ring Buoy: Kiefer, United Industries, or approved equal. Quantity as required by the Department of Health, three (3) minimum.

D. Rescue Hooks, 16' long x 1-1/2" aluminum pole and stainless-steel mounting hardware: Kiefer, Pentair, or approved equal. Quantity as required by the Department of Health, three (3) minimum.

E. Spine Board: C.J. Penton Aquatics long board with "L" bracket head immobilizer with foam pads and Velcro strap, 4 Velcro body straps, or equal. One (1) required.

F. Pool Safety Signs: As required by the Department of Health. Submittal required. Placement at the pool site shall be in conformance with Health Department Inspector. Three (3) sets minimum.

2.2 MAINTENANCE EQUIPMENT

A. Commercial Pool Vacuum: Provide pool vacuum cart with a 155-square foot single-cartridge filter, lid-mounted handle, separate lid-mounted bracket for electrical cord, and two rubber-tired ball bearing wheels with grease fittings. Cart and filter shall be fabricated from schedule 304 stainless steel with welds treated and passified. Provide Whisperflo pump with a 1 1/2 hp, 115/230 volt, maximum 20 amp draw @ 120 volts, single phase motor and integral trap. Pump shall be UL and NSF listed, have 2" suction and 1 1/2" discharge fittings, and have a brass priming valve with hose bib. Entire pump assembly shall be anchored to vacuum cart with two stainless steel bolts. Provide a 100 foot 10 AWG 3/C SJ electrical cord with ground fault interrupter (GFI) plus. Cord shall be wired to a double pole, 30-amp switch which shall be mounted on pump motor. One (1) required.

B. Heavy Duty Vacuum Hose: 2" x 50' with hose connector. Pentair, Smooth Bore or approved equal. One (1) required.

C. Utility Pole: 24' fiberglass with connectors. Pentair, Skimlite or approved equal. One (1) required.

D. Commercial Vacuum Head: 24" wide "flexible" vacuum head. Pentair Model #R201186 or approved equal. One (1) required.

E. Pool Wall Brush: 36" wide professional quality. Pentair or approved equal One (1) required.

F. Leaf Skimmer: 30" x 8" x 12", professional quality. Pentair, Spectrum or approved equal. One (1) required.

G. Water Quality Test Kit, Professional Grade, Palintest Photometer Test kit. Test included Palin Test 25 and 10 kits. Provide replacement tablets for 500 tests. Also required Taylor 2000 series test kit. LaMotte Model #PRO250-NJ or approved equal. One (1) required. All water chemistry controllers shall be able to test for free chlorines and total chlorines as required by code.

H. Pool Robotic Pool Cleaner: The automatic pool cleaner shall be Enduro – Turbo Clean XL50, One (1) required. Capable of operation via 120V, 220V in 50/60 Hz, or 24 VDC incoming power; 242 GPM or 14,530 gallons per hour. Utilize 20, 70, 105, 250 and 1,000 or 2,000 micron filter screens – all constructed of mesh.

1. Warranty: The robotic cleaner shall carry a 7-year anti-corrosion warranty on the stainless-steel frame from the date of product start-up. The cleaner shall carry a two-year warranty against all defects in material and workmanship, from date of product start-up, including all components in the system not including wearable items

2.3 FITTINGS

A. Main Drain Frame & Grate: As provided by swimming pool manufacturer. See plan for size and quantity. Contractor shall provide to the Owner a Certificate of Compliance, signed by a licensed design professional, for main drain sump(s) and frame(s) and grate(s), as required by the Virginia Graeme Baker Act.

B. Gutter Grate: As provided by swimming pool manufacturer. To be gray in color.

C. Surface Skimmer: As provided by swimming pool manufacturer. One (1) required.

D. Wall Return Inlet 1-1/2” Adjustable: As provided by swimming pool manufacturer. Four (4) required.

E. Floor Return Inlet 1-1/2” As provided by swimming pool manufacturer. Forty (40) required.

F. Hydrotherapy Jets: ‘Waterway’ #2123440, or Anzen #7 7/16” orifice, or approved equal. Ten (10) required.

G. Swimming Pool Underwater Lights: Jandy niched white LED lights #WPHV5LS100 large white LED LIGHT, 120V 500 kelvin, 65 watt bulb, 100’ cord (field verify cord length prior to ordering). Provide PVC pro niche by ‘Jandy’ ‘VN’. Jandy, Pentair, or approved equal. Twenty-five (25) required.

H. Junction Box for Underwater Lights, completed with strain reliefs: Hydrel #1719, Appleton or approved equal. Fifteen (15) required.

I. Water Level Control System: Levelor K110 sensor with controller or approved equal. One (1) required.

2.4 WET PLAY EQUIPMENT

	Product	Quantity
1.	Depth Charge Splashtacular	3
2.	Depth Charge Activator Splashtacular	-
3.	Leaflet (0011-4271) Waterplay	1
4.	Daisy Mae (0011-4265) Waterplay	1
5.	Split Spurt (0010-7482	3

2.5 DECK EQUIPMENT

A. Starting Platform Anchors: KDI Paragon 'Competitor' #23103DW, 6" deep, six (6) KDI Paragon, Spectrum Xcellerator #24070 dual post anchor, or equal. All anchors to be provided with cover plates and removal tools.

B. Adjustable Starting Platforms: Track Start+ Competitor, side step #25427, complete with adjustable backplate wedge, side hand grips, Track Start+, Spectrum Xcellerator #133171, or equal. Furnish complete with safety hard covers and cable lock. Six (6) required.

C. Stanchion Sockets: 1.90" I.D. Bronze. KDI-Paragon 38201TC, S.R. Smith, Paddock, or Spectrum. Four (4) required.

D. Stanchion Posts: 1.90" O.D. x .145 wall. KDI-Paragon four (4) #38106 8' post, four (4) #38301 hook and collar, KDI-Paragon, S.R. Smith, Paddock, or Spectrum.

E. Commercial Cup Anchor: As provided by swimming pool manufacturer. Twenty-two (22) required.

F. Racing Lanes, 25 Yard: Competitor #200-330, no known equal. Verify color with Owner's Representative prior to ordering. Seven (7) required. Competitor, Malmsten, or equal. Provide vinyl covered stainless steel lane line extensions, Knorr System model #EP-009-0020 or approved equal, two (2) per lane line.

G. Racing Lane Reel with Cover: KDI-Paragon #75101SS with cover #75133, KDI-Paragon, S.R. Smith, Competitor, or Spectrum. One (1) required.

H. Moveable Lifeguard Chair: 1.90" O.D. x .065 wall. KDI-Paragon 20302, KDI-Paragon, S.R. Smith, Paddock, or Spectrum. Two (2) required.

I. Figure 4 Grab Rails: As provided by swimming pool manufacturer. Four (4) sets required.

J. Recessed Steps, Set of 3: SR Smith #62-209-4001, KDI-Paragon #32102. Four (4) sets of three required.

K. Handrail: Custom 3 bend, 1.90" O.D. x .145" wall. Spectrum, S.R. Smith, or Paddock. Six (6) required.

L. Ramp Rail: Custom ADA ramp handrails. Two (2) total. Spectrum, S.R. Smtih, or Paddock.

M. Anchor Sockets for Hand Rails: KDI-Paragon 28102, KDI-Paragon, S.R. Smith, Paddock, or Spectrum. Eight (8) required.

N. Stainless steel Escutcheon Plates for Hand Rails: Spectrum Model #35214, KDI-Paragon, S.R. Smith, Paddock, or Spectrum. Sixteen (16) required.

O. Accessible Lift: Aqua Creek Mighty 400 #F-MTY400 (350 lb. min and 400 lb. max lifting capacity) self-operated, or approved equal. Furnish complete with anchors, cover, extra battery pack and transporter cart #INV01902. All parts and accessories shall be 'Coastal Gray'. Three (3) required.

P. Backstroke Pennants: 'Champion' 3/16" diameter vinyl coated cable #50-175, 'Champion' hardware package #53-030, and 'Champion' 12" x 18" vinyl coated polyester pennants #53-020, Lincoln Equipment, Knorr Systems or equal.

2.6 SWIMMING POOL / ACTIVITY POOL STRAINERS

A. 'Fluidtrol' RSW series FRP reducing basket strainers. One (1) 6" x 4" standard, one (1) 6" x 5", and one (1) 10" x 8" each with acrylic lids and two (2) stainless steel strainers each.

2.7 SWIMMING POOL CIRCULATION PUMP

A. 'Paco' #4012-9, 4" x 5" type LC end suction centrifugal pump, 1187 RPM, 460V 3PH, 15 HP, rated at 475 GPM @ 60 ft. TDH; 76% efficient; premium efficiency TEFC motor; epoxy coat all wet surfaces. 'Paco', 'Aurora', or equal. (760 lbs.) Provide 'SPCS' EKO-FLEX pump control system variable speed drive model SPCS015N4X4 system 18.9" x 8.27" x 10.23" deep. Coordinate mounting location to maintain desired clearances, 460V 3PH.

2.8 SWIMMING POOL FILTERS

A. 'Pentair' CCP520 Clean & Clear plus cartridge filters. 520 sq. ft. of filter area each (1560 sq. ft. total) Rated at 450 GPM. Complete with 2" premanufactured automatic multiport valve, seismic anchorage. Provide all utilities, piping, valving, etc. Three (3) tanks total. (90 lbs.)

2.9 SWIMMING POOL ULTRAVIOLET SYSTEM

A. 'Evoqua' wafer UV model #WF-115-4-N, validated at 386 GPM, 4" flanged connection in line UV with one (1) lamp at 1500 watts, 208V 1PH. Control unit: 208V 1PH, 20" x 20" x 10" deep. (66 lbs.) Provide piping bypass, valving, ETS EZ valve strainer and installation and piping per manufacturer's recommendations. One (1) system total.

2.10 ACTIVITY POOL CIRCULATION PUMP

A. 'Paco' #30127, 4" x 3" type LC end suction centrifugal pump, 1173 RPM, 460V 3PH, 7.5 HP, rated at 250 GPM @ 60 ft. TDH; 70% efficient; premium efficiency TEFC motor; epoxy coat all wet surfaces. 'Paco', 'Aurora', or equal. (760 lbs.) Provide 'SPCS' EKO-FLEX pump control system variable speed drive model SPCS007N4X4 system 19.1" x 4.33" x 9.65" deep. Coordinate mounting location to maintain desired clearances, 460V 3PH (105 lbs).

2.11 ACTIVITY POOL VORTEX BOOSTER PUMP

A. 'Jandy' JCP series #JCP073ATS, 7.5 HP, 460V 3PH self-priming pump, 3450 RPM rated at 450 GPM at 45 ft. TDH, with integral strainer. One (1) total. (346 lbs.) To be interconnected with circulation pump to prevent use when circulation pump is not in operation. Provide with Accudrive #AD075X-4603-N4X 7.5 HP VFD.

2.12 ACTIVITY POOL RIVER BOOSTER PUMP

A. 'Paco' #6012-3, 6" x 8" X 12" type LC end suction centrifugal pump, 1150 RPM, 460V 3PH, 15 HP, rated at 1200 GPM @ 35 ft. TDH; 83% efficient; premium efficiency TEFC motor; epoxy coat all wet surfaces. 'Paco', 'Aurora', or equal. (760 lbs.) Interconnect with circulation pump so it can only operate when circulation pump is on. Provide 'SPCS' EKO-FLEX pump control system variable speed drive model SPCS015N4X4 system 18.9" x 8.27" x 10.23" deep. Coordinate mounting location to maintain desired clearances, 460V 3PH.

2.13 ACTIVITY POOL FEATURE PUMP

A. 'Jandy' Stealth series SHPF1.0-3PH; 1HP; 460V 3PH, rated at 180 GPM at 60 ft. TDH with integral strainer. One (1) total. (64 lbs).

2.14 ACTIVITY POOL FILTERS

A. 'Pentair' CCP520 Clean & Clear plus cartridge filters. 520 sq. ft. of filter area each (1040 sq. ft. total) Rated at 300 GPM. Complete with 2" premanufactured automatic multiport valve, seismic anchorage. Provide all utilities, piping, valving, etc. Two (2) total. (90 lbs.)

2.15 ACTIVITY POOL ULTRAVIOLET TREATMENT SYSTEM

A. 'Evoqua' wafer UV model #WF-115-4-N, validated at 386 GPM, 4" flanged connection in line UV with one (1) lamp at 1500 watts, 208V 1PH. Control unit: 208V 1PH, 20" x 20" x 10" deep. (66 lbs.) Provide piping bypass, valving, ETS EZ valve strainer and installation and piping per manufacturer's recommendations. One (1) system total.

2.16 HYDROTHERAPY SPA CIRCULATION PUMP

A. 'Jandy' SHPF1.0-3PH, 1HP, 3PH pump; 208V, self-priming pump, 3450 RPM rated at 82 GPM at 70 ft. TDH, with integral strainer. One (1) total. (57 lbs.) Pump to be provided with Accudrive #AD0-2303-N4X 1 HP VFD, signet digital flowmeter and all necessary components for a fully functional system. VFD shall have a user lockout. Pump to be programmed with normal flow rate of 60 ft. GPM. One (1) total.

2.17 HYDROTHERAPY SPA BOOSTER PUMP

A. 'Jandy' SHPF 5.0 3PH pump; 460V 3PH, 5 HP with Danfoss 5HP variable frequency drive, self-priming pump, 3450 RPM rated at 225 GPM at 60 ft. TDH, with integral strainer. One (1) total. (95 lbs.) Pump to be programmed with normal flow rate of 225 ft. GPM. One (1) total.

2.18 HYDROTHERAPY SPA FILTER

A. 'Pentair' CCP520 Clean & Clear plus cartridge filters. 520 sq. ft. of filter area. Rated at 150 GPM. Provide all utilities, piping, valving, etc. One (1) total. (90 lbs.)

2.19 HYDROTHERAPY SPA ULTRAVIOLET TREATMENT SYSTEM

A. 'Evoqua' wafer UV model #WF-115-3-N, validated at 242 GPM, 3" flanged connection in line UV with one (1) lamp at 1500 watts, 208V 1PH. Control unit: 208V 1PH, 20" x 20" x 10" deep. (66 lbs.) Provide piping bypass, valving, ETS EZ valve strainer and installation and piping per manufacturer's recommendations. One (1) system total.

2.20 HEAT EXCHANGER POC

A. Swimming pool, activity pool and hydrotherapy spa heat exchanger POC, see MEP for heat exchanger and for continuation.

2.21 WATER CHEMISTRY CONTROLLER

A. Provide each chemical controller with Ethernet POC

1. Swimming Pool: 'BecSys 7' BECSYS7-XS1GP1XOLLBX
2. Activity Pool: 'BecSys 7' BECSYS7-XS1GP1XOLLBX
3. Hydrotherapy Spa: 'BecSys 5' BECSYS7-XS1GP1XOLLBX

2.22 ACID TABLET FEEDERS

A. Provide PPG 'Acid Rite' unit model AR-450, 45 lb. storage. Complete with piping, valving, venturi injection and ¾ booster pumps. NSF 50 certified. Three (3) total.

2.23 SWIMMING POOL SALTWATER CHLORINE GENERATION SYTEM

A. 'Chlorking' Chlor-25, 25 lbs/day capacity, electrolytic process hydrochlorous acid reverting to sodium chloride, 208V, 15 AMP, NEMA 3R enclosure, 0.5% salinity operational level, installed in accordance with manufacturer's recommendations. Two (2) total.

2.24 ACTIVITY POOL SALTWATER CHLORINE GENERATION SYTEM

A. 'Chlorking' Chlor-25, 25 lbs/day capacity, electrolytic process hydrochlorous acid reverting to sodium chloride, 208V, 15 AMP, NEMA 3R enclosure, 0.5% salinity operational level, installed in accordance with manufacturer's recommendations. Two (2) total.

2.25 HYDROTHERAPY SPA SALTWATER CHLORINE GENERATION SYTEM

A. 'Chlorking' Chlor-5.0, 5 lbs/day capacity, electrolytic process hydrochlorous acid reverting to sodium chloride, 120V, 15 AMP, NEMA 3R enclosure, 0.5% salinity operational level, installed in accordance with manufacturer's recommendations. Two (2) total.

2.26 CARBON DIOXIDE STORAGE FEED SYSTEM

A. Provide two (2) NOVO-600, 600 lb storage tanks with seismic restraints and remote fill ports (operating weight = 594 liquid lbs. each). Provide three (3) EKO3 PH-MTS CO2 high efficiency feed systems with alkalinity control, 0 to 160 SCFH feed capacity booster pump, piping injector, flowmeter, relays and acid feed alkalinity control tied to acid tablet feeders. (92 lbs. each) Hard pipe to point of injection. Provide within mechanical room hard wired 'Analox' #API-KIT CO2 detector with audible and visual alarms. UL 1971 standard listed. One (1) total.

2.27 LIGHTING CONTACTOR PANEL

A. 'Allan Bradley' #500L or approved equal. Panel shall be mounted in a NEMA 12 hinged cover – lockable enclosure. Contactors to be switched by momentary switch equal to 'Hubbell' #1557 mounted in J-box in mechanical equipment room. Refer to electrical plans for location of Owner coordinated remote underwater light switch.

2.28 SWIMMING POOL / ACTIVITY POOL FILL SYSTEM(S)

A. Swimming Pool / Activity Pool: 2" 'Cla-Val' fill system to include 2" 'Cla-Val' solenoid control valve #136-01BY, 2" duct iron, epoxy coated body with cast iron disc retainer and diaphragm washer, bronze trim, flanged globe pattern, 120V at 60hz. Solenoid wiring shall be wired to water chemistry controller. Provide 6" air gap at fill point. Two (2) total. Connected to source down stream of reduced pressure backflow preventor.

B. Hydrotherapy Spa: 1" 'Cla-Val' fill system to include 1" 'Cla-Val' solenoid control valve #136-01BY, 2" duct iron, epoxy coated body with cast iron disc retainer and diaphragm washer, bronze trim, flanged globe pattern, 120V at 60hz. Solenoid wiring shall be wired to water chemistry controller. Provide ¾" fill at hydrotherapy spa wall above waterline. One (1) total. Connected to source down stream of reduced pressure backflow preventor.

2.29 CARTRIDGE FILTER CLEANING STATION

A. Three tank rinse and wash station with three (3) Chemtainer cylindrical tanks and stands #TC1840AP

2.30 EYEWASH/SHOWER

A. Provide Haws model #8309 WC corrosion resistant combination eyewash shower. See MEP sheets for water supply piping. One (1) required.

2.31 ACTIVITY POOL FEATURE PUMP ULTRAVIOLET TREATMENT SYSTEM

A. 'Evoqua' wafer UV model #WF-115-3-N, validated at 242 GPM, 3" flanged connection in line UV with one (1) lamp at 1500 watts, 208V 1PH. Control unit: 208V 1PH, 20" x 20" x 10" deep. (66 lbs.) Provide piping bypass, valving, ETS EZ valve strainer and installation and piping per manufacturer's recommendations. One (1) system total.

2.32 AIR COMPRESSOR

A. Depth charge compressor with manifold system, CAT-60040CAD, 4HP, 220V, 60 gallon, oil free, ultra quiet compressor with 'ARO ¾" water separation / regulator kit, 0 to 140 psi adjustment range #C38451-610 with depth charge air manifold system and 'Acme' T-1-81051 208V to 230V boosting transformer. Contractor to coordinate with all trades and install per each manufacturer's installation and operations instructions.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to installing the items of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that the swimming pool equipment items may be installed in strict accordance with original design, pertinent codes and regulations, and the manufacturers' recommendations.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner's Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies are fully resolved.
3. Failure to notify the Owner's Representative and give written notice of discrepancies shall constitute acceptance by the Installer of existing conditions as fit and proper to receive its Work.

3.2 INSTALLATION

A. Supply and install items of swimming pool equipment in strict accordance with applicable codes and regulations, the original design, and the manufacturer's published recommendations, anchoring firmly and securely for long life under hard use.

B. Coordinate with other trades to insure all imbedded items are set plumb and flush. Railing ends must have anchor sockets and escutcheon plates. Be certain that deck equipment and railings are properly bonded prior to imbedding.

C. All equipment shall be braced and/or anchored to resist a horizontal force acting in any direction using the criteria shown on the Drawings.

3.3 INSTRUCTION

A. The Contractor shall provide a factory certified representative(s) to start-up and certify proper installation, operation and full warranty status of all swimming pool mechanical equipment. The Contractor shall provide not less than two 8-hour days of on-site training for facility staff in the operation and maintenance of the swimming pool mechanical equipment and systems. The two 8-hour days shall be separated by a minimum of seven calendar days and be completed within the 14-day start-up period.

3.4 EQUIPMENT ACTIVATION

A. All water chemistry and filtration mechanical equipment shall be operational upon filling of pool after plaster. Chemicals and other related support items as supplied by Contractor, shall be in supply at start-up.

B. For the first fourteen (14) calendar days after completion of the pool plaster, brush all plastered surfaces at least twice a day and coordinate with General Contractor to ensure that the plaster is carefully maintained after the initial fourteen day period. In addition, coordinate with the Contractor to ensure that pool filtration equipment is continuously running during the initial fourteen day period.

C. Start-up and provide qualified personnel to operate pool equipment for a period not less than fourteen (14) days after the pool is placed in operation, or until the Owner takes occupancy of the facility or letter of substantial completion. During this time, Contractor shall instruct and supervise the Owner's personnel in the various operating and maintenance techniques involved. Contractor shall be responsible for supply of chemicals during this not less than fourteen (14) day period and at time of turnover to Owner, chemical storage tanks shall be full. (Owner's personnel shall be fully trained and capable of assuming swimming pool maintenance tasks, training may begin before Owner takes occupancy).

3.5 CLEAN-UP

A. Upon completion of swimming pool equipment, remove all debris, materials and equipment occasioned by this Work to the approval of the Owner’s Representative.

END OF SECTION 13 11 06

13 11 07 – SWIMMING POOL MECHANICAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Swimming pool mechanical piping as indicated on the Drawings for circulation and filtration systems, pool water heating systems, chemical control systems, booster pump systems and appurtenances.

B. Domestic water system from points of connection within swimming pool mechanical equipment room to make-up water system.

C. Filter backwash piping to point of connection with backwash retention pit as required.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards:

1. All equipment supplied or work performed shall comply with the International Building Code,2022 edition.
2. Work shall be performed in accordance with the applicable editions of all National, State and local codes, laws, regulations and ordinances, including the following:
   a. American National Standards Institute (ANSI).
   b. American Society for Testing Materials (ASTM).
   c. American Waterworks Association (AWWA).
   d. American Welding Society (AWS).
3. Do not construe anything in the Drawings or Specifications to permit Work not conforming to these requirements.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00. Requests for substitutions shall conform with requirements of Article 1.10.A of Section 13 11 00.

B. Required submittals include:

1. Pipe and Fittings as specified in Article 2.2 of this Section.
2. Valves as specified in Article 2.3 of this Section.
3. Pressure / Vacuum Gauges as specified in Article 2.4 of this Section.

4. Pipe Hangers and Supports as specified in Article 2.5 of this Section.
5. Sleeves and Waterstops as specified in Article 2.6 of this Section.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

A. Delivery: Deliver all materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store all materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project site.

C. Protection: Use all means necessary to protect swimming pool mechanical items before, during and after installation and to protect the installed Work specified in other Sections.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

1.5 JOB CONDITIONS

A. Cooperate with entities performing Work specified in other Sections to so that no conflict of new construction or occupied space may occur. Should any installation Work be done without such craft coordination, that Work so installed shall be removed and re-installed.

PART 2 - PRODUCTS

2.1 PRODUCT QUALITY

A. Materials and equipment shall be new, of the best quality for the purpose intended, and shall be clearly marked with the manufacturer's name and nameplate data or stamp and rating. As far as practicable, materials and equipment shall be of one manufacturer.

2.2 PIPE AND FITTINGS

A. PVC Schedule 40: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be white. Dura, Lasco, or approved equal.

B. PVC Schedule 80: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be gray. Dura, Lasco, or approved equal.

C. CPVC Schedule 80 Influent/Effluent Heater Piping: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be gray. Dura, or Lasco.

D. Cold plunge piping shall be schedule 80 throughout, from the cold plunge to the pool mechanical room. Install insulation on all cold-water PVC schedule 80 piping. Provide NBR/PVC closed-cell pipe insulation, pre-slit, pre-glued with overlap, ¾" wall thickness with a temperature range between -70° to 220°F for schedule 80 PVC pipe. Install pipe insulation per the manufacturer's recommendations.

E. PVC DR25: Conforming to ATSM D-1784, use with epoxy coated bell and spigot-type fittings or epoxy coated mechanical joint by flange adapters with epoxy coated cast iron fittings as specified in Article 2.02 (F), below. Johns-Manville "Big Blue", Diamond Plastics, or approved equal.

F. Copper Tubing: ASTM Specification B-88, hard drawn, with ANSI Standard B16.22 wrot copper fittings.

G. Steel: ASTM Specification A-120, Schedule 40 black or galvanized pipe with ASTM A-47 150 lb. banded malleable iron threaded fittings.

H. Cast Iron: ASTM Specification B16.1, cast iron flanged fittings, provide epoxy coating as required for use with chlorinated water.

2.3 VALVES

A. Ball Valves:

1. For pool system: True-Union design, PTFE seat material with FPM or FKM Double O-ring stem seals, locking handle, NSF certified. PVC schedule 80 body for below grade installation. PVC Schedule 80 body for above grade installation. Furnish ball valves on all pip diameters 2 ½" or less with a rating of at least 200psi at 73° F, Asahi, Ipex or Nibco.
2. For copper pipe system: 3-piece full-port Bronze body valve with Teflon seat, 'Apollo', 'Nibco' or approved equal.

B. Butterfly Valves:

1. Epoxy coated cast or ductile iron body, 316 stainless steel disc and stem, viton seat material, furnish hand wheel/gear operators on all valves 8" and larger. DeZurick, Keystone, Ipex or equal.
2. PVC body, PVC disc and EPDM construction suitable for chlorinated water applications. Stem shall be of 316 stainless steel and non-wetted. Valves shall be self-gasketed design with a convex sealing arrangement. Valves 1-1/2" – 10" shall be rated to 150 psi and 12" valves shall be rated to 100 psi at 70°F. Asahi Pool-Pro, no known equal.

C. Check Valves: Wafer-type, epoxy coated cast or ductile iron body, 316 stainless steel plates and shaft, viton seat material. Centerline, Metraflex, or approved equal.

D. Surge Chamber Float Valve: EPD #2-0020-019 Float Control Valve, " line size, as manufactured by Environmental Products Division of Doughboy Recreational, Rancho Cucamonga, CA, no known equal.

E. Surge Chamber Isolation Valve: Butterfly valve, tapped lug style, bronze body, stainless steel stem, bronze disc, phenolic back-up ring, EPT seat material. Provide stainless steel shaft extension, shaft housing and tool operator located 2'-0" above floor level with deck access grate as required. DeZurick, Keystone, Asahi, Spears, Ipex or approved equal.

F. RP Backflow Preventer: Febco #835-B for 2" and smaller; #825 for 2-1/2" and larger. Febco, Watts, or approved equal.

G. Make-up Water Control: Cla-Val make-up water control valve with ductile iron body/cover, bronze trim, globe pattern, Buna-N rubber seals. Pilot system materials to consist of bronze/brass with stainless steel wetted parts and Buna-N rubber seals.

H. System to include: 100-01 Hytrol valve, CF1-C1KX float control, X46A flow clean strainers, and copper tubing with brass fittings. Float linkage and float rod shall be PVC and brass. Base plate shall be 316 stainless steel. The plastic float shall be provided with 8' PVC rod and stops and a brass counterweight. Provide model #124-01AKX available KSI (714) 754-044.

2.4 PRESSURE / VACUUM GAUGES

A. Furnish and install pressure and vacuum gauges on the discharge and suction sides of all pumps. 2" or 2 1/2" diameter dial, bottom connection, chrome ring, shut-off cock and snubber. Ranges shall be selected to indicate between mid-point and two-thirds of maximum range under design conditions. Marsh, Trerice, or approved equal.

2.5 PIPE HANGERS AND SUPPORTS

A. General:

1. The requirements of this Section relates to various requirements of the Agreement, General and Supplementary Conditions, Specifications, Drawings, and modifying documents which are part of the Construction Contract. Responsibility for coordination of all such applicable requirements will be that of the Contractor.

B. Description:

1. This section provides guidelines and limitations for the support of all mechanical, electrical, plumbing or architectural items from the building structure, and for the seismic bracing of such items.
2. Design and install all support and bracing systems as required for the swimming pool systems. Provide for attachment to portions of the building structure capable of bearing the loads imposed. Design these systems to not overstress the building structure.

C. Quality Assurance:

1. Design and install all support systems to comply with the requirements of the International Building Code.
2. Seismic bracing is to be designed by a professional engineer licensed in the State of Washington.

D. Submittals:

1. Submit shop drawings for all substructures and attachment methods.
2. Submit proposed alternative methods of attachment for review and approval by the Architects, prior to deviating from the requirements given below.
3. For all pipe hangers and support systems, submit structural calculations and details which include all resultant forces applied to the building structure and are prepared and signed by the Contractor's licensed Washington professional engineer. Calculations will be reviewed for compliance with design criteria, not for arithmetic.

E. Materials:

1. Use Kin-Line, Grinnel, or approved equal.
2. Support all pipelines individually with hangers, each branch having at least one hanger. Lateral brace as noted and required.

3. Support piping near floor with steel stanchions welded to end plates secured to pipe and floor.
4. Support vertical piping at each floor level. Install coupling in piping at each support. Coupling shall rest on and transmit load to support. Isolate copper from steel supports with vinyl electrician's tape around pipe and coupling.
5. Use Stoneman "Trisolator," Unistrut, or approved equal, isolators at each hanger and other support points on bare copper tubing system.
6. For PVC pipe, space hangers four (4) feet apart for pipe sizes 1" and under, five (5) feet apart for pipe sizes 1-1/4" to 2", and six (6) feet apart for pipe sizes over 2". Space hangers for horizontal pipes at a maximum of six (6) feet for copper 2" and smaller and for steel 1-1/4" and smaller; ten (10) feet for copper 2-1/2" and larger and for steel 1-1/2" and larger.
7. Size hanger rods, screws, bolts, nuts, etc., according to manufacturer's sizing charts.
8. Trapeze hangers may be used for parallel lines.
9. Use galvanized or stainless steel hangers, attachments, rods, nuts, bolts, and other accessories in pool mechanical room, high humidity areas, or where exposed to weather. Hot dip galvanize all items which are not factory furnished. Plating for hinged movements must be done at the factory.
10. Lateral Bracing: To prevent swaying of the piping systems, provide angle iron bracing and anchor into wall or overhead framing. Piping shall be braced or anchored in such a way as to resist a horizontal force of 50% of its operating weight in any direction.
11. Do not use wire or other makeshift devices for hangers.
12. Furnish all substructures and fasteners required to comply with the limitations given below. Use material as specified in the various sections and as appropriate to their use.
13. Install stainless steel or FRP Unistrut, pipe clamps/hangers, supports/bracing with stainless steel hardware in the chemical storage rooms, surge/balance tanks, or any other corrosive environment.

F. Guidelines & Limitations:

1. Each Contractor will coordinate the load requirements from all subcontractors so that no combination of loads overstresses the building structure or exceed the limitations given below.
2. Concrete Structure:
   a. Support all loads hung from concrete structure with cast-in-place inserts, unless drilled-in anchors are specifically approved in writing prior to placing the concrete.
   b. Concrete anchors must not penetrate into reinforcing bars. Where the anchors boring indicates the presence of reinforcing bar, patch hole with an epoxy type grout and relocate anchor 12 diameters away.
   c. Individual expansion anchors cannot support any loads greater than 300 pounds or manufacturer’s specified load capacity without approval.
3. Steel Structure:
   a. Hang no more than 20 pounds per metal deck rib in any span.
   b. At beams, hang all beam loads greater than 40 pounds concentric to beam, not off the flanges.
   c. Attached no loads to the beams or girders greater than the following without specific approval from the architect;
      1) Roof beams and girders: 300 pound point load or 600 pound total load for a single span.

G. Seismic Bracing:

1. Design and install seismic bracing to not ground out vibration and sound isolation systems.
2. All items of mechanical and electrical equipment 60” or more in height are to be seismically braced whether such bracing is shown or not.

2.6 SLEEVES AND WATERSTOPS

A. Provide sleeves where work of this Section passes through fire rated partitions, floors and ceilings, concrete slabs or exterior of structure. Caulk clearance space using sealant appropriate for application in conformance with manufacturer's recommendations and Title 24 of Washington Code of Regulations. 3m, Dow Corning, or approved equal. In lieu of sleeves and caulking, "Link Seal" products may be used.

B. Provide prefabricated waterstops as indicated on the Drawings at all pipe penetrations through structures containing stored water (i.e., swimming pools, balance/surge tanks, etc.) to insure leak-proof seals.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to Work of this Section, carefully inspect the installed Work of other trades and verify that such work is complete to the point where this installation may properly commence.
2. Verify that items of this Section may be installed in accordance with the original design and referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner’s Representative.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
3. Failure to notify the Owner’s Representative and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive his work.

3.2 ABBREVIATIONS AND SYMBOLS

A. Abbreviations and symbols on the Drawings are those most commonly used. Obtain clarification from the Owner’s Representative on any questionable items before bid.

3.3 GENERAL PIPING REQUIREMENTS

A. Size any section of pipe for which size is not indicated or any intermediate section erroneously shown undersized the same size as the largest pipe connecting to it. Sizes listed are nominal.

B. Cut pipe accurately to job measurements and install without springing or forcing, true to line and grade, generally square with building and/or structures and adequately supported to prevent undue stress on pipe, fittings and accessories.

C. Make changes of direction with manufactured fittings. Street ells, bushings, reducing flanges, close nipples or bending of pipe is not allowed.

D. Use great care to install piping in accordance with best practice. Plastic pipe shall be “snaked” in trenches to allow for thermal expansion.

E. All above grade, below grade and buried or imbedded PVC shall be installed using solvent weld fittings. Also, each and every fitting and pipe end shall be prepared with solvent primer. Fittings shall be joined individually and with enough time between assembly of adjacent joints to allow them to seal solidly. After joining, an even ring of primer must be visible around the entire fitting. If any fittings are installed without visible primer, the fitting shall be removed and discarded and piping recut, rechamfered and joint made up again using a new fitting. All procedures, methods and techniques used to make up solvent weld joints shall be in strict accordance with manufacturer's recommendations.

F. Arrange pipe and hangers to allow for expansion, contraction and structural settlement. No pipe shall contact structure except penetrations as shown on the Drawings.

G. Provide dielectric connections between copper and dissimilar metals. In copper systems, threaded piping including connections to equipment shall be brass pipe and fittings. Install dielectric connections in vertical sections of piping only.

H. Run pipe full size through shut-off valves, balancing valves, etc. Change pipe size within three (3) pipe diameters of final connection to control valves, fixtures and other equipment.

I. Provide unions or flanges at connections to equipment, on service side of valves and elsewhere as required to facilitate ease of maintenance.

J. Locate equipment shut-off valves as close to equipment as possible maintaining easy valve access.

K. Make all connections between domestic water systems and equipment or face piping with approved backflow prevention devices as required.

L. All PVC pipe exposed to direct sunlight shall be painted with two coats of Exterior Acrylic Semi-Gloss Paint, Sherwin Williams or equal. Color to be selected by the Architect. Prior to painting the PVC pipes, the exterior of all PVC pipes shall be wiped with Methyl Ethyl Ketone, or an approved equal, to remove the glaze from the pipes.

M. The Main Drain pipe must run either level or uphill from the main drain sump, through the surge pit (if applicable) and then to the circulation pump.

3.4 TRENCH EXCAVATION AND BACKFILL

A. Excavation:

1. Excavate and backfill trenches as required for the Work of this Section. Conform to requirements of Section 13 11 01.
2. The Contractor shall perform all excavation of every description and of whatever materials encountered, to the depths indicated on the Drawings or as necessary. The Contractor shall dispose of the excavated materials not required or suitable for backfill as directed, and shall perform such grading as may be necessary to prevent surface water from flowing into the trenches. The Contractor shall provide adequate equipment for the removal of storm or subsurface waters, which may accumulate in the excavated areas.

B. Trenching:

1. Excavate trenches to lines and grades as indicated on the Drawings and with banks as nearly vertical as practicable.

2. Bottoms of trenches shall be accurately graded to provide uniform bearing on undisturbed soil for the entire length of each section of pipe.
3. The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall shall not exceed 8” on either side of the pipe. The width of trench above the top of pipe may be wider if necessary.
4. Over-depth excavations shall be filled with tamped sand to required grades.
5. Excavations of five (5) feet or more in depth shall be shored or supported in conformance with rules, and regulations of State and Federal Governments. Shoring shall be constructed, maintained and removed in a manner to prevent caving of the excavation walls or other load on the pipe.

C. Backfilling:

1. Material for backfilling of pipes shall be approved granular material less than two (2) inches in diameter obtained from the excavation. No material of a perishable, spongy or otherwise unsuitable nature shall be used as backfill.
2. Backfilling of pipe trenches shall commence immediately after installation and testing to preclude damage to the installed pipe. Backfill around pipe shall be carefully placed so as not to displace or damage the pipe, and shall be carried up symmetrically on each side of the pipe to one foot above the top of the pipe. The material shall be carefully compacted or consolidated before additional backfill is placed.
3. Backfill above an elevation of one foot above the top of pipe in conformance with requirements of Section 13 11 01. Material for balance of backfill shall be approved granular material less than six (6) inches in diameter taken from the excavation.
4. Unless otherwise indicated on the Drawings, all pipe shall have a minimum of eighteen (18) inches of cover.

3.5 GENERAL EQUIPMENT REQUIREMENTS

A. Position equipment to result in good appearance and easy access to all components for maintenance and repairs.

B. Install piping, flues, breeching and ducts so that they do not interfere with equipment access.

C. Install level, secure and out of moisture. Provide shims, anchors, support straps, angles, grouted bases, or other items as required to accomplish proper installation.

D. All screws, nuts, bolts and washers shall be galvanized, or stainless steel. After fabrication, hot-dip galvanize unfinished ferrous items for outdoor, below grade or other use subject to moisture.

E. Extend 1/2” Schedule 40 black steel pipe lubrication tubes from all hard to reach locations to front of equipment or to access points. Terminate with proper type of lubrication fitting.

3.6 VALVES AND STRAINERS

A. If no shut-off is indicated, provide ball valves at inlet connections and balance valves at outlet connections to fixtures and equipment. Provide proper valve trim for service intended.

B. Use no solder end valves unless noted otherwise; provide adapters in copper tubing systems.

C. Locate valves with stems above horizontal plane of pipe. In general, locate valves within six (6) feet of floor, out from under equipment, in accessible locations with adequate clearance around hand wheels or levers for easy operation.

D. Provide all valves, cocks and strainers, full pipe size unless indicated otherwise.

E. Provide hand wheel operators on all valves 6” and larger, under 6” lever operators may be used.

F. Provide tool operated valve with stainless steel shaft extension and 'on deck' tool operation for surge chamber butterfly isolation valve.

3.7 IDENTIFICATION OF PIPING

A. Identify each valve by a numbered brass tag with hole and brass chain mounted on valve stem or handle. Tag to be a minimum of 1” in diameter and numbers at least 1/4” high stamped into tag. Valves and plumbing lines shall be labeled clearly with the source or destination descriptions.

B. Install an identification chart in a plastic or glass framed enclosure, which schematically illustrates the proper operation of all piping systems and indicates number and location of all valves and control devices within the system.

C. The direction of flow for the recirculation equipment shall be labeled clearly with directional symbols such as arrows on all piping in the equipment area. Where the recirculation equipment for more than one pool is located on site, the equipment shall be marked as to which pool the system serves.

3.8 TESTS

A. Perform tests in presence of Owner’s Representative with no pressure loss or noticeable leaks.

B. Do not include valves and equipment in tests. Include connection to previously tested sections if systems are tested in sections.

C. Perform tests as follows:

System	Test Pressure	Test Medium	Duration
Skimmer Lines and Lawson Main Drain sump lines	20psig	Water*	4 hours
Pool Piping	50 psig	Water*	4 hours
Pool Main Drains	30 psig	Water*	4 hours
Domestic Water	150 psig	Water*	4 hours

***Never test PVC pipe or fittings with air or other gases, always use water.**

3.9 PIPE MATERIAL APPLICATION

A. PVC Schedule 40: Below grade swimming pool piping and domestic water piping up to 12” line size; use standard solvent weld fittings.

B. PVC Schedule 80: Above grade swimming pool piping up to 12” line size; use solvent weld Schedule 80 or epoxy coated cast iron fittings.

C. Type L Hard Copper: Above grade domestic water piping.

D. CPVC Schedule 80; Pool Heater Piping.

E. Schedule 40 Steel: Natural gas piping.

F. Pipe Insulation for Cold Plunge or Cold Water Piping: Install pipe insulation on all cold water PVC schedule 80 cold plunge circulation piping located in the pool mechanical room and exposed above grade piping. Provide NBR/PVC closed-cell pipe insulation, pre-slit, pre-glued with overlap, ¾" wall thickness with a temperature range between -70° to 220°F for schedule 80 PVC pipe.

3.10 CUTTING AND DRILLING

A. Cutting or drilling necessary for installation of Work of this Section shall be done only with approval of Owner's Representative.

3.11 CLOSING-IN OF UNINSPECTED WORK

A. Do not cover or enclose Work before testing and inspection. Re-open Work prematurely closed and restore all Work damaged.

3.12 QUIETNESS

A. Quietness is a requirement. Eliminate noise, other than that caused by specified equipment operating at optimum conditions, as directed by Owner's Representative.

3.13 FLUSHING OF LINES

A. Flush or blow out pipes free from foreign substances before installing valves, stops or making final connections. Clean piping systems of dirt and dust prior to initial start-up.

B. Just prior to plastering the pool, under the observations of the IOR, the pool mechanical system shall be flushed using the pool circulation pump. Circulate water through the mechanical system until the effluent water from the pool return heads runs clean.

3.14 CLEAN-UP

A. After all Work has been tested and approved, the Swimming Pool Subcontractor shall thoroughly clean all parts of the equipment installations, including all pool pipe and fittings in the pool mechanical room. Exposed parts shall be cleaned of cement, plaster and other materials and all grease and oil spots removed with solvent.

B. The Swimming Pool Subcontractor shall remove debris from the Project site. Cartons, boxes, packing crates and excess materials not used, occasioned by this work shall be disposed of to the satisfaction of the Owner's Representative.

C. If the above requirements of clean up are not performed to the satisfaction of the Owner's Representative, the Owner reserves the right to order the work done, the cost of which shall be borne by the Swimming Pool Subcontractor.

END OF SECTION 13 11 07

13 11 08 – SWIMMING POOL ELECTRICAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials and equipment as required to install the swimming pool electrical system including but not limited to:

1. A complete and operable system of service equipment, switchboards, panelboards, conduits, switches, time clocks and wiring for power and lighting, motor control centers.
2. Junction and/or pull boxes, conduits, disconnects, starters, contactors, wiring and connection of all motors and mechanical equipment, including connection and wiring of line voltage controls associated with the mechanical systems.
3. Swimming pool underwater lighting systems.
4. Swimming pool timing system outlets and scoreboard.
5. Complete grounding system as required and shown on the Drawings.
6. Complete equipotential bonding system as required and shown on the Drawings and in accordance with National Electric Code Article 680.
7. Adjusting and preliminary operation of the completed electrical system as described in Article 3.6, A of this Section.
8. Cleaning of all completed Work and installation adjustment of all trim and decorative items.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.
2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.
3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Ordinances and Codes: Materials and construction shall conform with all applicable code requirements, including:

1. National Electrical Code, latest edition; Electrical Safety Orders of the State of Washington; Department of Industrial Relations; regulations of the State Fire Marshal; rules and regulations of the Board of Underwriters of the Pacific, UL 50, 50E and NEMA 250 rating.
2. International Building Code, latest edition.

C. Verification of Conditions:

1. The locations shown on the Drawings are diagrammatic only and the exact finish location of equipment and materials cannot be indicated. Therefore, locations of all Work and equipment shall be verified to avoid interferences, preserve head room and keep openings and passageways clear. Changes shall be made in locations of equipment and materials which may be necessary to accomplish these purposes.

D. Preliminary Operations and Testing:

1. Motor driven equipment shall be tested for correct rotation and completion of all connections.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00. Requests for substitutions shall conform with requirements of Article 1.10.A of Section 13 11 00.

B. B. Required submittals include:

1. Conduit and Fittings as specified in Article 2.2 of this Section.
2. Panelboards as specified in Article 2.8 of this Section.
3. Circuit Breakers as specified in Article 2.9 of this Section.
4. Motor Starters as specified in Article 2.12 and 2.13 of this Section.
5. Fuses as specified in Article 2.15 of this Section.
6. Time Clocks as specified in Article 2.16 of this Section.
7. Ground Fault Circuit Interrupters as specified in Article 2.17 of this Section.
8. NEMA Type 4x corrosion resistant UL 50, 50E & NEMA 250 rating for enclosures, cabinets and boxes as specified in Article 2.11 & 2.18 of this Section.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

A. Delivery: Deliver all materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store all materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project site.

C. Protection: Use all means necessary to protect swimming pool electrical materials before, during, and after installation and to protect the installed Work specified in other Sections.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Materials shall be new, in unbroken packages and bear the U.L. label of approval.

B. Equipment of one type shall be by same manufacturer. One type of equipment for classifications such as:

1. Switchboards, panels, buss duct, disconnect switches and allied items.
2. Conduit.
3. Wire.
4. Conduit fittings.
5. Fixtures of the same general type.
6. Wiring devices.

2.2 CONDUIT AND FITTINGS

A. Conduit within or under buildings or where exposed outdoors shall be rigid metal threaded, hot dipped galvanized, or U.L. approved plastic except where noted otherwise on the Drawings. Metallic conduit shall be of the same metal between outlets or terminals.

B. Use flexible metallic conduit only for short connections of motors and where specifically called for on Drawings. Maximum length shall be 40". Use only liquid tight flexible metal conduit. Install an unbroken #12 AWG insulated copper grounding conductor in each liquid tight flexible conduit with permanent connection at motor junction box and service panel ground.

C. Protect, before installation, metallic conduit runs in all slabs laid on grade or in contact with the earth or exposed in damp locations, with two (2) heavy coats of asphaltum rust-resisting compound.

D. Encase conduits 2-1/2" or larger run underground, outside, or under buildings, in concrete envelopes a minimum of 3" thick, except as indicated otherwise on Drawings or stubouts. Conduits 2 and smaller laid 18" below finish surface in soil.

E. Low voltage runs underground outside buildings, 1-1/4" or smaller, may be G.I. or sherardized steel conduit, with machine applied wrapping equal to double wrap or Scotch-Wrap #50 tape, half lapped and quadrupled at joints in lieu of concrete encasement.

F. Service conduits through foundations or concrete members shall run through metal sleeves with adequate clearances for full movement of the conduit. Do not run conduits through footings.

G. Secure conduits run exposed on surfaces with one hole heavy-duty straps or fasten with matching fittings to inserts or trapezes, parallel to building walls and ceilings.

H. Cap all conduit or duct stub-outs with standard factory caps; except cap threaded steel conduit with B.I. water pipe caps in outdoor locations.

I. Use conduit fittings as manufactured by Crouse-Hinds Company, Appleton Electric Co., or approved equal.

J. Employ U.L. liquid tight fittings for use with liquid tight flexible metal conduit.

K. Use unions as manufactured by Appleton, O-Z/Gedney, or approved equal. The use of running threads will not be permitted.

L. Exposed conduit and fittings in chemical rooms shall be nonmetallic rigid polyvinyl chloride, corrosion resistant rated suitable for installation in corrosive environments and in accordance with the latest NEC requirements.

2.3 EQUIPOTENTIAL BONDING/GROUNDING

A. Bond together and ground to a common ground at a single point all metallic conduit, piping systems, pool reinforcing steel, metal parts of ladders, lifeguard stands, handrails and their supports and the like. The solid copper bonding conductor shall not be smaller than #8 copper. Provide equipotential bonding per Article 680 of the National Electrical Code. In instances where no deck reinforcement is present, Contractor shall provide a minimum of three feet of equipotential bonding material in conformance with Code. All bonding items shall be inspected prior to concrete pour.

2.4 WIRING CONNECTIONS

A. Make connections without strain on conductors, allowing the conductors to take a natural position after connections or taps are made. Include all strand of wire in making the connection.

B. Make connections for wiring by one of the following means:

1. Make all taps or connections to conductors with compression type connectors except those smaller than #8 B&S gauge may have soldered connections. Solderless connections for #10 AWG or smaller may be used and shall be "Scotchlok", Buchanan, or approved equal. For #8 AWG or larger, they shall be T&B "LockTite", Burndy "Versitaps", or approved equal.
2. All cable or conductor terminal lugs shall be Burndy "Quicklug", Ilsco, or approved equal. Two piece stamped lugs and solder lugs will not be approved.
3. Paint taped splices in damp or outdoor locations with two (2) coats of insulating paint.
4. Tag all branch circuit wires with circuit number at the panelboard and at each point of use with linen or plastic tags.

2.5 CONDUCTORS

A. Copper RHW or THW. Do not make splices between boxes.

2.6 COLOR CODING

A. Neutrals (identified conductors shall be white).

B. Phase conductors shall be red for phase B; blue for phase C.

C. Green shall be used for mechanical equipment and receptacle grounds only.

2.7 MOTOR WIRING

A. Make final connections to motors with the required AWG (Minimum #12), Flamenol machine tool wire, 19 strand. Control wiring for equipment shall be Flamenol machine tool wire, 19 strand of required AWG. Provide corrosion resistant junction boxes at each item of equipment to change from standard building wiring to machine tool wire.

B. Phase motors as proper in direction of rotation.

2.8 PANELBOARDS

A. Panelboards shall be flush or surface mounting as indicated with circuit breakers as shown on panel schedule, hinged lockable doors, index card holders and proper bussing.

B. Where indicated on the drawings, panelboards shall be furnished with subfeed breakers and/or lugs, split bussing, contractors, time switches, relays, etc., as required.

C. All panelboards shall be keyed alike.

D. All panelboard enclosures shall be corrosion resistant rated NEMA 4X in accordance with the latest NEC requirements.

E. Furnish corrosion resistant panelboard enclosures and terminal cabinets with Yale 46515 flush locks and LL806 keys except where indicated otherwise herein. Fasten the trim to panel boards and terminal cabinet by means of concealed, bolted or screwed fasteners accessible only when the door is open.

F. Panelboards 208/120 volt, three phase, 4 wire, S/N or 120/240 volt, single phase, 3 wire, S/N.

Panelboard types as manufactured by:	
Westinghouse	Type B10B
General Electric	Type NLAB
Square D	Type NQOB

G. Panelboards for 480/277 volt, three panes, 4 wire, S/N.

Panelboard types as manufactured by:	
Westinghouse	Type Pow-R-Line 2
General Electric	Type AE
Square D	Type NEHB
Sylvania	Type NH1B
I.T.E.	Type Approved Equal

H. Panelboard for bussing sizes thru 400 amp shall be 20" wide surface mounted type. Recess mounted type shall have a 20" wide (maximum) recess metal enclosure with trim plate cover extending 1" on all sides of enclosure. Depth shall be 5-3/4" nominal. Height of panel as required for devices.

I. Provide 6" additional gutter space in all panels where double lugs are required, or where cable size exceeds bus size. Minimum bottom gutter space shall be 6" high. 12" additional gutter space may be required for aluminum feeders where used.

J. Panelboards shown on the drawings with relays, time clocks or other control devices shall have a separate metal barriered compartment mounted above panel with separate hinged locking door to match panelboard. Provide mounting sub-base in cabinet for control devices and wiring terminal strips.

K. Panelboard shall have a circuit index card holder removable type, with clear plastic cover. Index card shall have numbers imprinted to match circuit breaker numbers.

2.9 CIRCUIT BREAKERS

A. Breakers shall have a minimum short circuit interrupting rating of 10,000A symmetrical for panelboard voltage thru 240 volt and 14000A for panelboards thru 600 volts or as specified on the drawings. In no case shall the interrupting rating be less than the bus withstand rating unless noted otherwise on the drawings.

B. Circuit breakers as manufactured by the following companies only are acceptable:

1. General Electric Company
2. Square D Company
3. Westinghouse Company
4. I.T.E. Company

C. Circuit breakers shall be arranged in the panels so that the breakers of the proper trip settings and numbers correspond to the numbering in the panel schedules on the drawings. Circuit numbers of breakers shall be black-on-white micarta tabs or other previously approved method. Circuit number tabs which can readily be changed from front of panel will not be accepted. Circuit number tabs shall not be attached to or be a part of the breaker.

D. Where two or three pole breakers occur in the panels, they shall be common trip units. Single pole breakers with tie-bar between handles will not be accepted.

E. All circuit breakers shall be padlockable in the "off" position. Locking facilities shall be riveted or mechanically attached to the circuit breaker (submit sample for approval). Other means of attachment shall not be accepted without prior written approval of Architect.

F. Where branch circuit breakers supply the power to motors and signal systems, the breakers shall be furnished with lockout clips, mounted in the "on" position. The breakers shall be able to trip automatically with lockout clips in place.

G. Panelboard circuit breakers shall be bolt-on type.

2.10 BUSSING

A. Bussing shall be rectangular cross section copper, or full length silver or tin-plated aluminum.

B. Bussing shall be braces to withstand symmetrical short circuit ratings as follows or as noted on drawings. In no case shall bus short circuit bracing be less than specified circuit breakers.

C. Each panelboard shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

2.11 POOL MECHANICAL EQUIPMENT ENCLOSURES, TERMINAL CABINETS & MISC CABINETS

A. All pool mechanical equipment enclosures, terminal cabinets and miscellaneous cabinets in the pool mechanical room or chemical storage rooms shall be corrosion resistant rated in accordance with the latest NEC requirements. Enclosures and all cabinets shall be flush mounted (except where noted a surface) of the size indicated on the drawings, and complete with hinged lockable doors and the number of 2-way screw terminals required for termination of all conductors. Terminal cabinet locks to operated form same key used for panelboards. The trim to terminal cabinets shall be fastened by means of concealed bolted or screwed fasteners accessible behind door to terminal cabinets. Terminal cabinets shall have 5/8" plywood backing.

B. Provide engraved nameplate on each enclosure and cabinet indicating its designation and system (i.e., Swimming Pool - Panel ‘SP’).

2.12 MOTOR CONTROL INDIVIDUAL STARTERS

A. Manual Motor Starters:

1. Provide flush or surface mounting manual motor starters with number of poles and size of thermal overload heaters as required for the motor being controlled (equipped with overload heaters, one for each motor lead). Back boxes shall be supplied with all flush mounting starters whether they are toggle type requiring only a 4" square outlet box or the

larger type requiring a special box and cover designed to accept the particular unit. All box types shall be corrosion resistant rated in accordance with the latest NEC requirements.

2. Unless otherwise noted on the drawings, all manual starters for single phase motors, smaller than 1 h.p., shall be the compact toggle type. Manual starters for all single phase motors, 1 to 5 h.p., and all three phase motors up to 5 h.p. shall be the heavy duty type.
3. Where manual motor starter is shown with pilot light, the pilot light shall be installed in a separate outlet box adjacent to the starter outlet, and engraved nameplate in indicate function of pilot light.
4. The following motor starters as manufactured by:

Manufacturer	**Single Phase 1HP and Below**	**Others**
Arrow Hart	Type RL	Type LL
General Electric	CR 101	Class CR 1062
I.T.E.	Class C10, C11 or C12	Class C20
Square D Company	Class 2510, Type A	Class 2510, Type B & C
Westinghouse	Type MS	Type A100
Allen Bradley	Approved Equal	Approved Equal.

B. Individual Magnetic Motor Starters:

1. Magnetic motor starters shall be A.C. line voltage, across-the-line units in a corrosion resistant rated enclosure in accordance with the latest NEC requirements.
2. All starters located outside of a building whether or not indicated shall be W.P. (weatherproof), and all starters noted W.P. shall be furnished in a corrosion resistant rated stainless steel enclosure in accordance with the latest NEC requirements.
3. Starter shall be horsepower rated for the motor controlled, and shall be equipped with properly sized overload elements. Every pole shall be with overload element.
4. Verify the exact motor current and voltage characteristics with the Contractor supplying the motor before installation of a starter.
5. Each starter shall be equipped with "Hand-Off-Auto" switch or stop-start pushbutton as required.
6. Coils shall be designed to operate on voltage indicated on control diagrams and have built-in-under the voltage release for coil circuit to drop motor starter off the line when the line voltage drops below normal operating voltage.
7. The coil control circuit shall be independently fused, sized to protect coil.
8. Starters to be equipped with running pilot light indication with a "Push-to-Test" feature.
9. Magnetic starters shall have a minimum of two auxiliary contacts. Additional auxiliary contacts shall be provided as required to comply with the requirements of the wiring diagrams on the electrical and mechanical drawings and the description of the function in the Mechanical Section of the Specifications.
10. Starters shall comply with NEMA standards, size and horsepower ratings as indicated on drawings.
11. The following types of magnetic motor starters as manufactured by:

Manufacture	**Type**
General Electric	Class CR 106
I.T.E.	Class A20
Square D Company	Class 8536
Westinghouse	Type A200 (Size 4 Max.) or Class II-200 (Sizes 5-8)

2.13 INDIVIDUAL COMBINATION MOTOR STARTERS

A. Combination starter shall incorporate fused disconnect switch and individual magnetic motor starter. Combination starters shall be mounted in a corrosion resistant rated enclosure in accordance with the latest NEC requirements.

B. Starters shall comply with NEMA standards, size and horsepower ratings as indicated on drawings General Electric, Square D, Westinghouse or I.T.E.

C. The disconnect handle used on combination starters shall control the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is "ON" or "OFF", and shall include a two-color handle grip, the black side visible in the "OFF" position indicating a safe condition, and the red side visible in the "ON" position indicating an unsafe or danger condition.

D. All starters used in combination starters shall be manufactured in accordance with the latest published NEMA standards, sizes, and horsepower ratings. These starters shall be furnished with three melting alloy type thermal overload relays.

E. Thermal units shall be of one-piece construction and interchangeable. The starter shall be inoperative if a thermal unit is removed.

2.14 MOTOR CONTROL CENTER, INTERLOCKS AND CONTROL DEVICES

A. Refer to mechanical and plumbing drawings and specifications and provide all control devices including timeswitches, relays and interconnection of starters as required.

B. Mount all relays and timeswitches in a separate compartment in motor control center unless otherwise indicated.

C. Whether shown on mechanical and plumbing drawings or control center schedules or not, where motors are controlled by external devices (i.e., thermostats, relays, float or pressure switches, etc.) or interlocked with other motors, each motor starter to be equipped with a "Hand-Off-Auto" selector switch in starter cover. Other starters equipped with a "Start' Stop" pushbutton station in starter cover. The Contractor shall be responsible to submit a complete and detailed set of shop drawings, electrical schematic design along with electrical component cut sheets from the MCC panel or the interlock control device manufacturer. RSD Total Control: Allan Pearson 949-380-7878, South Coast Controls: Anthony Ellis 714-998-5656, H2O Integration Controls, Mike Macri, 253-244-1576 or approved equal.

2.15 FUSES

A. Fuses shall be dual element, current limiting type, U.L. Class RK5 unless otherwise indicated on the drawings. Provide one spare set of fuses of each size and type in each motor control center.

2.16 TIME CLOCKS

A. Time clocks shall be provided for all underwater lighting systems and swimming pool circulation pumps not controlled by filter microprocessors.

B. Contacts shall have a minimum rating of 40 amperes at 277V.

C. Timing motor shall be heavy duty synchronous, self starting, high torque type, and shall be rated at 120, 208, 240, 277 volt 60 Hz.

D. Motor shall operate normally at temperature range of -60 degrees Fahrenheit to +120 degrees Fahrenheit.

E. Dial shall be 3" diameter, clearly calibrated with day/night zones and 24 hour rotation, with gear to provide one revolution yearly which automatically varies the on/off settings each day according to seasonal changes. Day and month of the year shall show clearly through calendar window on the dial.

F. Time clocks shall be equipped with 7-spoke omitting wheel marked with days of the week.

G. Time clocks shall be housed in a corrosion resistant rated enclosure in accordance with the latest NEC requirements.

H. Acceptable manufacturers are Intermatic, Tork, Paragon, or approved equal.

2.17 GROUND FAULT CIRCUIT INTERRUPTERS

A. Minimum rating shall be 20 amperes, 125V, 5 milliampere trip setting, Class A per UL943.

B. Manufacturer to be Crouse-Hinds, Leviton, or approved equal.

2.18 BOXES

A. Boxes shall be of the size required by ordinances or larger, must be corrosion resistant in accordance with the latest NEC requirements where concealed or exposed on ceilings or walls.

B. Outlets to be surface where wiring is exposed and flush in areas where conduit is concealed.

C. Provide surface outlets with proper corrosion resistant surface covers. Box and cover shall be deep enough to provide at least 1/4" clearance between back of device and back of box. Where box contains more than one device, use a corrosion resistant rated gang box with proper cover in accordance with the latest NEC requirements. Surface outlet boxes shall be of the threaded hub type wherever below 8'0".

D. If necessary for cable installation, additional pull boxes or junction boxes may be installed in accessible locations. Exposed pull boxes and junction boxes shall be corrosion resistant rated in accordance with the latest NEC requirements.

E. Where exposed to weather pull boxes larger than outlet boxes are required, galvanized code gauge sheet steel boxes may be used with covers attached by brass machine screws may be used. Boxes exposed to the weather shall be approved for the purpose, and conduit entrances shall be on the bottom made by means of an interchangeable hub with gasket and adapter nut. Pull boxes not shown on Drawings may be added only after approval of size and location is obtained.

F. For outlets exposed to weather or where noted, cast outlet boxes shall be Crouse-Hinds, Appleton, or approved equal. Boxes shall have proper number and size hubs. Device plates, covers, adapters and boxes shall be as manufactured by Crouse-Hinds, Appleton, or approved equal.

G. Exposed junction boxes, outlet boxes and pull boxes for pool chemical rooms shall be non - metallic suitable for a corrosive environment and in accordance with the latest NEC requirements.

2.19 IDENTIFICATION MARKINGS

A. Plainly mark all motor and electrical appliance control equipment indicating the equipment controlled with engraved metal tags.

B. Provide laminated plastic nameplates on panelboards on the outside of the door at the top indicating panel designation and feeder source.

C. Provide laminated plastic nameplates on distribution switchboards and motor control centers at the top center indicating panel designation and feeder source.

D. Identify each distribution switchboard and motor control center circuit breaker with a laminated plastic nameplate indicating its' use.

E. Type panelboard directories on the forms provided with the equipment, indicating the use of each branch circuit breaker.

F. Fasten all laminated plastic nameplates to surfaces with two (2) or more screws.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify conditions at the Project site before submitting bid. Be responsible for providing all necessary wiring for the new electrical systems. Wherever wiring is being disrupted due to remodeling or changes, reconnect existing and provide new wiring circuits to accomplish a fully operable system at no additional cost to the Owner.

3.2 COORDINATION

A. The Drawings are essentially diagrammatic and indicate the desired location, size, routes, connection points, etc., and are to be followed as closely as possible. Proper judgment must be exercised in executing the Work so as to provide the best possible installation in the available space and to overcome difficulties, limitations or interference wherever encountered. Be responsible for the correct placement of this Work, the proper location and connection in relation to Work of other trades, for determining the exact location of all conduits, outlets and equipment, and for installing the conduits in such a manner as to conform to the structure, avoid obstruction, preserve headroom and keep openings and passageways clear. Particular attention is directed to the close coordination required on exposed Work. Locations shown on Architectural or Mechanical Drawings if different than those shown on Electrical Drawings should be communicated to the Owner’s Representative in writing for clarification.

3.3 INSTALLATION

A. Trenching and Backfill: Conform with requirements of Section 13 11 01. Provide minimum cover as required by Code.

B. Conduit Installation:

1. Conduit and metallic raceway systems shall be mechanically and electrically continuous from sources of current to all outlets in a manner to provide a continuous grounding path. Close ends of conduit during construction to prevent entrance of dirt or moisture.
2. Securely fasten conduit to the building construction within three feet of each outlet and within every ten feet thereafter. Secure it to boxes, cabinets, pull boxes, terminals with two locknuts and ends equipped with bushings or a terminal fitting. Cut square with ends carefully reamed.
3. Make bends or elbows so that the conduit will not be injured or flattened.
4. Use insulated metallic bushings in all places where bushings are required.
5. Run exposed conduits level or plumb and parallel to the construction members of the building. No cutting across or diagonal runs will be permitted. Neatly surmount structural obstructions encountered on conduit runs by the use of fittings or pull boxes.
6. Identify feeder conduits by stamped metal tags secured to exposed section of conduit in main or sub-panels.
7. Make up all threaded conduit joints gas and watertight with conductive sealer except conduit above ground in dry indoor locations.
8. Rigidly support all boxes independently of the conduit system.

C. Connections to Equipment:

1. Fully connect, in an approved manner, all electrical outlets, apparatus, motors, equipment, fixtures, wiring devices and appliances whether they are installed under the Electrical Contract or not, which require electrical connections, to the corresponding electrical system outlet.
2. Where the Work of this Section requires connections to be made to equipment that is furnished and set-in-place under other Sections, obtain such roughing-in dimensions from the manufacturer or supplier of each item as required and assume full responsibility for the installation of the connections thereto.

3.4 ADJUSTMENT AND CLEAN-UP

A. Preliminary Operation: Should the Owner's Representative deem it necessary to operate the electrical installation or any part thereof prior to Substantial Completion of the Work, consent to such preliminary operation and supervise conduction of same. Subcontractor shall pay all costs occasioned by such operation. Preliminary operation shall not be construed as an acceptance of any Work installed under this Contract.

B. Clean-up: Upon completion of the Work of this Section, immediately remove all swimming pool electrical materials, debris and rubbish occasioned by this Work to the approval of the Owner's Representative.

END OF SECTION 13 11 08

13 11 09 – PREFABRICATED SWIMMING POOL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, General Conditions, Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes the following items:

1. Prefabricated Wall System.
2. Prefabricated Gutter System.
3. Prefabricated Headwall Assemblies.
4. Base Frames, Buttresses, Panel Supports and other structural support components.
5. Prefabricated Bottom Drains.
6. Moveable bulkhead with track and starting platform anchors.
7. PVC Floor Membrane:
   a. Normal.
   b. Anti-slip.
8. Inlets:
   a. Floor.
9. Accessories:
   a. Floating Line Anchors.
   b. Wall Targets.

B. Related Sections include the following:

10. Division 13 Section 13 11 02 "SWIMMING POOL CONCRETE" for additional concrete pool foundation tolerance and finishing requirements

1.3 DEFINITIONS

A. Base Frame: Structural steel member bolted to bottom panel flange and concrete foundation designed to provide adjustable interface between wall panels and concrete foundation.

B. Bottom Drain: Drain typically placed at lowest portions of pool typically used to drain the pool but may also be used in conjunction with filtration. Often termed ‘Main Drain’.

C. Buttress: Structural steel member bolted to panel support or base frame and foundation designed to transfer applied loads to the foundation.

D. Floating Line Anchor: Steel component at pool perimeter used to secure the ends of floating lines. May be one of several availably types depending on pool design.

E. Floor Underlayment: Material placed between the foundation and the PVC floor membrane, which may be designed to cushion the floor, buffer imperfections in the floor finish, provide a sub-membrane drainage layer, etc.

F. Gutter: Component of wall system designed to convey water from the pool along it's perimeter to the filtration system.

G. Gutter Mounted: An accessory supported by steel brackets attached to the gutter system designed to reduce the need for deck equipment. May consist of handrails, line anchors, stanchion sockets, or other accessories.

H. Inlet: Water distribution device located at finished pool wall or floor used to distribute water from filtration system into the pool.

I. Liquid PVC: PVC dissolved in a solution that, when exposed to air, will bond to PVC and harden to form a seal.

J. Panel Support: Steel member bolted to the wall panels at panel seams.

K. Primary Components: Structural or critical elements of pool assembly. Primary components include, but are not necessarily limited to, base frames, wall panels, panel supports, buttresses, gutters, and gutter supports, concrete anchors, and PVC membrane.

L. PVC Membrane: Flexible sheet PVC of typically small thickness formed into rolls for use in various applications.

M. PVC Rope: Strips of PVC used in conjunction with a heat welding process to provide a primary seal in many applications.

N. PVC Welding: Process of bonding two or more PVC elements by using a special heat tool to melt adjacent layers of PVC then applying pressure to allow the melted layers to bond and cool.

O. Secondary Components: Less critical elements of pool assembly and fasteners. Secondary components include, but are not necessarily limited to, fasteners, accessories, grilles, PVC sealants and seaming materials, and tile and tile components.

P. Structural Supports: Base Frames, panel supports, buttresses, etc. designed to provide structural stability to wall system.

Q. Wall Panels: Fabricated sheet steel components, which when properly connected and supported, provide pool wall surface and waterproofing.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Install prefabricated swimming pool components utilizing manufacturer's standard and/or custom components and assemblies integrated into a complete system that form a pool capable of withstanding imposed structural loads, thermally imposed movement, and deterioration from weather, site, and service conditions at a minimum as specified in this Article.

B. Structural Performance: Install wall panels, structural supports, structural connections capable of withstanding the effects of soil (backfill) pressures, and hydrostatic & other loads and resulting stresses within the limits without leakage and under the conditions indicated:

1. Lateral Backfill Loads: Include lateral loads including lateral soil pressure, pool decks, other significant adjacent structures, and overburden created by compaction efforts performed in conformance with compaction techniques specified in this Article.
2. Hydrostatic Loads: Include lateral loads induced by the presence of water within the pool.

3. Lateral Live Loads: Include loads induced by contact of swimmers with the structure under intended use conditions.
4. Seismic Loads: Include lateral loads that may be induced into the structure from seismic activity. Consult applicable building codes and geotechnical information as required.
5. Load Combinations: Install pool system to withstand the following load combinations:
   a. Lateral Backfill.
   b. Hydrostatic.
   c. Hydrostatic + Lateral Backfill + Lateral Live.
   d. Hydrostatic + Lateral Backfill + Lateral Live + Seismic.
6. Deflection Limits: Install assemblies to withstand design loads with deflections no greater than the following:
   e. Structural Bracing: Horizontal deflection of 1/250 of the height, not to exceed .015 inches.

C. Water Penetration for Wall and Floor Systems: Install wall and floor assemblies manufactured and installed with no water penetration (leakage) through the system(s). PVC shall be continuous across connections between wall panels, between wall panels and floor membrane, and across joints between sections of floor membrane.

1.5 SUBMITTALS

A. General: For the following items in this section, submit 6 sets of documents. Provide submittals in accordance with the requirements of section 01 33 00.

B. Product Data: Include material descriptions and performance characteristics for the following system components:

1. Wall Panels.
2. Structural Supports.
3. Gutters.
4. Connections & Interface Components.
5. Headwall Assemblies.
6. Drains.
7. Inlets.
8. Floor Membrane.
9. Accessories.

C. Shop Drawings: Contractor to provide plans and structural calculations developed by the Pool Manufacturer indicating the type of anchor system & structural components and the type and number of accessories provided. Plans and calculations to be sealed by an engineer registered within the State of Washington. The shop drawings shall be submitted for plan review to the local building or plan review jurisdiction. The manufacturer shall be required to make all necessary modifications or changes to the plans or calculations as required by the local building or plan review for final approval. The manufacturer and Contractor shall report all necessary changes to the Architect.

D. Product Certificates: Signed by manufacturer of pool system certifying that products furnished comply with requirements.

E. Installer Certificate: Signed by manufacturer certifying that installation contractor complies with requirements.

F. Manufacturer Certificate: Signed by manufacturer certifying that they comply with requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has specialized experience in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer and who has successfully completed five (5) projects similar in scope and size within the past five (5) years. Temporary installations will not be considered for reference completed projects.

B. Pre-installation Conference: Conduct conference at Project site prior to start of installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall deliver components and other manufactured items to the Project Site so as not to be damaged or deformed. Package small components together in crates or containers to prevent loss of small items. Package hazardous and/or sensitive materials together and clearly labeled to indicate use of caution or extra attention is required. Finished panels shall be covered with continuously applied adhesive-fixed protective layer to prevent damage to panel surface. Bundle and secure components to prevent scattering and damage to other materials during shipment.

B. Storage at Project Site:

1. All pool components shall be stored and staged with sufficient site safety and security to ensure damage or losses from vandalism, theft, and weather do not occur.
2. Stack non-structural materials on platforms or pallets, covered with tarpaulins or other suitable weather tight and ventilated covering. Store underlayment and boxed items to ensure dryness. Do not store wall panels, PVC membrane, PVC profiles, or other soft-finish items in contact with other materials that might cause staining, denting, or other surface damage, or in direct sunlight.
3. Store hazardous materials as follows:
    a. Store in a climate-controlled environment within temperature ranges specified by product manufacturer.
    b. Keep out of direct sunlight.
    c. Store away from open flame or sources of heat.
    d. Comply with applicable safety regulations governing hazardous material storage and handling.

C. Handling: Unload, store, and erect manufactured pool components to prevent bending, warping, twisting, and surface damage.

D. See spec section 01 60 00 for additional requirements.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit installation according to manufacturer's written instructions and warranty requirements. Various phases of installation may have differing requirements.

B. Field Measurements: Prior to commencement of installation, site conditions shall be approved in writing by installation contractor as specified in Section 3.1 ‘Examination’. As projects may be phased, installation contractor shall only approve those portions of the project ready for pool installation.

C. Concrete Surfaces: At all times concrete floor shall be protected from oil, paint, solvents, etc., as many of these items will damage PVC membranes. Installation contractor and manufacturer shall be notified in writing if such items do come in contact with concrete floor. These items shall be remedied as required by manufacturer at Contractor's expense.

1.9 COORDINATION

A. Coordinate size and location of concrete footings, stem walls, and floors. Concrete, reinforcement, and formwork requirements are specified in Division 13 Section 13 11 02 "SWIMMING POOL CONCRETE."

B. Facilitation of storage and staging of hazardous and non-hazardous materials in conformance with Section 1.7 'Delivery Storage & Handling' requirements.

C. Contractor to coordinate quality control inspections with the pool manufacturer and Architect. Contractor will notify the manufacturer to visit the site at the following milestones to inspect the work completed and report if any corrections are required. Contractor will provide to Architect, manufacturers site visit report noting conditions and quality of work completed.

1. Delivery
2. Structure assembly
3. Waterproofing / Membrane installation
4. Waterproofing / Membrane installation completion prior to water fill.
5. Final Inspection

1.10 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty on Prefabricated Pool System: Written warranty, executed by manufacturer agreeing to repair or replace pool system components provided by manufacturer that have failed and/or directly result in leakage of the pool.

1. Warranty Period: Water-tightness and structural integrity-fifteen years from date of Substantial Completion. Plastic grille structural integrity-one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Myrtha Pools, no known equal.

2.2 STRUCTURAL COMPONENTS

A. Primary components shall be fabricated by cold working from AISI 304 or 316 stainless steel sheet or standard shapes.

B. Secondary components shall be grade AISI 304 stainless steel (minimum) and may be fabricated by hot-working as required.

C. Anchor Rods, Bolts, Nuts, and Washers. As follows:

1. Grade AISI 304 stainless steel minimum.

D. Chemical Anchors

1. Chemical anchor capsules in accordance with ASTM E 1512

2.3 PVC-COATED STEEL MATERIALS

A. Stainless Steel Sheet: Grade AISI 304 stainless steel minimum.

B. PVC-Coated Stainless-Steel Plate: All PVC coated stainless steel components shall be constructed from PVC coated stainless steel sheet (or blanks) manufactured by hot calendaring PVC to the stainless-steel sheet. The bonded PVC shall withstand tensile (de-lamination) force of 27 lb on a sample if 1” at 180° angle de-lamination.

2.4 PVC MEMBRANE

A. Floor Membrane: PVC floor membrane shall be a reinforced PVC geo-membrane (chemically coated fabric) with the following properties:

1. Minimum thickness of 1.5mm in accordance with ASTM D 374.
2. Minimum resistance to tearing of 90 lb/90 lb in accordance with ASTM D 1004.
3. Minimum resistance to peeling of 130/130 N/mm in accordance with ASTM D 638

2.5 FABRICATION, GENERAL

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark a minimum of one of each part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate elements to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Cold-formed members shall be free of cracks, tears, and ruptures.

B. Primary Components: Shop fabricate all aspects of primary structural components and panels. Punch/bend all elements including punching of holes for filtration components, through-panel fasteners, lights and accessories, bolted connections and bending of flanges for bolted connections and recesses. Field cutting/modification of primary components is not permitted.

2.6 2.06 STRUCTURAL SYSTEM

A. Structural Elements: Manufacturer's standard structural primary system, designed to withstand required loads and specified requirements. Primary system includes base frame, wall panels, panel supports, buttresses, gutter supports and gutters.

1. General: Provide structural elements with required splice members. Factory drill or punch for field-bolted assembly.
   a. Slight variations in pool depth, locations of accessories, and locations of change in floor slope may be acceptable if necessary to meet manufacturer's standard, as approved by Architect.
2. Base Frames: 'C'-shaped sections fabricated from cold-worked steel (14ga (2mm) steel sheet minimum). Frame construction shall ensure tight horizontal tolerance and allow for vertical adjustment to compensate for variations in finished concrete.
3. Wall Panels: Panels fabricated from cold-worked PVC laminated steel (14ga (2mm) steel sheet minimum). Panel construction shall provide for flanged-bolted connections with compatible steel with no through-panel fasteners below tile line. Flange bolt spacing shall not exceed 6" without utilizing flange stiffening element. Wall panels will have a protective plastic film on the interior face (water side) of the panel that will be removed during the installation process, before the pool is filled with water. Wall panels will have a clear, protective coating applied to the exterior face to provide a permanent shield against oxidation from chlorinated atmosphere.
4. Panel Supports: Panel supports fabricated from cold-worked steel (14ga (2mm) steel sheet minimum). Flanges, connection plates, and stiffening elements shall be fabricated by cold-working (no steel welding is permitted).
5. Buttresses: Structural braces fabricated from 14ga (2mm) steel sheet minimum. In lieu of fabrication from cold-worked sheet, buttresses may be fabricated from hot or cold formed standard angle, c, zee or other standard section provided all additional flanges, connection plates, and stiffening elements are fabricated by cold-working (no steel welding is permitted).
6. Gutter Supports: Brackets fabricated from cold-worked steel (14ga (2mm) steel sheet minimum). Gutter supports shall be fabricated integrally with panel supports or separately provided gutter support construction provides for bolted connection to panel supports.
7. Gutter: Channels fabricated from cold-worked PVC laminated steel (14ga (1.5mm) steel sheet minimum). Gutter construction shall provide for flanged-bolted connections with compatible steel between gutter segments. Gutter splice plates are not permitted. Gutters/gutter supports for tile finished gutters shall be constructed with permanent adjustment system to level gutter at skim line prior to installation of tile (floating of tile on gutter or adjustment of coping over 1/8" to obtain level skim is not permitted). Gutters will have a protective plastic film on the interior face (water side) of the gutter that will be removed during the installation process, before the pool is filled with water. Gutters will have a clear, protective coating applied to the exterior face to provide a permanent shield against oxidation from chlorinated atmosphere.
8. Gutter Drain Flanges: Flanges fabricated from hot or cold formed steel. Flanges may be secured to gutter or gutter drain manifold by steel welding. Flanges shall be fabricated to connect to standard PVC flanges. Gutter drains placed in accordance with the Architects drawings. No flanges in the gutters is permitted; this would obstruct the free flowing of water into the drain.

B. Structural Anchoring: Provide anchoring to foundation as follows:

   1. Rods: AISI 304 Stainless Steel in Epoxy filled holes in accordance with anchor manufacturer's written instruction.

C. Connection Hardware: Provide stainless steel bolts, nuts, washers, screws, etc. for fasteners in permanent contact with stainless steel elements, whether through head contact or by penetration through the steel. Bolts/nuts shall be fabricated to prevent seizing (standard bolts with field-applied anti-seize solution are not acceptable).

2.7 STEEL ACCESSORIES

A. Line Anchors: Shall be designed and fabricated to withstand forces specified by floating line manufacturer or by recognized swimming authority. Line anchor construction shall utilize third party bracing elements (not solely supported by wall panel) and/or utilize pool structural system to provide resistance to service forces (line anchors secured only to wall panels are not permitted).

B. Gutter Mounted Elements: Shall be designed and fabricated to withstand forces specified by accessory manufacturer and/or recognized swimming authority in addition to those service conditions specified by governing code officials. Exposed steel shall be polished stainless steel.

C. Bottom Drains: Shall be fabricated from cold worked PVC laminated steel (14ga (2mm) minimum) and/or rigid PVC to facilitate PVC membrane welding at drain edges or fabricated from sheet steel having 16ga (2mm) minimum thickness be equipped with a steel flange, counter flange, two gaskets, compatible fasteners designed to prevent seizing. Drains shall be designed and fabricated to facilitate monolithic concrete slab or block-out type installations and concrete bonding. Drains shall be equipped with grounding lugs or holes for connecting grounding wiring.

2.8 PLASTIC GRILLES & ACCESSORIES

A. Gutter Grilles: Grilles fabricated in multiple-interchangeable segments. Grilles shall be fabricated with buffers or slats parallel to pool edge to limit deck splash-over.

2.9 SOURCE QUALITY CONTROL

A. Manufacturer shall present certificate of ISO 9001 (or better) registration or the following:

1. Manufacturer will employ an independent testing agency chosen by Contractor to perform source quality-control testing and special inspections, and to prepare test reports.
    a. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
    b. Manufacturer shall allow testing agency access to places where structural/primary components are being fabricated or produced and cooperate with testing agency and provide samples of materials as may be requested for additional testing and evaluation.
2. Manufacturer shall correct deficiencies in or remove and replace primary components that inspections and test reports indicate do not comply with requirements.
3. Additional testing, at manufacturer's expense, will be performed to determine compliance of corrected Work with requirements.
4. Testing agency will report test results promptly and in writing to Contractor and Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Conditions: Installation contractor shall confirm in writing suitability of project site to proceed with installation. Items to be confirmed shall include but are not necessarily limited to:

1. Accessibility to pool area.
2. Safety of pool excavation.

3. Ability to store and stage materials in conformance with Section 1.7 'Delivery Storage & Handling'

B. Field Measurements: Construction of the pool foundation and floor shall be coordinated and confirmed as follows:

1. A survey shall be conducted of the formwork for the foundation for the complete pool system (including footings and floor slab) by a qualified independent surveyor. A drawing and/or report of their findings shall be submitted for review. Along with other applicable information, statement of compliance with construction documents is required. Surveyor shall specifically consider the following:
   a. World and relative placement of pool foundation
   b. Vertical and horizontal line
   c. Elevation
   d. Allowable construction tolerance
2. Upon completion of the concrete pool foundation, a final survey will be conducted by installation contractor. A drawing and/or report of their findings shall be submitted for review. Deficiencies in any of the areas listed below shall be identified along with other applicable information. The installation contractor along with the manufacturer shall note in writing any possible recommendations for correction of deficient conditions and advise of possible delays and additional costs that may result as soon as possible, specifically considering the following:
   a. World and relative placement of pool foundation
   b. Horizontal line
   c. Elevation
   d. Concrete finish

C. Site inspections, contractor to request and coordinate inspections by a manufacturer representative pursuant to the requirements of specification section 13 11 09, paragraph 1.9C

3.2 PREPARATION

A. Clean concrete as follows:

1. Mud and dirt shall be swept or washed from concrete floor.
2. Oil, paint, and solvents shall be cleaned and surfaces treated per manufacturer's recommendations as required in Section 1.8.C 'PROJECT CONDITIONS'.

3.3 TANK INSTALLATION

A. Install pool system according to manufacturer's written instructions and installation drawings.

B. Install grounding for steel components according to applicable articles and governing codes.

C. Prior to component installation, all primary components shall be inspected for damage or defect. Do not install damaged or defective components. Notify pool manufacturer immediately of any damaged or defective components.

D. Do not field cut, drill, or alter primary members without written approval from pool system manufacturer.

E. Set primary and secondary components in locations and to elevations indicated and according to manufacturer's written specification. Maintain structural stability of pool during installation.

F. Base Frame:

1. Connect all base frame elements and set into position prior to leveling to ensure all components are manufactured to the required overall dimensions.
2. Attach base frame to concrete as required to ensure both finished line and elevation are maintained throughout installation.

G. Wall Panels, Panel Supports, Buttresses, and Gutter Supports.

1. Stage wall panels as required around pool perimeter to protect panel surface at all times.
2. Remove protective panel covering from connecting flanges to prevent covering from being trapped between connecting flanges.
3. Connect wall panels to base frame, panel supports and adjacent wall panels per manufacturer's recommendations with as few bolts as required to prevent gapping between panels. Gutter supports may be installed at this time.
4. Connect buttresses to panel supports and panel supports to foundation to ensure walls are properly braced during installation.
5. After wall segments are installed from end-to-end, install remaining fasteners and tighten per manufacturer's recommendations.
6. Perform final adjustment of wall verticality (and horizontal line if necessary).
7. Final tighten anchors.

H. Gutters & Gutter Supports:

1. Connect remaining gutter supports to panel supports.
2. Attach gutter segments to wall panels/gutter supports/adjacent gutter segments per manufacturer's recommendations with as few bolts as required to prevent gapping between gutter segments.
3. Final tighten gutter segment-to-gutter segment flanges.
4. Final tighten remaining fasteners.
5. Once all gutter segments are fixed place, adjust all skimming sections of gutters to constant water level.

3.4 WALL PANEL SEALING

A. General: Install uniform-watertight PVC seals.

1. Wall panel sealing shall be performed according to manufacturer's written instructions.
2. Mechanical (welded PVC) and chemical seals shall be applied within temperature and climatic ranges specified by manufacturer.

B. Mechanical Seals:

1. Clean surfaces of dirt, dust, debris, and adhesive film by scrubbing with a lightly abrasive fabric or cloth and a mild detergent. Rinse surfaces.
2. Install PVC rods and/or strips to minimize joints and splices.
3. Rods and strips shall be welded to panel to ensure good bond, free of exposed scorching, and free of substrate blisters and wrinkles.
4. Exposed edges of strips and rods shall be chemically sealed as specified in the following item 3.4.D 'Chemical Seals'.

C. Chemical Seals:

1. Clean surfaces of dirt, dust, debris, and adhesive film by scrubbing with a lightly abrasive fabric or cloth and a mild detergent. Rinse surfaces.
2. Avoid application of harsh chemicals and primers on exposed-finished PVC.
3. Ensure substrate remains dry throughout application and curing of chemical seal.
4. Apply liquid PVC in thin layers to prevent forming of bubbles in curing PVC. Seal layers shall be free of such bubbles.
5. Sealant layers applied within four hours over previous layers do not require additional cleaning before application of additional layers. After four hours, sealed surfaces shall be cleaned with cloth or sponge and mild detergent and water.

3.5 PVC MEMBRANE INSTALLATION

A. Inspection:

1. Prior to Work of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation can properly commence
2. Verify that swimming pool membrane can be installed in accordance with the original design and all referenced standards, including proprietary application techniques and application training/certifications.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Architect.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved
3. Failure to notify the Architect and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive the Work.

C. Installation

1. Completion of other work: DO NOT commence installation of membrane of swimming pool(s) until the following conditions have been met:
    a. The Health Department and/or other governing agencies have approved the pool(s) plumbing installation.
    b. All concrete pool deck construction is complete and the pool decks have been thoroughly cleaned.
    c. All landscaping in areas adjacent to the pool(s) or spa(s) is complete and the landscape irrigation system is operable.
    d. All painting in the pool area is complete.
    e. All welding and grinding in locations adjacent to the pool area are complete.
    f. The backwash sewer connection is complete.
    g. Pool(s) and/or spa(s) area(s) perimeter fencing installation is complete.
    h. All trash and debris have been removed from areas adjacent to the pool(s) or spa(s), particularly those areas that are normally upwind from the pool(s) or spa(s).
    i. All dust raising construction and/or activities in areas adjacent to the pool(s) or spa(s) are complete or mitigated.
    j. The circulation system is/are operational.
    k. The mechanical system has been flushed sufficiently to remove all dirt and debris from the piping system.
    l. All necessary chemicals (Chorine, pH adjuster, Sodium Bicarbonate and Calcium Chloride or any other required chemicals) are on site and ready for use.
    m. Obtain written approval from the Owner and the Architect

D. Contractor accepts all liability from damage done to the pool membrane and wall panels if the pool(s) membrane installation is before the completion of the above listed items or without the written approval of the Owner and the Architect.

E. Install membrane according to manufacturer's written instructions and installation drawings.

F. Prior to permanent fixing or welding, PVC membrane shall be inspected for visible defects or blemishes. Do not install damaged or defective membrane. Notify pool manufacturer immediately of any damaged or defective membrane.

G. PVC membrane shall be stretched both longitudinally and transversely to prevent wrinkles from forming. Wrinkled PVC membrane shall be removed and replaced.

H. Seams:

1. All seams in membrane and connections between membrane and wall panels shall be heat continuously welded a minimum of 38mm (1-1/2”). Heat welding devices explicitly designed for PVC membrane welding shall be utilized for welding. Welds shall be spot checked per manufacturer’s written instruction prior to final seam sealing.
2. PVC weld seams shall not extend into flanged accessory connections. Utilize secondary PVC section to provide uniform surface for flanged connections.
3. Exposed PVC membrane edges shall be sealed with liquid PVC or by heat sealing according to manufacturer’s written instructions.

I. Pool Filling:

1. After the membrane installation has been completed and all PVC joints have cured gradually fill the pool with water within 24hrs, preventing all damage to finished membrane and wall panel surfaces.
2. Flow the water continuously until the pool is filled.
3. Coordinate with Contractor to ensure that the pool is continuously monitored while filling to prevent overfill

J. POOL MEMBRANE AUTHORIZATION FORM:

1. The competition and instructional pool membrane liner installations at are hereby approved and may proceed with filling of water. Pursuant to the requirements of specification section 13 11 05, paragraph 3.1.

Owner	Date
Architect / Project Manager	Date
Manufacturer Representative	Date

3.6 ACCESSORIES INSTALLATION

A. General: Install accessories according to accessory manufacturer and pool manufacturer's written instructions and installation drawings and install grounding for steel accessories according to applicable articles and governing codes.

B. Floor Inlets

1. Remove screws, cover plates, flanges, and gaskets and store well-marked in secure location.
2. Setting:
3. Set inlets as required to flush flange of inlet with finished top surface of PVC floor membrane. Setting may require recessing floor inlet in concrete for floors with no under layment.
4. Securing:
   a. For floor inlets positioned on concrete floors with slope in excess of 5 degrees (approx 1:12), do not cut floor membrane for inlet until water is filled within 2' (horizontal) of inlet to prevent wrinkles from forming near floor inlet.
   b. For floor inlets in line with floor membrane seams, install PVC membrane ring having a minimum radius of 62mm (2-1/2") greater than the inlet flange radius (flange diameter +124mm [5"]) centered about floor inlet in conjunction with 3.8.C.3.a. Trim PVC floor membrane approximately 12mm (1/2") greater that flange radius (flange diameter +25mm [1"]). Weld approximately 50mm (2") of floor membrane to top surface of PVC membrane ring. Liquid seal cut/exposed edges of PVC membrane according to section 3.04.C 'Chemical Seals'.
   c. Install all screws in inlet flange according to manufacturer's recommendations regarding screw torque. Do not over-tighten.
5. Install screws, cover plates, flanges, and gaskets immediately prior to pool commissioning.

C. Bottom Drains

1. Remove grille and install under-membrane drain sub-assembly (if supplied). Install temporary wood or other protective covering securely over drain.
2. Install grounding according to applicable articles and governing codes.
3. Set drain body flush with adjacent concrete.
4. Temporarily remove bracing members located over drain flanges as required to facilitate drain plumbing pressure testing. Immediately re-install bracing members upon completion of testing.
5. Install drain grilles immediately prior to pool commissioning.

3.7 ERECTION AND LOCATION TOLERANCES

A. Horizontal Line: Refer to Certification Requirements noted on Drawing Sheet #CP-1.

B. Structure Elevation: Elevation of wall system below tile or coping shall remain within +/- 1/8" of required elevation to achieve finished pool water level.

C. Finished Skim Elevation: Finished elevation of skimming tile or coping shall remain within +/- 3/32" of specified pool water level.

3.8 EQUIPMENT ACTIVATION

A. All water chemistry and filtration mechanical equipment shall be operational upon filling of pool. Chemicals and other related support items as supplied by Contractor, shall be in supply at start-up.

B. For the first fourteen (14) calendar days after completion of filling the pool, brush all pool surface surfaces at least twice a day and coordinate with General Contractor to ensure that the plaster is carefully maintained after the initial fourteen-day period. In addition, coordinate with the Contractor to ensure that pool filtration equipment is continuously running during the initial fourteen-day period.

C. Start-up and provide qualified personnel to operate pool equipment for a period not less than fourteen (14) days after the pool is placed in operation, or until the Owner takes occupancy of the facility or letter of substantial completion. During this time, Contractor shall instruct and supervise the Owner's personnel in the various operating and maintenance techniques involved. Contractor shall be responsible for supply of chemicals during this not less than fourteen (14) day period and at time of turnover to Owner, chemical storage tanks shall be full. (Owner's personnel shall be fully trained and capable of assuming swimming pool maintenance tasks, training may begin before Owner takes occupancy).

3.9 CLEAN-UP

A. Upon completion of swimming pool installation, remove all materials, equipment and debris occasioned by this Work and leave the job site in a clean and presentable condition. Perform all such clean-up to the approval of the Owner’s Representative

END OF SECTION 13 11 09

SECTION 13 24 16 – SAUNA ROOM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Sauna Room

B. Related Sections include the following:
   1. Section 09 22 16 “Non-structural Metal Framing.”
   2. Section 09 29 00 “Gypsum Board.”
   3. Division 26 Electrical

C. Work to be done by others: All work set forth below will be included under other sections for the specifications.

1. Foundation, sub-floor, and final floor work
2. All electrical work from supply, including connections to heaters and lights.
3. Installation of metal stud walls and ceiling joists, gypsum wall finish and primed.
4. Installation of insulation between wall studs and ceiling joists.

1.3 ACTION SUBMITTALS

A. Product Data.

B. Shop drawings: Provide shop drawings for Consultant review and Contractor coordination. Include all electrical connections and switch and light locations.

1.4 INFORMATION SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery of products to avoid extended on-site storage and to avoid delaying the Work.

B. Store materials under cover and protected from weather and contact with damp or wet surfaces. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. APEX SAUNAS, Woodinville, WA, or approved equal.

2.2 PRODUCT

A. SAUNA: Size and configuration as shown on plans.

1. Walls and ceiling interior materials: shall be ½" thick Western Red Cedar, V-joint, kiln-dried to 12% or less. Boards to be blind nailed using 4d galvanized finish nails or comparable galvanized staples. Wallboards mounted horizontally.

2. Bench Construction for the Pre-Cut Package: Standard width equals 20". Face and tops of clear, kiln dried Western Red Cedar S4S (smooth 4 sides), 1x4 (tops with ¼" spacing). All framing of SPF (spruce, pine, fir) 2x4. Tops fastened with 4d galvanized nails. Bench legs are of clear, kiln-dried Western Red Cedar 2x4. Seating layout per drawings.

3. Backrests: S4S (smooth 4 sides) clear Western Red Cedar

4. Interior Trim: Ceiling, Base, & Corner molding of clear, kiln-dried Western Red Cedar.

5. Heater Guard Rail: Shall be constructed of clear Western Red Cedar, to surround heater. Dimensions shall match UL requirements for proper spacing between heater and guard rail.

6. Door: Shall be by others. Door handle to be wood and by sauna manufacturer. Coordinate attachment with door manufacturer.

7. Sauna Heater: Shall be sized according to the sauna room (in cubic feet). Heater shall be UL-listed, and shall include vulcanite igneous rocks.

8. Floor: Duragrid plastic squares – color to be selected by architect.

9. Controls: Shall be UL-listed and matched with heater according to chart.

10. Light: Shall be wall-mounted, UL-listed, vapor proof light fixture. Frosted white globe with satin finish, neoprene gasket aluminum base.

11. Accessories: All sauna packages include standard accessories consisting of a thermometer, wood bucket, wood ladle, and a wall-mounted light.

2.3 WARRANTY

A. Provide a 5 year warranty on all parts and materials, from date of Substantial Completion.

PART 3 - EXECUTION

1.6 EXAMINATION

A. Examine walls, subfloor, and support framing for compliance with installation tolerances and other conditions affecting performance of sauna and steam units.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Field verify dimensions for shop drawings and before ordering.

C. Coordinate with General Contractor the electrical connections, floor and wall finishes.

1.7 INSTALLATION

A. Code Requirement: All materials, components, and work shall conform to all applicable local, state, and federal building and safety codes, ordinances and regulations.

B. Contractor shall install each unit per the manufacturer's instructions and shop drawings.

C. Field fit, install, and finish wood door trim to fit tight to masonry opening. Finish to match door.

D. Walls and Ceiling: Walls shall be insulated with R-19 rated fiberglass insulation and the ceiling shall be insulated with R-38 rated fiberglass insulation, with foil vapor barrier.

E. Install Contractor provided door handle.

F. Provide any required WAC signage and coordinate installation with General Contractor.

1.8 ADJUSTING

A. Repair damaged surfaces and finishes after completing erection. Replace damaged materials or products if repairs are not approved by Engineer.

END OF SECTION 13 24 16

SECTION 21 00 00 - FIRE SUPPRESSION BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 DESIGN-BUILD SUMMARY

A. Work included in 21 00 00 applies to Division 21, Fire Suppression work to provide materials, labor, tools, permits and incidentals to make fire suppression systems ready for Owner's use for proposed project.

1.2 DESIGN-BUILD INSTRUCTIONS

A. This document is issued to give Bidders a basis for preparing a proposal to design and install a complete Fire Suppression system for this project.

B. Alternates to this Document may be offered as a separate proposal.

1.3 DESIGN-BUILD APPROACH

A. Use this Specification for design/engineering requirements, workmanship and materials or construction. Utilize design-build concept throughout construction phase of project.

B. Investigate and be apprised of applicable codes, rules, and regulations as enforced by AHJ.

C. Visit the Site of the proposed construction. Verify and inspect the existing site to determine conditions that affect this work.

1.4 DESIGN-BUILD CRITERIA

A. Related Work Specified Elsewhere: Contents of Section apply to Division 21, Fire Suppression Specifications. Requirements of Section are a minimum for Division 21, Fire Suppression Sections, unless otherwise stated in each Section, in which case that Section's requirements take precedence.

B. Reference Basis of Design narrative document.

C. Fire Suppression Design Criteria: Refer to individual Division 21, Fire Suppression Sections for fire suppression system design criteria.

D. Fire Suppression Equipment: Refer to individual Division 21, Fire Suppression Sections for fire suppression equipment requirements.

1.5 SECTION INCLUDES

A. Work included in 21 00 00, Fire Suppression Basic Requirements applies to Division 21, Fire Suppression work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of fire protection systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete Item of work furnished.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted Item.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.6 RELATED SECTIONS

A. Content of Section applies to Division 21, Fire Suppression Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:
   a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
   b. Drawings
   c. Addenda
   d. Owner/Architect Agreement
   e. Owner/Contractor Agreement
   f. Codes, Standards, Public Ordinances and Permits

1.7 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 21, Fire Suppression Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of Washington:
   a. IBC - International Building Code
   b. IFC - International Fire Code
   c. IMC - International Mechanical Code
   d. NEC - National Electrical Code
   e. UPC - Uniform Plumbing Code
   f. WAC - Washington Administrative Code
   g. WSEC - Washington State Energy Code

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ADA - Americans with Disabilities Act
2. AHRI - Air-Conditioning Heating & Refrigeration Institute
3. ANSI - American National Standards Institute
4. ASCE - American Society of Civil Engineers
5. ASCE-7 Minimum Design Loads for Buildings and Other Structures
6. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
7. ASHRAE Guideline 0, the Commissioning Process
8. ASME - American Society of Mechanical Engineers
9. ASPE - American Society of Plumbing Engineers
10. ASSE - American Society of Sanitary Engineering
11. ASTM - ASTM International
12. AWWA - American Water Works Association
13. CFR - Code of Federal Regulations
14. EPA - Environmental Protection Agency
15. ETL - Electrical Testing Laboratories
16. FCC - Federal Communications Commission
17. FM - FM Global
18. FM Global - FM Global Approval Guide
19. IAPMO - International Association of Plumbing and Mechanical Official
20. ICC - International Code Council
21. IEC - International Electrotechnical Commission
22. ICC-ESR - International Code Council Evaluation Service Reports
23. HI - Hydraulic Institute Standards
24. ISO - International Organization for Standardization
25. MSS - Manufacturers Standardization Society
26. NEC - National Electric Code
27. NEMA - National Electrical Manufacturers Association
28. NFPA - National Fire Protection Association:
    a. NFPA 13 - Standard for the Installation of Sprinkler Systems
    b. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection
    c. NFPA 22 - Standard for Water Tanks for Private Fire Protection
    d. NFPA 24 - Standard for Installation of Private Fire Service Mains and Their Appurtenances
    e. NFPA 25 - Standard for Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
    f. NFPA 70 - National Electrical Code
    g. NFPA 72 - National Fire Alarm and Signaling Code
29. NRCA - National Roofing Contractors Association
30. NSF - National Sanitation Foundation
31. OSHA - Occupational Safety and Health Administration
32. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
33. TIMA - Thermal Insulation Manufacturers Association
34. UL - Underwriters Laboratories Inc.

D. See Division 21, Fire Suppression individual Sections for additional references.

1.8 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 21, Fire Suppression sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

D. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.

E. Submit shop drawings, calculations and product data sheets as one complete stand-alone package to AHJ, Owner's insurance underwriter and Engineer.

F. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 21, Fire Suppression Sections.

G. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.

1. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed Item. Highlight connections by/to other trades.
2. Include technical data, installation instructions and dimensioned drawings for products, equipment and devices installed, furnished or provided. Reference Division 21, Fire Suppression specification Sections for specific Item required in product data submittal outside of these requirements.
3. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
4. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.
5. See Division 21, Fire Suppression Sections for additional submittal requirements outside of these requirements.

H. Maximum of two reviews provided of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to Contractor without review.

I. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

J. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-16 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

K. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 21, Fire Suppression coordination documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical and Division 28, Electronic Safety and Security submittals.

L. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

M. Substitutions and Variation from Basis of Design:

1. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
2. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

N. Shop Drawings:

1. Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout, pipe layout, hanger layout, sway brace layout, seismic restraints, sway brace calculations, drains, location of drain discharge, risers, valves, details, water test information, physical device layout plans, and control wiring diagrams. Reference individual Division 21, Fire Suppression Sections for additional requirements for shop drawings outside of these requirements.
2. Shop Drawings and hydraulics calculations, sway brace calculations, trapeze hanger calculations, and the like, to be prepared under the direct supervision and control of a Professional Engineer competent to do such work and licensed in the state of Washington. Drawings and calculations to bear the seal and wet signature of the Professional Engineer.
3. Provide Shop Drawings which indicate information required by NFPA 13, 20, and 22. Include room names and fire sprinkler occupancy hazard classifications.
4. Provide Shop Drawings illustrating information for Hydraulic Information Sign for each hydraulic remote area calculated.
5. Utilizing the Reflected Ceiling backgrounds, provide Shop Drawings illustrating locations of fire sprinklers and piping.

6. Utilizing the Structural backgrounds, provide Shop Drawings illustrating locations and types of hangers and sway braces.
7. Provide Shop Drawings illustrating each type of hanger, including fasteners to structure.
8. Provide Shop Drawings illustrating each type of branchline restraint and sway brace, including length of sway brace member, sway brace fittings, minimum and maximum angles from vertical of sway brace member, method of attachment to structure, size, length and embedment of attachment to structure and size and type of structural member to which sway brace will be attached. Number each type of restraint and sway brace. Indicate on Drawings locations of each type of numbered restraint and sway brace.
9. Provide details for any hanger, attachment, or sway brace to be attached to any I-joist, structural insulated panels (SIPs), cross laminated timber, and similar engineered structural products according to the specifications of the engineered product manufacturer.
10. Provide Shop Drawings illustrating information for Sprinkler System General Information Sign.
11. Shop Drawings to include a cross-sectional view that shows the sprinkler heads and piping in relation to the building's architectural and structural information. View to be chosen based on a location that will display the most information.
12. When required, provide Coordination Drawings.
13. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
14. Provide details of hanger, sway bracing and branch line restraint attachments to structure and to piping. Include details on the size and load capacities of fasteners. Provide verification of the structural capacity to withstand seismic load.
15. Provide sway bracing calculations on drawings showing horizontal seismic design load and requirements, with indication of zone of influence for each bracing location.
16. Provide a schedule of sway bracing type, size, and design criteria, including length, angle from vertical, and load capacities.
17. Clearly indicate the elevation of the highest sprinkler in relation to the elevation of the flow test pressure gauge monitor hydrant.
18. Provide details of flexible sprinkler hose fitting per manufacturer's schedule of equivalent feet used in hydraulic calculations, showing device length, maximum number of 90-degree bends and expected radius of bends.
19. Provide a schedule of signage to be installed at each flexible sprinkler hose fitting.
20. On the drawings, provide a list of number, model, temperature, sprinkler Identification number, manufacturer, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the spare sprinkler cabinet and the issue date or revision date of the list.
21. Spare sprinkler head cabinet size indicating the number of spare sprinkler head to be contained therein.

O. Samples: Provide samples when requested by individual Sections.

P. Resubmission Requirements:

1. Make any corrections or change in submittals when required. Provide submittals as specified. The Engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Clearly indicate changes on Drawings and cloud changes in the submittals.
2. Resubmit for review until review indicates no exceptions taken or make "corrections as noted".

Q. Operation and Maintenance Manuals/Owner's Instructions:

1. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or Item requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
    a. Include copies of certificates of code authority acceptance, code-required acceptance tests; test reports and certificates.
    b. Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Sections.
    c. Catalog description of each Item of equipment actually installed on job.
    d. Instructions for operation and maintenance of fire suppression systems composed of operating instructions, maintenance instructions and manufacturer's literature as follows:
        1) Testing and Maintenance Schedule Chart: Provide an 8-1/2- by 11-inch typewritten list of each item of installed equipment requiring testing inspection, lubrication or service, describing and scheduling performance of maintenance.
        2) Manufacturer's Literature: Provide copies of manufacturer's instructions for operation and maintenance of fire suppression equipment, including replacement parts list with name and address of nearest distributor. Mark each copy with equipment identification label as listed in equipment schedule, i.e. F-5 etc.
    e. Include product certificates of warranties and guarantees.
    f. Include Record Drawings.
    g. Include copy of water supply flow test used as basis for hydraulic calculations.
    h. Include hydraulic calculations and sway brace calculations.
    i. Include Contractor’s Material and Test Certificates for Aboveground Piping/Underground Piping.
    j. Include a copy of NFPA 25.
    k. Include a copy of valve charts and whether normally open or normally closed.
    l. Include a copy of drain, auxiliary, and low point drains charts.
    m. Include a copy of the list to be included in the spare sprinkler head box.
    n. Include copy of Fire Pump Start-Up and acceptance test.
    o. Include copy of Fire Pump original test curve.
    p. Include copy of Clean Agent System acceptance test.
    q. Include Commissioning Reports.
    r. Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
    s. Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, and quantities relevant to each piece of equipment: i.e. belts, motors, lubricants, and filters.
    t. Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub-assemblies.
    u. Include copy of startup and test reports specific to each piece of equipment.
    v. Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

2. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 21 00 00, Fire Suppression Basic Requirements, Article titled "Demonstration".
3. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

R. Record Drawings:

1. Maintain at site at least one set of Drawings for recording “As-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical Item. Include items changed by field orders, supplemental instructions, and constructed conditions.
2. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
3. At completion of project, input changes to original project on Revit Model and make one set of black-line drawings created from Revit Model in version/release equal to contract drawings. Submit Revit Model and drawings upon substantial completion.
4. Invert elevations and dimensioned locations for water services and drainage piping below grade extending to 5-feet outside building line.
5. Record Drawings to include site information or reference site information for complete understanding of the fire protection system between the building and the point of connection to the water supply and location of flow test pressure hydrants.
6. See Division 21, Fire Suppression individual Sections for additional items to include in Record Drawings.

S. Calculations: Submit hydraulic, sway brace, and fire pump and the like calculations.

1. Hydraulic Calculations:
    a. Include friction losses between the hydraulically most remote design area and the hydrant flow test pressure hydrant.
    b. Hydraulic calculations to be performed on a nationally recognized fire sprinkler hydraulic calculation computer program, with cover sheets in the format required by the latest edition of NFPA 13. Hydraulic calculations performed “by hand” or not on a nationally recognized fire sprinkler hydraulic calculations computer program will be returned without review by Engineer.
    c. Provide one or more hydraulic calculations for each hydraulically most remote area.
    d. Where it is not obvious which area is most hydraulically remote, perform and submit for review additional hydraulic calculations proving the hydraulically most remote area.
    e. For grid systems, either provide “peaked” hydraulic calculations, or provide two additional sets of hydraulic calculations for each hydraulically most remote area.
    f. Include pressure losses between the highest sprinkler and the elevation of the pressure gauge monitor hydrant of the flow test.
    g. Include friction loss for flexible branch line connectors per manufacturer's schedule of equivalent feet for device length, maximum number of bends and expected radius of bends.
    h. When flexible sprinkler hose fittings are added to an existing system, provide hydraulic calculations verifying the design flow rate will be achieved."

i. For Future Tenant Improvement Spaces: Include in hydraulic calculations friction loss allowances for future installation of flexible sprinkler head connectors so that flexible connectors may be installed in the future without revisions to the overhead system.

2. Sway Brace Calculations:
   a. Sway brace calculations utilizing a proprietary computer calculation program only used for the sway brace components supported by that manufacturer. For example, only “manufacturer X” sway brace components, and not those of another manufacturer, may be calculated on a "manufacturer X” sway brace computer calculation program.
   b. Provide seismic calculations for any sway brace to be attached to any I-joist, structural insulated panels (SIPs), cross laminated timber, and similar engineered structural products according to the specifications of the I-joist manufacturer.

1.9 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every Item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.10 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.11 COORDINATION DOCUMENTS

A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, fire alarm and fire pump, plumbing, cable trays, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, electrical, fire alarm ceiling suspension and tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling and finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.

B. Prepare Drawings as follows:

1. Provide drawings in Revit Model. Revit Model release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
3. Indicate fire protection system piping including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
4. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible Item. Drawings also to indicate proposed ceiling grid and lighting layout as shown on electrical drawings, architectural reflected ceiling drawings and HVAC equipment, ductwork and piping. Drawings to indicate proposed and identified structural members to which hangers and sway braces will be attached as shown on structural drawings.
5. Incorporate Addenda Item and change orders.
6. Provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to sprinkler heads, pipe, fittings, hangers and bracing materials.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL, ETL, FM, and ICC-ES listed and labeled for their intended fire protection function or be approved by State, County, and City authorities prior to procurement and installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of Washington, and Federal regulations relating to hazardous materials.
2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Install equipment requiring access (i.e. drains, control operators, valves, motors, engines, pumps, controllers, air compressors, gauges, fill cups, tanks, cleanouts and the like) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents.
2. In absence of specific requirements, comply with the following:
    a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions specified. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
    b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
    c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection.

2. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM International E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating coordinating installation of piping systems.
2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums: Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 21, Fire Suppression Sections.

B. Provide fire suppression equipment and piping, both hanging and base mounted, with mounting connection points of sufficient strength to resist lateral seismic forces equal to lateral seismic forces as determined by building code and NFPA 13 calculations, whichever is more demanding.

C. See Structural Drawings for seismic design criteria for sway bracing and seismic restraint.

D. Earthquake resistant designs for Fire Protection (Division 21) equipment and distribution, i.e. fire sprinkler systems, fire standpipe systems, fire pumps, fire pump controllers, fire tanks, clean agent fire suppression systems, etc. to conform to regulations of jurisdiction having authority.

E. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.

F. Provide stamped Shop Drawings from licensed Engineer of seismic bracing and seismic movement assemblies for piping, equipment, tanks, pumps controllers and the like. Submit shop drawings along with equipment submittals.

G. Provide stamped Shop Drawings from licensed Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.

H. Provide details of flexible drops for sprinklers in conformance with Building Code and ASCE-7 requirements of ceilings. Coordinate with Architectural and Structural Drawings and Specifications.

I. Piping: Per NFPA 13, ASCE-7 and local requirements.

J. Equipment:

1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA, ASCE 7 and local requirements.
2. Provide means to prohibit excessive motion of fire protection equipment during an earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Notify Architect in writing at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground piping installation prior to backfilling.
2. Prior to covering walls.
3. Prior to ceiling cover/installation.
4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
5. When mains or branchlines are to be permanently concealed by construction or insulation systems.
6. When fire suppression systems, or portions of, are being tested and ready for inspection by AHJ.

C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

D. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 01, General Requirements.

B. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Cutting and patching performed under Division 21, Fire Suppression includes, but is not limited to:
   a. Cutting and patching of plaster or partitions.
   b. Cutting and patching of finished ceilings.
2. Perform cutting and patching by skilled craftsmen in trade of work to be performed. Fill holes which are cut oversized for completed work. Match refinished areas with existing adjacent finish in a manner acceptable to Architect.

3. When masonry to concrete construction must be penetrated, provide a steel pipe sleeve in opening and grout in place in a neat manner. Leave grout surface to match existing finish. Provide escutcheons. If sleeves are not provided, core drill penetrations.
4. Locate concealed utilities to eliminate possible service interruption or damage.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.
6. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
7. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftspeople of each respective trade in conformance with appropriate Division of Work.
8. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
9. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, landscaping, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
10. Repair mutilation of building around pipes, equipment, hangers, and braces.

3.5 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing at no additional cost to Owner.

3.6 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

B. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Handle materials delivered to project site with care to avoid damage and deterioration. Store materials in original containers which identify manufacturer, name, brand and model numbers on site inside building or protected from weather, sun, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
3. Protect bright finished shafts, bearing housings and similar items until in service.

3.7 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

D. Prior to acceptance of work and during time designated by Architect, provide necessary qualified personnel to operate system for a period of two hours.

E. Instruct the Owner in the operation of the sprinkler system, including main valve position (open or closed) recognition, system drainage, system testing, dry pipe valve reset and the relation to the fire alarm system.

F. Upon completion of work and adjustment of equipment, test systems to demonstrate to Owner's Authorized Representative and Architect that equipment is furnished and installed or connected under provisions of these Specifications.

3.8 CLEANING

A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Upon completion of installation, except for sprinklers, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

C. Sprinklers may not be cleaned except for vacuuming in a manner in which no part of the sprinkler is touched by the vacuuming equipment. Replace sprinklers which bear traces of foreign substances with sprinklers of same model, temperature, K-factor, orifice, finish, style, orientation, and the like.

3.9 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Install equipment in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start-up equipment, in accordance with manufacturer's start-up instructions, in the presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment. Provide pump impellers to obtain Basis of Design design capacities.

D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.10 PAINTING

A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes.

B. In absence of specific requirements, comply with individual Division 21, Fire Suppression Sections and the following:

1. Ferrous Metal: After completion of fire protection work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
2. After acceptance by Authority Having Jurisdiction (AHJ), in a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
3. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
4. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
5. Covers: Covers such as vault covers and the like will be furnished with finishes which resist corrosion and rust.

3.11 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.

B. In absence of specific requirements, comply with individual Sections in Division 21, Fire Suppression. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:

1. Testing reports including Contractor's Material and Test Certificate for Underground Piping, Contractor's Material and Test Certificate for Aboveground Piping, Contractor's Material and Test Certificate for Private Fire Service Mains, Fire pump acceptance test data report, and the like.
2. Cleaning
3. Operation and Maintenance Manuals
4. Training of Operating Personnel
5. Record Drawings
6. Warranty and Guaranty Certificates
7. Start-up/Test Document and Commissioning Reports
8. Letter of Conformance

3.12 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 21 00 00, Fire Suppression Basic Requirements and individual Division 21, Fire Suppression Sections.

B. Upon completion of installation of equipment, sprinklers, hose valves and piping and after units are water pressurized, test system to demonstrate capability and compliance with requirements. When possible, correct malfunctioning items at site, then retest to demonstrate compliance; otherwise remove and replace with new Item and proceed with retesting.

C. Inspect each installed Item for damage to finish. If feasible, restore and match finish to original, except fire sprinklers, at site; otherwise, remove Item and replace with new Item. Feasibility and match to be judged by Architect. Remove cracked or dented Item and replace with new Item.

D. Fire sprinklers may not be reused, or cleaned, except for dusting. Replace damaged, field painted, oversprayed, overcoated or field coated sprinklers with new sprinklers of same manufacturer, model, finish, K-factor and performance characteristics. Where identical replacement sprinklers are not available, provide sprinklers of similar finish, style, K-factor and performance characteristics.

3.13 LETTER OF CONFORMANCE

A. Provide Letter of Conformance and copies of manufacturers' warranties and extended warranties with a statement that fire suppression items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals.

B. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.14 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize fire protection equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

END OF SECTION 21 00 00

SECTION 21 05 00 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Buried Ductile Iron Pipe and Fittings
2. Buried Polyvinyl Chloride (PVC) Pipe and Fittings
3. Buried High Density Polyethylene (HDPE) Pipe and Fittings
4. Joint Restraints
5. Aboveground Black Steel Pipe and Fittings
6. Wall and Floor Penetrations and Sleeves
7. Switches, Valve Supervisory
8. Switches, Water Detector
9. Hangers and Supports
10. Struts and Strut Clamps
11. Sway Braces and Restraints
12. Seismic Separation Assembly
13. Anchors and Attachments
14. Pipe Stands
15. Gauges
16. Alarm Bells
17. Fire Department Connection
18. Valves
19. Backflow Prevention Devices
20. Pipe, Valve, and Fire Protection Equipment Identification
21. Signs
22. Drains

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 22, Plumbing
2. Division 23, Heating, Ventilating and Air Conditioning
3. Division 26, Electrical
4. Division 28, Electronic Safety and Security
5. Division 31, Earthwork
6. Section 21 00 00, Fire Suppression Basic Requirements
7. Section 21 13 00, Fire Suppression Sprinkler Systems
8. Section 21 30 00, Electric Fire Pumps
9. Section 21 41 00, Storage Tanks for Fire Suppression Water

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. Meet requirements of ASCE 7, Minimum Design Loads for Buildings and Other Structures, by American Society of Civil Engineers, latest adopted edition.

1.4 SUBMITTALS

A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Material and Equipment: Listed for its intended fire protection use in current UL Fire Protection Equipment Directory, or UL Online Certifications Directory for Fire Protection, FM Global Approval Guide, and International Code Council Evaluation Service Reports. All material and equipment to be new and from a current manufacturer.
2. Provide per AHJ requirements.
3. References to product Specifications for materials are listed according to accepted ANSI, ASTM, ASME, AWWA and other base standards. Materials to meet latest approved versions of these standards.
4. Fire Suppression Screw-Thread Connections: Comply with local fire department/fire marshal regulations for sizes, threading and arrangement of connections for fire department equipment to fire department connections.
5. Manufacturers: Unless an item is marked "No substitutions", submit substitution request for materials of other than named manufacturers.
6. Noise and Vibration:
    a. Install vibration isolators and measures required to prevent noise and vibration from being transmitted to occupied areas. Select equipment to operate within noise coefficient (NC) design level for particular type of installation in relation to its location.
    b. After installation, make proper adjustments to reduce noise and vibration to acceptable levels as defined by Architect.
    c. In acoustically sensitive areas, design system in a manner that minimizes the number of wall penetrations.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM IMPAIRMENT

A. When returning a water-based fire protection system to service after impairment or control valve closure, verify the system is in working order by performing a main drain test per NFPA 25.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Buried Ductile Iron Pipe and Fittings:

1. American Cast Iron Pipe Co.
2. Atlantic States Cast Iron Pipe Co.
3. Clow Water Systems Co.
4. EBAA Iron, Inc.
5. Griffin Pipe Products Co.
6. McWane Cast Iron Pipe Co.
7. Pacific States Cast Iron Pipe Co.
8. United States Pipe & Foundry Co.
9. Star Pipe Products
10. Tyler Union
11. Or approved equivalent.

B. Buried PVC Pipe and Fittings:

1. Certainteed Corp.
2. JM Eagle
3. National Pipe and Plastics Inc.
4. Or approved equivalent.

C. Buried HDPE Pipe and Fittings:

1. Dura-Line Poly Pipe
2. Or approved equivalent.

D. Joint Restraints:

1. Star Pipe Products
2. Tyler Pipe Co.
3. EBAA Iron, Inc.
4. Uni-Flange Corp.
5. Union Foundry Co.
6. United States Pipe and Foundry Co.
7. Or approved equivalent.

E. Aboveground Black Steel Pipe and Fittings:

1. Pipe:
    a. Bull Moose Tube
    b. Wheatland Tube Co.
    c. Youngstown Tube Co.
    d. Tex-Tube Co.
    e. State Pipe and Supply, Inc.
    f. Or approved equivalent
2. Fittings, Mechanical and Grooved Couplings:
    a. Victaulic
    b. Gruvlok
    c. Shurjoint Piping Products Inc.
    d. Smith-Cooper International
    e. Tyco Fire & Building Products
    f. Viking Corp.
    g. ARGCO
    h. Anvil International
    i. Dixon Valve & Coupling

j. Or approved equivalent.

3. Fittings, Threaded:
   a. Ward Mfg.
   b. Anvil International
   c. Smith-Cooper International
   d. Aegis Technologies
   e. Or approved equivalent.
4. Fittings, Rubber Gasketed:
   a. Victaulic
   b. Anvil International
   c. AnvilStar
   d. EBAA Iron, Inc.
   e. Shurjoint Piping Products, Inc.
   f. Smith-Cooper International
   g. Tyco Fire & Building Products
   h. Viking Corp.
   i. Ward Mfg.
   j. ARGCO
   k. Dixon Valve & Coupling
   l. Or approved equivalent.
5. Fittings, Welded:
   a. Anvil International
   b. Shurjoint Piping Products Inc.
   c. Smith-Cooper International
   d. State Pipe & Supply, Inc.
   e. Or approved equivalent.
6. Fittings, Flanged:
   a. Victaulic
   b. United Brand Fittings
   c. U.S. Pipe
   d. Anvil S.P.F.
   e. Iowa Fittings Co.
   f. Tyco Fire Products
   g. Or approved equivalent.

F. Wall and Floor Penetrations and Sleeves:

1. ARGCO
2. Fire Protection Products Inc. (FPPI)
3. Or approved equivalent.

G. Switches, Valve Supervisory:

1. Potter Electric Signal Co.
2. System Sensor
3. Or approved equivalent.

H. Switches, Water Detector:

1. Water Flow Switches; Wet Sprinkler Systems:
   a. Potter Electric Signal Co.
   b. System Sensor
   c. Or approved equivalent.

2. Pressure Operated Alarm Switches; Dry Pipe Sprinkler Systems:
    a. Detection of Water Flow:
        1) Potter Electric Signal Co.
        2) System Sensor
        3) Or approved equivalent.
    b. Detection of Low Pressure:
        1) Potter Electric Signal Co.
        2) System Sensor
        3) Or approved equivalent.

I. Hangers and Supports:

1. Cooper B-Line Tolco
2. Anvil International
3. ITW Buildex Sammys
4. Erico International
5. PHD Mfg. Inc.
6. Or approved equivalent.

J. Struts and Strut Clamps:

1. Cooper B-Line Tolco
2. Or approved equivalent.

K. Sway Braces and Restraints:

1. Cooper B-Line Tolco
2. Anvil International
3. Erico International
4. PHD Mfg. Inc.
5. Or approved equivalent.

L. Seismic Separation Assembly:

1. Metraflex Fireloop
2. Anvil International
3. Unisource Mfg. Inc.
4. Mason Industries
5. Twin Cities Hose
6. Or approved equivalent.

M. Anchors and Attachments:

1. Concrete:
    a. Cast-In Place Anchors for Hangers:
        1) Cooper B-Line Tolco
        2) Erico International
        3) Or approved equivalent.
    b. Cast-In Place Anchors for Braces:
        1) Cooper B-Line Tolco
        2) Anvil International
        3) Erico International
        4) Or approved equivalent.

c. Attachments as specified or described by structural. If not specified or described by structural, then as follows:
   1) Hilti
   2) Powers
   3) Simpson Strong-Tie
   4) DeWalt
   5) Or approved equivalent.

2. Wood:
   a. Cooper B-Line Tolco
   b. Anvil International
   c. Elco Construction Products
   d. Erico International
   e. ITW Buildex Sammys
   f. Or approved equivalent.
3. Steel:
   a. Cooper B-Line Tolco
   b. Anvil International
   c. Elco Construction Products
   d. Erico International
   e. ITW Buildex Sammys
   f. Or approved equivalent.

N. Pipe Stands:

1. Cooper B-Line Tolco
2. Anvil International
3. Or approved equivalent.

O. Gauges:

1. Ashcroft
2. US Gauge
3. Brecco
4. Reliable Automatic Sprinkler Co.
5. Fire Protection Products, Inc. (FPPI)
6. ARGCO
7. Wika Instrument Corp.
8. Or approved equivalent.

P. Alarm Bells:

1. Potter
2. System Sensor
3. Or approved equivalent.

Q. Fire Department Connection:

1. Guardian Fire Equipment
2. Fire End Croker Corp.
3. Potter-Roemer
4. Elkhart Brass
5. Tyco Fire & Building Products
6. Fire Protection Products, Inc. (FPPI)

7. Or approved equivalent.

R. Valves:

1. OS&Y Gate:
   a. Victaulic
   b. Nibco
   c. Mueller
   d. Or approved equivalent.
2. NRS Gate:
   a. Nibco
   b. Mueller
   c. Victaulic
   d. Or approved equivalent.
3. Swing Check:
   a. Victaulic
   b. Nibco
   c. Mueller
   d. Viking
   e. Tyco
   f. AnvilStar
   g. Reliable
   h. Or approved equivalent.
4. Wafer Check:
   a. Nibco
   b. Mueller
   c. Viking
   d. Tyco
   e. Or approved equivalent.
5. Butterfly Valves:
   a. Victaulic
   b. Nibco
   c. Tyco
   d. Use lug body next to pumps; Nibco.
   e. Reliable
   f. Or approved equivalent.
6. Pressure Relief:
   a. Watts
   b. United Brass Works
   c. AGF
   d. Or approved equivalent.
7. Automatic Ball Drip Drain Valve:
   a. Tyco
   b. Reliable Automatic Sprinkler Co.
   c. Or approved equivalent.
8. Three-Way Gauge Valve:
   a. Fire Protection Products Inc. (FPPI)
   b. AGF Mfg. Inc.
   c. Nibco
   d. Or approved equivalent.
9. Automatic Air Release Valve:
   a. Potter Electric Signal Co.
   b. Or approved equivalent.

10. Ball Valve:
    a. Victaulic
    b. Apollo Valves
    c. Fire Protection Products Inc. (FPPI)
    d. Nibco
    e. Or approved equivalent.

S. Backflow Prevention Devices; Double Check Valve Assembly:

1. Ames
2. Febco
3. Zurn Wilkins
4. Apollo Valves
5. Or approved equivalent.

T. Pipe, Valve, and Fire Protection Equipment Identification:

1. Fire Protection Products, Inc. (FPPI)
2. ARGCO
3. Or approved equivalent.

U. Signs:

1. Tyco Fire Products
2. Reliable Automatic Sprinkler
3. Viking Corp.
4. ARGCO
5. Or approved equivalent.

V. Drains:

1. Reference Aboveground Black Steel Pipe and Fittings.
2. AGF
3. Victaulic
4. Or approved equivalent.

2.2 BURIED DUCTILE IRON PIPE AND FITTINGS

A. Pipe:

1. Thickness: Class 52 ductile iron, AWWA C151.
2. Pressure: 150 psi or 10.34 bar.
3. Cement mortar lined per AWWA C104, field encased with 8 mil polyethylene bag per AWWA C105. Coat all bolts, restraining rods, and the like with bitumastic prior to encasement in the polyethylene bag.

B. Fittings: AWWA C110, 350 psi or 24.13 bar. Cement mortar lined per AWWA C104, field encased with 8 mil polyethylene bag per AWWA C105. Coat all bolts, restraining rods, and the like with bitumastic prior to encasement in the polyethylene bag.

C. Fittings restrained with thrust blocks or restraining rods per NFPA 24.

D. Underground Valves: Factory coated with powdered epoxy or equivalent corrosion resistant coating. Bolts coated with bitumastic in the field. Encase the entire valve in 8-mil polyethylene bag in accordance with AWWA C-105.

E. Flexible Underground Expansion Joints:

1. AWWA C153, AWWA C116, AWWA C105.
2. Expansion joint designed and cast as an integral part of a ball and socket type flexible joint.
3. Internal and external epoxy lined.
4. Sealing Gasket: EPDM.
5. Polyethylene sleeve.

2.3 BURIED PVC PIPE AND FITTINGS

A. Pipe: SDR-18, AWWA C900.

B. Fittings:

1. AWWA C907, CSA B137.2.
2. PVC fittings restrained with thrust blocks per NFPA 24.
3. Ductile Iron Fittings and Restraining Rods: AWWA C110, 350 psi or 24.13 bar. Cement mortar lined per AWWA C104, field encased with 8 mil polyethylene bag per AWWA C105. Coat all bolts, restraining rods, and the like with bitumastic prior to encasement in the polyethylene bag.
4. Underground Valves: Factory coated with powdered epoxy or equivalent corrosion resistant coating. Bolts coated with bitumastic in the field. Encase the entire valve in 8-mil polyethylene bag in accordance with AWWA C-105.

C. Install tracer wire on all non-metallic underground water lines. Type R.H.W., #10 A.W.G. stranded.

2.4 BURIED HDPE PIPE AND FITTINGS

A. Pipe: SDR 7, AWWA C906, 250 psi or 17.24 bar. Thermal fusion, butt welded.

B. Fittings restrained with thrust blocks per NFPA 24.

C. Install tracer wire on all non-metallic underground water lines. Type R.H.W., #10 A.W.G. stranded.

2.5 JOINT RESTRAINTS

A. Mechanical joint wedge action for ductile iron pipe.

B. Gland: Ductile Iron.

C. Wedges: Ductile iron.

D. Full restraint pressure rating of pipe with minimum safety factor of 2:1.

2.6 ABOVEGROUND BLACK STEEL PIPE AND FITTINGS

A. Wet Pipe Systems:

1. Pipe Size 2-inch Diameter and Smaller: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 40 when installed with threaded fittings, minimum Schedule 10 when installed with grooved fittings.
2. Pipe Size 2-1/2-inch Diameter and Larger: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 10.
3. Exposed pipe 8-feet or less above finished floor: A minimum of Schedule 40.

B. Dry Pipe Systems:

1. Pipe Size 2-inch Diameter and Smaller: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 40 when installed with threaded fittings, minimum Schedule 10 when installed with grooved fittings.
2. Pipe Size 2-1/2-inch Diameter and Larger: ASTM A53, ASTM A135, or ASTM A795; minimum of Schedule 10.

C. Joints:

1. Threaded, flanged or bevel welded.
2. Piping installed in plenums or shafts to have welded joints.

D. Fittings:

1. Threaded:
   a. Malleable Iron: Class 150 and Class 300, ANSI B16.3.
   b. Cast Iron: Class 125 and 250, ANSI B16.3.
2. Flanged:
   a. Cast iron; Class 125 and 250, ASME B16.1.
   b. Raised ground face, bolt holes spot faced.
3. Welded:
   a. Carbon Steel: Long radius, standard weight or extra strong.
   b. Factory Wrought Steel Buttweld Fittings: ASME B16.9.
   c. Buttwelding Ends for Pipe, Valves, Flanges and Fittings: ASME B16.25.
   d. Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures: ASTM A234.
   e. Steel Pipe Flanges and Flanged Fittings: ASME B16.5.
   f. Forged Steel Fittings, Socket Welded and Threaded: ASME B16.11.
4. Mechanical Fittings and Grooved Couplings:
   a. Couplings: UL 213, AWWA C606, ASTM A536 ductile iron or ASTM A47 malleable iron, with enamel finish and grooves or shoulders designed to accept grooved couplings. Synthetic-rubber gasket with central-cavity, pressure-responsive design and ASTM A183 carbon-steel bolts and nuts.
   b. FM Global approved.

E. Anti-Microbial Coating: Factory-applied coating to inhibit corrosion from microbiological organisms.

2.7 WALL AND FLOOR PENETRATIONS AND SLEEVES

A. Below Grade and High Water Table Areas: Waterproof elastomeric compound.

2.8 SWITCHES, VALVE SUPERVISORY

A. Provide to mount on applicable, compatible valve (OS&Y gate, or PIV), with SPDT switches to match requirements of fire alarm system. Provide with cover tamper switch where required by AHJ.

2.9 SWITCHES, WATER DETECTOR

A. Provide with cover tamper switch where required by AHJ.

B. Water Flow Switches:

1. Vane-type; SPDT switches; electronic retard, adjustable time delay (0 to 75 seconds).
2. Wet Sprinkler Systems: 450 PSI, 18-feet per second, 4-10 gpm.

C. Pressure Operated Alarm Switches: Pressure actuated with SPDT electrical switches and adjustable time delay (0 to 75 seconds).

2.10 HANGERS AND SUPPORTS

A. General: Select size of hangers and supports to exactly fit pipe size for bare piping.

B. Hangers: Ferrous.

C. Hanger Rods: Zinc electroplated carbon steel.

D. Finishes: Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

E. Materials:

1. Use carbon steel pipe hangers and supports, metal trapeze pipe hangers and attachments for general service applications.
2. Use stainless steel hangers, rods and attachments for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries and the like.

2.11 STRUTS AND STRUT CLAMPS

A. Electro-galvanized steel.

B. Designed for supporting pipe runs from strut supports.

C. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries and the like.

2.12 SWAY BRACES AND RESTRAINTS

A. Sway Bracing: From a single manufacturer and compatible with sway brace calculation program.

B. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries, and the like.

2.13 SEISMIC SEPARATION ASSEMBLY

A. Flexible expansion loop, designed for seismic movement for sprinkler pipe passing through or crossing building seismic joints. Impart no thrust loads to building structure.

B. Two flexible sections of hose and braid, two 90 degree elbows and 180 degree return. Factory supplied, center support nut located at the bottom of the 180 degree return, drain/air release plug. Provide materials of construction and end fitting type consistent with pipe material and equipment/pipe connection fittings.

2.14 ANCHORS AND ATTACHMENTS

A. General: Anchor supports to masonry, concrete and block walls per anchoring system manufacturer’s recommendations, or as modified by project Structural Engineer.

B. Materials:

1. Ferrous.
2. Stainless steel for corrosive environment applications. Examples of corrosive environment applications include, but are not limited to: swimming pools and spas, pool and spa equipment rooms and adjacent areas, chemical rooms, kidney dialysis areas, marine and beach environments, commercial laundries, and the like.

C. Attachments in Concrete:

1. Cast in Place Anchors for Hangers: Verify listing is for hangers, braces, or both.
2. Suitable for hanging and bracing fire protection systems in concrete which is subject to cracking in a seismic event.
3. Seismic Design Areas C, D, E and F:
    a. Compatible with International Code Council Evaluation Service Acceptance Criteria AC-193 and AC308 for expansion, screw and adhesive anchors. Meet requirements of ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary.
    b. All models of Hilti HDI and ITW Red Head Multi-Set II anchors are not approved for attaching fire protection systems in Seismic Design Areas C, D, E and F. No Exceptions.

D. ITW Buildex Sammys with FM Approval only are not allowed in certain seismic zones. Verify with FM that FM Approval is effective in project’s seismic zone.

2.15 PIPE STANDS

A. Adjustable Pipe Saddle Support with Yoke:

1. Designed to support horizontal pipe from floor stanchion.
2. U-bolt and hex nuts to hold pipe securely to saddle or pipe clamp type.
3. ANSI/MSS SP-69; SP-58. Type 37.
4. Steel pipe with steel saddle.

B. Base Stand:

1. Steel pipe welded to steel base plate.
2. Meet requirements of 12X anchor diameter hole spacing for seismic applications.

2.16 PRESSURE GAUGES

A. 3.5-inch, dial type, bronze bourdon tube or spring type, stainless steel case. 0 to 300 PSI.

2.17 ALARM BELLS

A. Minimum weatherproof backbox, typical 90 dBA at 10-feet.

B. Provide sign that reads, "When Bell Rings - Call 911".

2.18 FIRE DEPARTMENT CONNECTION

A. General:

1. Thread to match fire department hardware; automatic drip connected to drain; threaded dust cap and chain of same material and finish as body.
2. Provide with individual clappers.

B. Type: Flush-Mounted Wall Type

C. Finish: Ductile Iron

D. Inlet Size: 2-1/2-inch.

E. Number of Inlets: Two.

F. Outlet Size: 4-inch.

G. Size of Pipe between Fire Department Connection and Sprinkler System: 4-inch.

H. Drain: 3/4-inch automatic ball drip, to outside.

I. Sign: Auto Sprinkler Fire Department Connection

2.19 VALVES

A. OS&Y Gate:

1. 2-1/2-inches and Larger: Iron body.
2. 2-inches and Smaller: Bronze body.

B. NRS Gate:

1. Iron body. Non-rising stem with indicator post.
2. Underground Butterfly Valves: Telescopic barrel type.

C. Swing Check: Iron body, rubber and bronze faced checks.

D. Wafer Check: Iron body, rubber seat, spring actuated.

E. Butterfly Valves: Ductile iron body with factory-installed tamper switches. Use lug body next to pumps.

F. Pressure Relief: Bronze body, stainless steel spring.

G. Automatic Ball Drip Drain Valve: Bronze, spring-type.

H. Three-Way Gauge Valve: Brass; rated to 300 psi.

I. Automatic Air-Release Valve for Wet Systems:

1. Rated to 175 psi.
2. Automatic float-type with shutoff mounted in a water retention pan.
3. Single set 24VAC@2A for electronic supervision.
4. Ball valve switch with cover tamper.

J. Ball Valves: Brass body, brass stem; forged brass ball disc.

2.20 BACKFLOW PREVENTION DEVICES

A. Double Check Valve Assembly:

1. Two check valves in series with OS&Y gate or butterfly valves at each end.
2. Provide detector if required by local utility.
3. UL listed or FM Global Approved for fire suppression service as an assembly.
4. Approved by local and state authorities, including project's State Department of Health for the position in which it is installed.

B. Provide Water Bureau approved Bypass-Meter and compatible Touch-Pad. Touch-Pad unit must be accessible from right-of-way.

2.21 PIPE, VALVE, AND FIRE PROTECTION EQUIPMENT IDENTIFICATION

A. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.

B. Corrosion-resistant chain or permanent adhesive.

2.22 SIGNS

A. Engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker.

B. Corrosion-resistant chain or permanent adhesive.

2.23 DRAINS

A. Reference Aboveground Black Steel Pipe and Fittings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in conformance with UL Listing, FM Approval or ICC-ES requirements and restrictions.

B. Install per manufacturer's instructions and recommendations.

3.2 BURIED DUCTILE IRON PIPE AND FITTINGS

A. Pipe Sleeves:

1. Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with nonshrinking firestopping, smokestopping and water stopping grout or approved equivalent caulking compound.
3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with nonshrinking caulking compound. Caulk/seal piping passing through fire-rated building assemblies with UL Listed or FM approved fire-rated firestopping compound. Provide fire-rated assemblies per local AHJ requirements.
4. Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations.

B. Buried Pipe:

1. Hydraulically calculated pipe to be of sufficient size as to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.
2. Excavation and Backfill:
    a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.
    b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.
    c. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of a testing laboratory.
    d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e. muck, peat and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no expense to Owner. Adequate width of trench for proper installation of piping or conduit.
    e. Support Foundations:

1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.
2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.
3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.
4) Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.

f. Backfilling:
1) Following installation and successful completion of required tests, backfill piping in lifts.
a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
2) Backfill Material:
a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

g. Compaction of Trench Backfill:
1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:
a) Mechanical tamper,
b) Vibratory compacter, or
c) Other approved methods appropriate to conditions encountered.
2) Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

C. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping and fittings against dirty water, chemicals, and mechanical damage both before and after installation. Restore to original condition or replace damaged pipe and fittings prior to final acceptance of work.

3.3 BURIED PVC PIPE AND FITTINGS

A. Securely fasten tracer wire to top of water line and place along the outside of transition to ductile iron pipe with one foot of slack placed adjacent to ductile iron pipe.

B. Buried Pipe:

1. Hydraulically calculated pipe to be of sufficient size as to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.
2. Excavation and Backfill:
    a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.
    b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.
    c. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of a testing laboratory.
    d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e. muck, peat and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no expense to Owner. Adequate width of trench for proper installation of piping or conduit.
    e. Support Foundations:
        1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.
        2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.
        3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.
        4) Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.
    f. Backfilling:
        1) Following installation and successful completion of required tests, backfill piping in lifts.
            a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.

b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.

2) Backfill Material:

a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.

b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

g. Compaction of Trench Backfill:

1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:

a) Mechanical tamper,

b) Vibratory compacter, or

c) Other approved methods appropriate to conditions encountered.

2) Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

C. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping and fittings against dirty water, chemicals, and mechanical damage both before and after installation. Restore to original condition or replace damaged pipe and fittings prior to final acceptance of work.

3.4 BURIED HDPE PIPE AND FITTINGS

A. Securely fasten tracer wire to top of water line and place along the outside of transition to ductile iron pipe with one foot of slack placed adjacent to ductile iron pipe.

B. Buried Pipe:

1. Hydraulically calculated pipe to be of sufficient size as to deliver the required flow while not exceeding a flow velocity of 15-feet per second or as required in accordance with the water department requirements, whichever is less.
2. Excavation and Backfill:
   a. General: Perform necessary excavation and backfill required for installation of mechanical work. Repair piping or other work damaged by Contractor's operations.
   b. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.
   c. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of a testing laboratory.
   d. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (i.e. muck, peat and the like), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material at no expense to Owner. Adequate width of trench for proper installation of piping or conduit.
   e. Support Foundations:

1) Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to a depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Sections of Specifications or Drawings.
2) Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.
3) Foundation Material: Where native material has been removed, place and compact necessary foundation material to form a base for replacement of required thickness of bedding material.
4) Bedding Material: Full bed site piping on sand, pea gravel or 3/4-inch minus crushed rock. Place a minimum 4-inch deep layer of sand or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide a firm foundation.

f. Backfilling:
1) Following installation and successful completion of required tests, backfill piping in lifts.
a) In "Pipe Zone," place backfill material and compact in lifts not to exceed 6-inches in depth to a height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
b) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
2) Backfill Material:
a) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
b) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."

g. Compaction of Trench Backfill:
1) Where compaction of trench backfill material is required, use one of following methods or combination thereof:
a) Mechanical tamper,
b) Vibratory compacter, or
c) Other approved methods appropriate to conditions encountered.
2) Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

C. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping and fittings against dirty water, chemicals, and mechanical damage both before and after installation. Restore to original condition or replace damaged pipe and fittings prior to final acceptance of work.

3.5 JOINT RESTRAINTS

A. Reference 3.01, General Installation Requirements.

3.6 ABOVEGROUND BLACK STEEL PIPE AND FITTINGS

A. Piping Routing:

1. Orient horizontal routes parallel with walls and beam lines.
2. Install piping as shown or described by diagrams, details and notations on Drawings or, if not indicated, install piping to provide the shortest route which does not obstruct usable space or block access for servicing the building and its equipment.
3. Install piping in concealed spaces above finished ceilings. Prior to design and installation. obtain pre-approval by Architect for exposed piping.
4. In open-to-structure areas which are open to public view, route exposed piping to minimize visual impact. Obtain Architect's and Engineer's approval of exposed piping installation.
5. Coordinate installation with other trades. Route piping as required to avoid building structure, equipment, plumbing piping, HVAC piping, ductwork, lighting fixtures, electrical conduits and bus ducts and similar work. Final location of lighting will have priority over final sprinkler locations. Provide drains to trapped sections of system which result from such routing. Other trades take precedence for installation space.
6. Support piping adjacent to walls, overhead construction, columns and other structural and permanent enclosure elements of the building. Limit clearance to 2-inches wherever furring is indicated for concealment of piping. Allow for insulation thickness. Locate insulated piping to provide minimum 1-inch clearance outside insulation.
7. Wherever possible in finished and occupied spaces, conceal piping from view by locating within column or beam enclosures, hollow wall construction, or above suspended ceilings. Do not encase horizontal routes in solid partitions, except where approved.
8. General Electrical Equipment Clearances: Do not route piping through electrical rooms, transformer vaults, elevator equipment rooms and other electrical or electronic equipment spaces and enclosures. Do not route piping above electric power or lighting panel, switchgear, low voltage panel, or similar electric device.
9. Rooms Protected by Alternative Systems: Route water filled and dry system piping around rooms protected by pre-action systems, clean agent systems, gaseous suppression systems and other alternative fire suppression systems.
10. Install pipe runs to minimize obstruction to other work.
11. Pitch all dry and pre-action system piping 1/4-inch per 10-feet for mains and 1/2-inch per 10-feet for branch lines, including pipe passing through both warm and cold areas.

B. Couplings:

1. Install where indicated on Drawings and on each side of pieces of equipment to permit easy removal of equipment.
2. Deburr cut edges.

C. Pipe Penetrations: Wire pipe cutout coupon at point of pipe penetration.

D. Pipe and Pipe Fittings:

1. Expansion and Flexibility: Install work with due regard for expansion and contraction to prevent damage to the piping, equipment, building and its contents. Provide piping offsets, loops, approved type expansion joints, sway bracing, wire restraints, vertical restraints, flexible couplings or other means to control pipe movement and to minimize pipe forces.
2. Coordinate support of pipe 4-inches and larger with Structural Engineer.
3. Provide clearances around piping per NFPA 13.

4. Install dry and pre-action welded pipe with welds facing vertically up, or where this is not possible, as close as possible to vertical between 46 degrees and 234 degrees. Intent is to minimize corrosion caused by moisture in the bottom of pipes.

3.7 WALL AND FLOOR PENETRATIONS AND SLEEVES

A. Escutcheons: Install on exposed pipes passing through walls or floors.

1. Pipe Sleeves: Lay out work in advance of pouring concrete and furnish and set sleeves necessary to complete work.
2. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with nonshrinking fire and water resistant grout or approved equivalent caulking compound. Caulk/seal piping penetrations through fire rated building walls and floors with listed, fire-rated assemblies. Provide fire-rated assemblies per local AHJ requirements.
3. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Caulk/seal piping penetrations through fire rated building walls and floors with listed, fire-rated assemblies. Provide fire-rated assemblies per local AHJ requirements.
4. Beam Sleeves:
   a. Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Penetrations must be indicated on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings.
   b. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
5. Penetrations in Fire-Rated Wall/Floor Assemblies:
   a. Reference Division 07, Thermal and Moisture Protection.
   b. Coordinate with Drawings location of fire rated walls, ceilings and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material.
   c. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814 and NFPA.
   d. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814.

3.8 SWITCHES, VALVE SUPERVISORY

A. Coordinate with Division 28, Electronic Safety and Security.

3.9 SWITCHES, WATER DETECTOR

A. Wire pipe cutout coupon at point of connection of switch to pipe.

B. Flow switches: Connect to system side of valves and drain connections.

C. Coordinate with Division 28, Electronic Safety and Security.

3.10 HANGERS AND SUPPORTS

A. Installation of pipe hangers, inserts and supports to conform to NFPA 13. Provide adjustable hangers, inserts, brackets, clamps, supplementary steel and other accessory materials required for proper support of pipe lines and equipment.

B. Provide supplementary materials for proper support and attachment of hangers.

3.11 STRUTS AND STRUT CLAMPS

A. Install per manufacturer's listed orientation.

3.12 SWAY BRACES AND RESTRAINTS

A. Locate per orientation and spacing as required by sway brace calculations.

B. Attach sway bracing directly to pipe or equipment being braced.

C. Do not attach sway bracing to bottom of truss members.

3.13 SEISMIC SEPARATION ASSEMBLY

A. Provide four-way sway braces upstream and downstream within 6-feet of the seismic separation assembly, attached to structure on opposite sides of the seismic joint.

B. Do not attach bracing to seismic separation assembly.

3.14 ANCHORS AND ATTACHMENTS

A. In post-tension construction, determine location of post-tension cables and install anchors to avoid contact or interference with post-tension cables. Coordinate with Structural.

B. Do not use powder-driven attachments.

C. Building Attachments and Inserts: Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves and flanges, for sizes NPS 2-1/2 and larger. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

D. Hanger and Support Attachments:

1. Concrete:
    a. Before Pouring: Prior to installation, coordinate locations of cast in place concrete inserts with other trades. Install in accordance with manufacturer's instructions.
    b. After Pouring:
        1) Where supports in slabs are required after concrete has been poured, provide drilled-in threaded inserts (mechanical-expansion anchors), installed in accordance with manufacturer's recommendations.
        2) Install mechanical-expansion anchors after concrete is completely cured and in accordance with manufacturer's installation instructions.
        3) Where anchors are to be installed in post-tension construction, determine and avoid locations of post-tension cables prior to drilling.

2. Metal Floor Deck: Support hangers per UL Listing or FM Approval for selected concrete insert before pouring of concrete topping, or from beam clamps fastened to structural steel.
3. Steel Joists: Support hangers from beam clamps fastened to bar joists or to auxiliary steel between bar joists as required.
4. C-Clamp Hangers: Do not attach to one side of double-angle bottom members.
5. Locate and install hangers, supports and attachments connecting to I-joists, structural insulated panels (SIPs), cross laminated timber and similar engineered structural products according to the structural product manufacturer specifications.

E. Make available to the Architect information required to verify the anchorage, sway bracing and restraint of fire protection systems.

3.15 PIPE STANDS

A. Secure to floor.

B. Install to maintain pipe level and plumb.

C. Securely attach to supported pipe by u-bolt.

3.16 GAUGES

A. Install gauges conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Install with dial positioned for maximum visibility.

3.17 ALARM BELLS

A. Locate exterior alarm bells at 8-feet above finished grade. Coordinate with Architect.

B. Coordinate with Division 26, Electrical and Division 28, Electronic Safety and Security.

3.18 FIRE DEPARTMENT CONNECTION

A. Locate with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

B. Provide method of draining FDC piping. Drain to sanitary sewer by indirect connection, or to exterior where damage, including damage to landscaping and staining of concrete, will not occur.

C. Locate away from building egress paths. Coordinate location with Fire Marshal.

3.19 VALVES

A. General:

1. Provide post indicator on buried control valves.
2. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.

3. Install valves where required for proper operation, testing and drainage. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow.

C. Wafer Check Valves: Install between two flanges in horizontal or vertical position, position for proper direction of flow.

D. Pressure Relief Valves: Provide piping to permanent drain.

3.20 BACKFLOW PREVENTION DEVICES

A. Install conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Provide listed backflow assembly at sprinkler system water source connection. Coordinate with local utility; conform to their installation requirements.

C. Provide method of forward flow testing at full system demand without dismantling any part of the system. Indicate location, method of testing and location of test drain discharge on submittal and As-Built Drawings. Provide signage as required by NFPA 13. Locate drainage for forward testing where damage will not occur, including damage to landscaping.

D. Chain and padlock in "open" position. Provide two sets of keys.

E. Provide control valve supervisory switches connected to the fire alarm system.

F. Reduced Pressure Backflow Preventer:

1. Locate within 5-feet of finished floor near drain shown on Plumbing Drawings or an existing drain of sufficient size which can accept full discharge of relief valve without doing damage or arrange and pay for installation of a suitable size drain.
2. Provide drain piping to sanitary sewer. Coordinate with Division 22, Plumbing.

3.21 PIPE, VALVE, AND FIRE PROTECTION EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate or corrosion resistant metal sign or plastic equipment marker, secured with corrosion-resistant chain or permanent adhesive on or near each Item of fire suppression equipment and each operational device, as specified in this specification if not otherwise specified for each Item or device.

B. Provide signs for the following general categories of equipment and operational devices: Valves, drains, pumps, standpipes, tanks and similar equipment.

C. Each new piece of equipment to bear a permanently attached identification plate, listing manufacturer's name, capacities, sizes and characteristics.

D. Piping to bear the manufacturer's name, schedule of thickness, size and ASTM identification number

E. Provide valve tag on every valve, control device, main drain, auxiliary drain, and drum drip in each system. Exclude check valves and valves within factory fabricated equipment units. List each tagged valve in valve schedule for each piping system.

F. List each tagged item and its location in valve schedule; identify on fire suppression drawings.

G. Install framed, glass or rigid transparent plastic covered, mounted valve schedule and valve location drawing in main riser or fire pump room.

H. Provide identification sign on ceiling tile below valve location.

I. Provide permanent identification sign at pressure regulating valves stating required setting of pressure regulator.

J. Adjusting: Relocate fire suppression identification device which has become visually blocked.

K. Cleaning: Clean face of identification devices and glass frames of valve charts.

3.22 SIGNS

A. General Information Signs: Provide a general information sign used to determine system design basis and information relevant to the inspection, testing and maintenance requirements required by NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems. Such general information is to be provided with a permanently marked weatherproof metal or rigid plastic sign, secured with corrosion-resistant wire, chain, or other acceptable means. Such signs are to be placed at each system control rise loop and auxiliary system control valve. The sign is to include the following information:

1. Name and Location of the Facility Protected
2. Presence of High-Piled and/or Rack Storage
3. Maximum Height of Storage Planned
4. Flow Test Data
5. Location of Auxiliary Drains and Low Point Drains
6. Original Results of Main Drain Flow Test
7. Name of Installing Contractor or Designer
8. Indication of presence and location of other auxiliary systems.

B. Dry Signs: At system riser supplying dry systems, provide the following information: volume in gallons contained in each system.

3.23 DRAINS

A. Locate drain connections within 7-feet of floor. Provide piping capable of being fully drained.

B. Provide a drain vent at top of vertical drains. Coordinate with Division 22, Plumbing.

C. Coordinate location of auxiliary drains with Architect. Architect to approve location before drain is installed.

D. Protect drains from tampering and accidental operation.

E. Protect drain discharge at the exterior with a turned-down 45 degree elbow.

END OF SECTION 21 05 00

SECTION 21 13 00 - FIRE SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Sprinklers
2. Flexible Sprinkler Hose Fitting Assembly - For fire sprinklers in suspended ceilings which are supplied by a wet pipe system.
3. Oversized Sprinkler Escutcheons - For dry sprinklers in suspended ceilings which are supplied by a wet pipe or dry pipe system.
4. Riser Manifold
5. Floor Control Assembly
6. Inspector's Test Connection
7. Dry-Pipe Valve
8. Nitrogen System
9. Wet System Air Vent
10. Spare Sprinkler Cabinet
11. Sprinkler Guards

B. This is a contractor designed system. Contact AHJ prior to bid to verify fire system requirements. Provide design compliant with codes as interpreted by AHJ.

C. Scope:

1. Wet-Pipe Sprinkler System.
2. Dry-pipe sprinkler system and/or dry barrel sprinklers for areas subject to 40 degrees F or less.
3. Private fire service main running from 5-feet outside the building to the inlet connection inside the building. Provide required valves and appurtenances.

D. Coordinate location and type of tamper, flow and pressure switches and fire alarm system.

E. Provide electrical connections and wiring as required for a complete and operable system. Includes but is not limited to bells, air compressors, sump pumps, fire pumps, jockey pumps and pump controllers.

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Division 22, Plumbing
2. Division 23, Heating, Ventilating and Air-Conditioning
3. Division 26, Electrical
4. Division 28, Electronic Safety and Security
5. Section 21 00 00, Fire Suppression Basic Requirements
6. Section 21 05 00, Common Work Results for Fire Suppression
7. Section 21 30 00, Electric Fire Pumps

8. Section 21 41 00, Storage Tanks for Fire Suppression Water

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Hydraulic calculations.
2. Sway brace calculations.
3. Details of sway bracing.
4. Details of interval and end of branch line restraints.
5. Details of flexible sprinkler hose fitting assembly, including number and radius of bends, corresponding to equivalent feet used in hydraulic calculations. Provide details of sign to be installed at each flexible sprinkler hose fitting assembly.
6. Details of oversized ceiling penetrations and oversized sprinkler escutcheons.
7. Trapeze hanger details and calculations, including size, length and material. Additionally, provide size, weight and number of pipes to be carried on the trapeze.
8. On submittal and As-Built drawings, provide text of sprinkler list to be installed in the spare sprinkler cabinet.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

A. Provide coverage for entire building. Field verify field conditions prior to submittal of bid. Adjust bid to provide protection features in accordance with applicable codes and interpretations by AHJ. Provide design and installation based on more stringent requirements if this specification and AHJ requirements differ from Code.

B. Design Parameters:

1. Building Areas: Offices, restrooms, corridors.
   a. Occupancy Classification: Light.
   b. Outside Hose Allowance: 100 GPM.
2. Building Areas: Electrical rooms, mechanical rooms.
   a. Occupancy Classification: Ordinary Group 1.
   b. Outside Hose Allowance: 250 GPM.
3. Building Areas: Low-piled miscellaneous storage.
   a. Occupancy Classification: Ordinary Group 2.

b. Outside Hose Allowance: 250 GPM.

4. Design parameters above are NFPA 13 minimums. Provide increased design densities, design areas and hose allowances to meet requirements of AHJ.

C. Sprinkler system design to include a 10 percent pressure and flow cushion between system demand point and available water supplies.

D. Extend hydraulic calculations from hydraulically most remote design area back to location of pressure hydrant of flow test or effective point of water supply where characteristics of water supply are known.

1.8 EXTRA STOCK

A. Provide extra sprinklers per code.

B. Provide suitable wrenches for each sprinkler type and metal storage cabinet in riser room.

1.9 CONTROL VALVES

A. Sprinkler system control valves to be OS&Y or butterfly valves located inside building in a room with outside door.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Sprinklers:

1. Finished Areas:
   a. Victaulic
   b. Viking
   c. Tyco
   d. Reliable
   e. Globe
   f. Senju
   g. Or approved equivalent.
2. Nonfinished Areas:
   a. Victaulic
   b. Viking
   c. Tyco
   d. Reliable
   e. Globe
   f. Or approved equivalent.
3. Dry Sprinklers:
   a. Victaulic
   b. Viking
   c. Tyco
   d. Reliable
   e. Or approved equivalent.

B. Flexible Sprinkler Hose Fitting Assembly:

1. Victaulic; VicFlex.
2. Flexhead Industries

3. SprinkFLEX
4. ARGCO
5. Reliable Automatic Sprinkler Company
6. Tyco Fire and Building Products
7. Viking Corporation
8. Or approved equivalent.

C. Oversized Sprinkler Escutcheons:

1. Victaulic; FireLock Expansion Plates.
2. Viking Corporation; Expansion Plate.
3. Tyco Fire Protection Products; Wide Adapter Plates.
4. Reliable Automatic Sprinkler; Extender Rings.
5. Globe Fire Sprinkler Corporation; Seismic Escutcheons.
6. Or approved equivalent.

D. Riser Manifold:

1. Viking EasyPac
2. Reliable; Model CR.
3. AGF; Model 8011.
4. Tyco; Model RM-1
5. Or approved equivalent.

E. Floor Control Assembly:

1. Victaulic; FireLock 747 with pressure relief valve.
2. Viking EasyPac
3. Reliable; Model FCV.
4. Or approved equivalent.

F. Inspector's Test Connection:

1. Combination Test and Drain:
   a. Victaulic; Series 720 TestMaster II Alarm Test Module with pressure relief valve.
   b. AGF; Model 1011, 2511, 3011, with pressure relief valve.
   c. Or approved equivalent.
2. Dry System Inspector's Test Connection:
   a. AGF; Model 3011.
   b. Or approved equivalent.

G. Dry-Pipe Valve:

1. Victaulic; Model FireLock NXT.
2. Viking; Model G-4000.
3. Tyco; Model DPV-1.
4. Or approved equivalent.

H. Nitrogen System:

1. Engineered Corrosion Solutions (ECS)
2. Potter Electrical Signal
3. South-Tek
4. Or approved equivalent.

I. Wet System Air Vent:

1. Engineered Corrosion Solutions (ECS)
2. Potter Electric Signal Company; Model PAV
3. Or approved equivalent.

J. Spare Sprinkler Cabinet:

1. Victaulic
2. Fire Protection Products, Inc. (FPPI).
3. Tyco Fire & Building Products
4. Allied Rubber and Gasket Co.
5. Potter Roemer Fire Pro.
6. Or approved equivalent.

K. Sprinkler Guards:

1. Victaulic
2. Viking
3. Tyco
4. Reliable
5. Globe
6. Senju
7. Or approved equivalent.

2.2 SPRINKLERS

A. Finished Areas:

1. Type: Glass-Bulb
2. Style: Concealed
3. Response: Quick-Response
4. Finish: White Polyester
5. Escutcheon:
6. Coverplate for Concealed Sprinklers: Flat plate, white

B. Nonfinished Areas:

1. Type: Glass-Bulb
2. Response: Quick-Response
3. Finish: Brass

C. Dry Sprinklers:

1. Type: Glass-Bulb
2. Style:
   a. Concealed
   b. Recessed
3. Response: Quick-Response
4. Finish:
   a. Chrome
   b. White Polyester
5. Escutcheon:
   a. Chrome

b. White Polyester
6. Coverplate for Concealed Sprinklers:
a. Flat Plate
b. Chrome
c. White
7. Dry Sprinkler Boot: Manufactured for use with the dry sprinkler it protects.

D. Pendent sprinklers supplied by dry or preaction piping: Dry pendent type.

2.3 FLEXIBLE SPRINKLER HOSE FITTING ASSEMBLY

A. Fully welded non-mechanical fittings, stainless steel, braided, leak-tested with minimum 1-inch true-bore internal corrugated hose diameter. 175 psi.

B. Ceiling Bracket: Galvanized steel, direct attachment type, with integrated snap-on clip ends and removable flexible hose attachment with set screw. FM1637, UL 2443.

C. Affix permanent sign, label or decal at each flexible sprinkler hose fitting assembly anchoring component limiting the relocation of the sprinkler.

2.4 OVERSIZED SPRINKLER ESCUTCHEONS

A. Metal.

B. Provide oversized ceiling penetrations and oversized sprinkler escutcheons for pendent sprinklers to comply with Building Code and ASCE-7 seismic requirements.

C. Same manufacturer as sprinklers.

2.5 RISER MANIFOLD

A. Water-flow alarm, gauge, integral pressure relief valve connected to drain, pressure gauge with 3-way gauge control valve and drain valve, integral pressure relief valve connected to drain, sight glass, smooth bore orifice union of same size as smallest orifice sprinkler installed.

B. Provide cover tamper switch when required by AHJ.

2.6 FLOOR CONTROL ASSEMBLY

A. Water-flow alarm, gauge, integral pressure relief valve connected to drain, sight glass, control valve, check valve, smooth bore orifice union of same size as smallest orifice sprinkler installed.

2.7 INSPECTOR'S TEST CONNECTION

A. Combination Test and Drain: Bronze body, brass stem, impregnated Teflon seat, chrome coated brass ball, steel handle with positive stops, tamper resistant test orifice, integral tamper resistant sight glasses, tapped and plugged port for system access, steel identification plate. Provide with pressure relief valve and drainage piping with bronze body and stainless steel spring.

B. Dry System Inspector’s Test Connection: Bronze, brass stem, steel handle, chrome-plated bronze ball, Teflon valve seat, tamper and corrosion resistant orifice equivalent to smallest sprinkler orifice, sight flow connection.

2.8 DRY-PIPE VALVE

A. Differential or low pressure actuator type.

B. Trim as recommended by manufacturer for variable pressure service, including air maintenance device, electric low pressure alarm switch, priming valves and test, main drain and pressure gauges.

C. External reset.

2.9 NITROGEN SYSTEM

A. Complete system package from one manufacturer, consisting of the following components:

1. Nitrogen Generation System
2. Oilless Air Compressor
3. Building Monitoring System
4. Alarm Integration
5. Auto Purge System
6. Auto Purge
7. Remote Annunciator
8. Supervisory Gas Monitoring
9. Air Maintenance Device

B. All components to be compatible with each other.

2.10 WET SYSTEM AIR VENT

A. Brass, UL 2573 with ball valve supervisory switch.

2.11 SPARE SPRINKLER CABINET

A. NFPA 13 Systems: Sized to accommodate a minimum of two spare sprinklers of each Sprinkler Identification Number (SIN), manufacturer, model, orifice, deflector type, temperature and thermal sensitivity, or a minimum of six sprinklers for facilities having under 300 sprinklers, or a minimum of 12 sprinklers for facilities having 300 to 1000 sprinklers, or a minimum of 24 sprinklers for facilities having over 1000 sprinklers, whichever is more.

B. Welded steel with hinged steel cover.

C. Red enamel or polyester coated finish inside and out.

2.12 SPRINKLER GUARDS

A. Metal.

B. Listed for use with sprinkler model to which it is attached.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's requirements and recommendations.

3.2 SPRINKLERS

A. Center sprinklers in center or quarter points of suspended ceiling tile.

B. Align sprinklers with architectural column lines, lighting, diffusers and other ceiling features. In unfinished ceilings, route piping to minimize visual impact. Sprinklers and piping not so aligned are to be removed and replaced at no additional cost to Owner.

C. Install dry sprinklers in a manner which does not trap water.

3.3 FLEXIBLE SPRINKLER HOSE FITTING ASSEMBLY

A. Install flexible sprinkler hose fitting assemblies where pendent sprinkler heads are located in acoustic ceiling tiles.

B. Install with no more bends than are included in equivalent footage used in hydraulic calculations.

C. Maintain manufacturer's recommended bending radius as included in equivalent footage used in hydraulic calculations.

D. Affix permanent sign, label or decal at each flexible sprinkler hose fitting assembly anchoring component limiting the relocation of the sprinkler.

3.4 OVERSIZED SPRINKLER ESCUTCHEONS

A. Coordinate oversized sprinkler escutcheons with ceiling construction and sprinkler style.

B. Provide for dry sprinkler penetrations in suspended ceilings.

3.5 RISER MANIFOLD

A. Install so valves and gauges are conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Provide connection to drain.

C. Pipe pressure relief valve to drain.

D. Install with supervised control valve(s) and check valve.

3.6 FLOOR CONTROL ASSEMBLY

A. Install so valves and gauges are conveniently and accessibly located with reference to finished building for repairs, removal and service.

B. Provide connection to drain.

C. Provide connection from pressure relief valve to drain.

D. Install with supervised control valve(s) and check valve.

3.7 INSPECTOR'S TEST CONNECTION

A. Locate where full flow discharge or pressure relief valve discharge will not do damage, including damage to landscaping and will not cause dangerous conditions to walking surfaces or discoloration to building surfaces.

B. Locate within 5-feet of finished floor.

3.8 DRY-PIPE VALVE

A. Install with sufficient access for ease of reset.

3.9 NITROGEN SYSTEM

A. Install per manufacturer's recommendations.

B. Provide a nitrogen purge valve at farthest point from nitrogen generator.

3.10 WET SYSTEM AIR VENT

A. Locate at a point in the system that will vent the most air.

B. Connect at top of pipe.

C. Locate so as not to interfere with sprinkler spray pattern.

D. Locate where it can be easily accessed for inspection and cleaning.

E. Pipe output of air vent to drain with an indirect connector or to exterior where it will not cause damage.

3.11 SPARE SPRINKLER CABINET

A. Attach to wall at the main sprinkler system riser.

B. Locate so cover is easy to open and readily accessible.

C. Locate in an area with a temperature between 40 and 100 degrees Fahrenheit.

D. Locate sprinkler wrenches inside cabinet.

E. Inside the cabinet, provide a list of sprinklers installed in the property, including sprinkler identification number, manufacturer, model, orifice, deflector type, thermal sensitivity and pressure rating, quantity of each type to be contained in the cabinet and issue or revision date of the list.

3.12 SPRINKLER GUARDS

A. Install per manufacturer's instructions and recommendations.

END OF SECTION 21 13 00

SECTION 21 30 00 - ELECTRIC FIRE PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included - Pumps supplying water to fire suppression water supplies, including the following:

1. In-Line Electric Motor Driven Pumps
2. Fire Pump Flow Test Meter
3. Exterior Fire Pump Test Header
4. Gauges for Fire Pumps
5. Fire Pump Circulation Relief Valve
6. Fire Pump Relief Valve
7. Fire Pump Electric Motor Drive Controllers
8. Fire Pump Automatic Transfer Switches
9. Fire Jockey Pump
10. Fire Jockey Pump Controller
11. Fire Pump Room
12. Fire Pump House
13. Automatic Air Release Device

B. This is a contractor designed system. Contact AHJ prior to bid and provide required fire system components as prescribed by governing codes as interpreted by AHJ.

C. Provide electrical connections and wiring as required for a complete and operable system.

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 21 00 00, Fire Suppression Basic Requirements
2. Section 21 05 00, Common Work Results for Fire Suppression
3. Section 21 13 00, Fire Suppression Sprinkler Systems
4. Section 21 41 00, Storage Tanks for Fire Suppression Water

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Manufacturer's catalog data, with certified pump curve.

2. Detailed pump room layout, 1/4-inch scale, plan views, with transverse and longitudinal Sections.
3. Test reports as required per NFPA 20.
4. Provide selective coordination of short circuit interruption capacity for electric motor driven fire pump power supply, per NFPA 20.
5. Wiring diagrams.
6. Heat loss calculations.
7. Fire pump room cooling calculations.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In-Line Electric Motor Driven Pumps:

1. AC Fire Pump
2. Armstrong
3. Aurora
4. Fairbanks Morse
5. Patterson
6. Peerless
7. Or approved equivalent.

B. Fire Pump Flow Test Meter:

1. Gerand
2. Or approved equivalent.

C. Exterior Fire Pump Test Header:

1. Croker
2. Or approved equivalent.

D. Gauges for Fire Pumps:

1. Ashcroft
2. US Gauge
3. Or approved equivalent.

E. Fire Pump Circulation Relief Valve:

1. United Brass Works
2. Watts
3. Or approved equivalent.

F. Fire Pump Relief Valve:

1. Cla-Val
2. Or approved equivalent.

G. Fire Pump Electric Motor Drive Controllers:

1. Firetrol
2. Metron
3. Master Control Systems
4. Joslyn Clark
5. Or approved equivalent.

H. Fire Pump Automatic Transfer Switches:

1. Firetrol
2. Metron
3. Master Control Systems
4. Joslyn Clark
5. Or approved equivalent.

I. Fire Jockey Pump:

1. Grundfos
2. Aurora
3. Or approved equivalent.

J. Fire Jockey Pump Controller:

1. Firetrol
2. Metron
3. Master Control Systems
4. Or approved equivalent.

K. Automatic Air Release Device:

1. AGF
2. Or approved equivalent.

2.2 GENERAL

A. Reference Division 21, individual Sections for additional product information.

B. UL Listed and FM Approved for fire pump systems.

2.3 IN-LINE ELECTRIC MOTOR DRIVEN PUMPS

A. General:

1. Single stage, close coupled, vertical in-line, electric motor driven.
2. Casing: Cast iron, ASTM A278, Class 30 or 35, or ductile iron, ASTM A536, Grade 65 with suction and discharge flanges located on a common centerline, 180 degrees apart, for mounting in the pipeline.
3. Renewable bronze wearing rings.

4. Impeller: Bronze, ASTM B584, fully enclosed, keyed to shaft.
5. Shaft: Steel with shaft sleeves.
6. Grease or water lubricated ball bearings.
7. Drive: Flexible coupling with coupling guard.
8. Direct coupled to motor shaft.
9. Split bronze packing glands.
10. Electric Motor: Coordinate with controller starter type.

B. Estimated Pump Rating: 1000 GPM rated pump, operating at 1800 RPM and 60 BHP at 60 PSIG. Size pump to meet sprinkler system and/or hose stream demands per building code and local interpretation.

2.4 FIRE PUMP FLOW TEST METER

A. Venturi type.

B. 4-1/2-inch or 6-inch dial meter.

C. Dial Meter Range in GPM, LPM, or M3/H.

D. Hoses with brass fittings with shut-off valves at the Venturi.

E. Size capable of water flow of not less than 175 percent of rated pump capacity.

2.5 EXTERIOR FIRE PUMP TEST HEADER

A. Cast brass body with end inlet.

B. Provide one outlet for each 250 gpm of flow at 150 percent of rated fire pump capacity.

C. Brass plate lettered, “Pump Test Connection”.

D. Caps and chains.

E. Exposed Finish: Polished brass.

2.6 GAUGES FOR FIRE PUMPS

A. 3-1/2-inch, dial type, Bourdon tube or spring type, 0 to 300 PSI.

2.7 FIRE PUMP CIRCULATION RELIEF VALVE

A. Bronze body, stainless steel spring.

2.8 FIRE PUMP RELIEF VALVE

A. Direct acting, spring-loaded, diaphragm type.

2.9 FIRE PUMP ELECTRIC MOTOR DRIVE CONTROLLERS

A. Controller:

1. Combined manual and electronic soft start with built-in transfer switch.

2. Operator Interface: Monitor and display motor operating conditions, alarms, events and pressure conditions. Display alarms, events and pressure conditions with time and date stamp.
3. Sequential start timer.
4. Digital status/alarm message display.
5. LED visual indicators.
6. Digital data logger.
7. Solid state pressure transducer.

B. Provide electrical withstand rating greater than the available fault. Withstand rating (amps RMS symmetrical) at service voltage per results of short circuit analysis per NFPA 20.

C. Coordinate controller requirements with emergency generator requirements and electrical engineer.

D. Enclosure: NEMA Type 2 enclosure, front opening, manual start/stop and 12-inch-high mounting feet. Select type of starter to match site conditions.

E. Automatic Weekly Test Initiation: Seven-day time clock, three-way test drain solenoid valve.

F. Coordinate with Electrical Drawings and Division 26, Electrical.

G. Provide controller heater.

2.10 FIRE PUMP AUTOMATIC TRANSFER SWITCHES

A. Normal Power Source: Utility.

B. Emergency Power Source: Utility.

C. Withstand rating equal to controller for normal power.

D. Withstand rating as applicable to generator set configuration for emergency power.

E. NEMA Type 2 enclosure.

F. Coordinate with Electrical Drawings and Division 26, Electrical.

2.11 FIRE JOCKEY PUMP

A. Electric drive.

2.12 FIRE JOCKEY PUMP CONTROLLER

A. UL listed, NEMA 2 enclosure, fused disconnect overload relay, exterior "Hand-Off-Auto" switch.

2.13 FIRE PUMP ROOM

A. Provide sufficient area to fit pump, pipe, equipment, controller, and the like.

B. Provide adequate clearance around each piece of equipment to be able to perform maintenance.

C. Provide clearance in front of electrical equipment per NFPA 70.

D. Locate pump room so as to avoid turbulence in the pump suction piping.

E. Provide suitable automatic means for maintaining the temperature of the pump room above 40 degrees F per NFPA 20, and below 104 degrees F or between minimum and maximum temperatures recommended by pump, motor, and pump controller manufacturers.

F. Provide artificial light and emergency light.

G. Provide make-up air and exhaust ventilation for fire pump room.

H. Provide drain adequate for packing gland discharge and circulation relief valve discharge.

I. Provide slight pitch on floor so water being discharged does not flow back toward pump, controller or equipment.

2.14 FIRE PUMP HOUSE

A. Provide sufficient area to fit pump, pipe, equipment, controller, and the like.

B. Provide adequate clearance around each piece of equipment to be able to perform maintenance.

C. Provide clearance in front of electrical equipment per NFPA 70.

D. Locate pump house so as to avoid turbulence in the pump suction piping.

E. Provide suitable automatic means for maintaining the temperature of the pump house above 40 degrees F per NFPA 20, and below 104 degrees F or between minimum and maximum temperatures recommended by pump, motor, and pump controller manufacturers.

F. Provide artificial light and emergency light.

G. Provide make-up air and exhaust ventilation for fire pump house.

H. Provide drain adequate for packing gland discharge and circulation relief valve discharge.

I. Provide slight pitch on floor so water being discharged does not flow back toward pump, controller or equipment.

2.15 AUTOMATIC AIR RELEASE DEVICE

A. Provide per Code and as Follows:

1. Stainless steel body.
2. Stainless steel float.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation:

1. Locate fire pump on 6-inch concrete housekeeping pad.

2. Pipe drains from pump bases, pump stuffing boxes, controller drains, and pump casings to a drain capable of handling the anticipated flow.

B. City Water Bypass:

1. Provide per Code and as Follows:
   a. Fitted with OS&Y gate or butterfly valves and check valve.
   b. Size per NFPA 20 and anticipated system demand per Building Code.
   c. Size per anticipated system demand per FM Global Loss Prevention Data Sheets.
2. Take supply between system side of backflow preventer and tank fill valves, where provided.
3. Connect discharge on system side of fire pump, after fire pump check valve.
4. Provide supervised isolation valve(s).

C. Earthquake Protection:

1. Provide bracing for the fire pump, driver, and fire pump controller. Brace calculations to meet minimum requirements of Building Code Chapter 16 and NFPA 13. Brace calculations to be signed and sealed by a structural engineer licensed in the State of Oregon. Coordinate with Structural and Civil.
2. Meet minimum requirements of FM Global Data Sheets.
3. Brace pump assemblies with high centers of gravity above their centers of gravity.
4. Where fire suppression system riser is part of the fire pump discharge piping, install a flexible pipe coupling at the base of system riser.

D. Tests:

1. Arrange for Tests to be Witnessed by:
   a. Fire Marshal
   b. AHJ
   c. Owner's Fire Insurance Underwriter
   d. Engineer
2. Acceptance Test: Provide acceptance test described in NFPA 20.
3. Provide factory trained, authorized representatives of the pump, controller, and engine manufacturers present for startup. Engage authorized representatives in day-to-day representation of their manufacturer. Provide written startup reports to Owner, Engineer, and AHJ.
4. Test pump at load on emergency power.
5. Meet NFPA 20 requirement for equipment unit test responsibility. Name party accepting unit performance responsibility in startup test report.

3.2 IN-LINE ELECTRIC MOTOR DRIVEN PUMPS

A. Use long radius elbows on suction side of pump. Do not install horizontal elbows within ten pipe diameters of in-line pump suction flange.

3.3 FIRE PUMP FLOW TEST METER

A. Discharge to atmosphere. Do not route meter discharge to pump inlet.

B. Discharge to suction tank. Do not route meter discharge to pump inlet piping. When discharging back into a tank, locate discharge nozzle(s) or pipe at a point as far from pump suction as is necessary to prevent pump from drafting air introduced by discharge of test water into tank.

C. Locate supervised isolation valves on inlet and discharge sides of flow meter at a distance as recommended by flow test meter manufacturer.

D. Provide a distance of not less than five diameters of suction pipe for top or bottom suction connection to the fire pump suction flange. Provide a distance of not less than ten diameters of suction pipe for side connection (not recommended) to the fire pump suction flange.

E. Provide automatic air release device if flow test meter piping forms an inverted "U", trapping air.

3.4 EXTERIOR FIRE PUMP TEST HEADER

A. Locate between 18-inches and 60-inches above finished grade in a location where water discharge will not cause damage, including damage to landscaping, or rust staining of adjacent finishes.

3.5 GAUGES FOR FIRE PUMPS

A. Provide gauges at pump suction and discharge.

3.6 FIRE PUMP CIRCULATION RELIEF VALVE

A. Pipe to drain capable of handling anticipated discharge.

3.7 FIRE PUMP RELIEF VALVE

A. Pipe relief valve discharge back to suction side of pump at least 10 diameters from suction inlet as far from pump suction as is necessary to prevent pump from drafting air introduced by discharge of relief valve water into tank.

3.8 FIRE PUMP ELECTRIC MOTOR DRIVE CONTROLLERS

A. Locate within line-of-sight of fire pump(s).

B. Locate where water damage will not occur, including water escaping from pump or connections.

C. Electrical connections and wiring: Coordinate with Division 26, Electrical and Division 28, Electronic Safety and Security.

D. Where dry pipe systems are served by fire pumps, ensure timer allowing a second pump to start is set to allow dry pipe system to fill and pressure to stabilize before second pump is called to start.

E. Set Points: 'On' at static suction plus fire pump shutoff head.

F. Where an emergency generator is sized to operate a single pump which is sized to supply maximum flow requirement and multiple pumps are provided for redundancy, provide lockout programming or relays within controller to prevent start of second pump until first pump is taken off line.

G. Automatic Timer Settings: Set to operate motor a minimum of ten minutes per week.

3.9 FIRE PUMP AUTOMATIC TRANSFER SWITCHES

A. Locate with fire pump electric motor driven controllers.

B. Electrical Connections and Wiring: Coordinate with Division 26, Electrical and Division 28, Electronic Safety and Security.

3.10 FIRE JOCKEY PUMP

A. Connect to emergency generator when required by AHJ.

3.11 FIRE JOCKEY PUMP CONTROLLER

A. Set Points: 'Off' at static suction plus fire pump shutoff head plus 15 PSI. 'On' at 10 PSI below 'Off' point.

B. Electrical Connections and Wiring: Coordinate with Division 26, Electrical and Division 28, Electronic Safety and Security.

3.12 FIRE PUMP ROOM

A. Provide pump installation in a 1-hour or 2-hour dedicated room.

3.13 FIRE PUMP HOUSE

A. Provide pump installation in a separate building located at least 50-feet from protected building.

3.14 AUTOMATIC AIR RELEASE DEVICE

A. Where flow test meter piping forms an inverted "U", located at highest points of piping near each end of the inverted "U".

END OF SECTION 21 30 00

SECTION 21 41 00 - STORAGE TANKS FOR FIRE SUPPRESSION WATER

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Reinforced Concrete Suction Tank
2. Ladder
3. Water Level Indicator
4. Tank Water Level Controls
5. Water Level Transducer
6. Automatic Fill Valve
7. Manual Fill Valve
8. Stilling Well
9. Overflow Pipe
10. Tank Vent
11. Heating System
12. Personnel Access Hatch

1.2 RELATED SECTIONS

A. Contents of Division 21, Fire Suppression and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 21 00 00, Fire Suppression Basic Requirements
2. Section 21 05 00, Common Work Results for Fire Suppression
3. Section 21 13 00, Fire Suppression Sprinkler Systems
4. Section 21 30 00, Electric Fire Pumps

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, provide the following:

1. Shop Drawings: Submit shop drawings which include all information required by NFPA 22, Plans.
2. Operation and Maintenance (O&M) Manuals: Submit test reports as required by NFPA 25 and Code.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:Qualifications: Company specializing in fire water tank systems of similar type and scope with three years' experience.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 21 00 00, Fire Suppression Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Reinforced Concrete Suction Tank:

1. Custom onsite fabrication
2. Or approved equivalent.

B. Water Level Indicator:

1. Safeguard Armored Tubular Liquid Level Gauge
2. Or approved equivalent.

C. Tank Water Level Controls:

1. Waterline Controls
2. Or approved equivalent.

D. Water Level Transducer:

1. Pressure Systems Submersible Level Transducer
2. Or approved equivalent.

E. Automatic Fill Valve:

1. Bermad
2. Victualic
3. Cla-Val
4. Or approved equivalent.

F. Manual Fill Valve: Listed for use.

G. Stilling Well: Listed for use.

H. Overflow Pipe:

1. Water Bug; Model 8000.
2. Or approved equivalent.

I. Tank Vent: Listed for use.

J. Heating System: Listed for use.

K. Personnel Access Hatch: Listed for use.

2.2 GENERAL

A. Reference Specification Section 21 05 00, Common Work Results for Fire Suppression, for additional product information.

B. Tank Size:

1. Provide a tank with a net usable capacity of 100,000 US gallons.
2. Measure usable capacity between the inlet of the overflow and the level of the antivortex plate.
3. Tank net usable capacity is an estimate. Design fire water based fire protection systems within capacity limitations of the tank. Notify architect if system demand and duration of water based systems cannot be met by the net usable capacity of the tank.

2.3 REINFORCED CONCRETE SUCTION TANK

A. Provide a Complete Waterproof Tank System, Consisting of the Following:

1. Pipe Connection and Fittings
2. Antivortex Assembly
3. Water Level Controls
4. Interior Ladders
5. Overflow Drain
6. Main Drain
7. Automatic Fill Valve Assembly
8. Manual Fill Valve Assembly
9. Access Hatch
10. Vent
11. Stilling Well
12. Water Heating System
13. Other required components and accessories for a complete and working system.

B. Provide required earthen support, drainage, anti-erosion suppression and as indicated on Drawings.

C. Coordinate required site preparation, concrete foundation, anti-erosion suppression, and concrete pads for pipe fittings in base of tank.

2.4 LADDER

A. Type 316 stainless steel, OSHA approved, permanently affixed.

2.5 WATER LEVEL INDICATOR

A. Sight-glass type mounted between tubular gauge glass valves, vent and drain ports.

2.6 TANK WATER LEVEL CONTROLS

A. General:

1. Provide a water level control system including NEMA4X control panel and solid state probes for water level sensing.
2. Control system to monitor the water level in the fire tank to determine temperature and level events used to control tank fill using at least five stainless-steel sensor probes, as follows:
   a. Fill start.
   b. Fill stop.
   c. High alarm.
   d. Low alarm.
   e. Temperature.

B. Control Panel:

1. 120 VAC power.
2. Provide monitoring and control of the following functions: Fill, high alarm, low alarm and temperature.
3. Provide separate dry contacts corresponding to higl level, low level, temperature, and loss of power for monitoring by the fire alarm system.
4. LED Indicators: Power, Fill, High alarm, low alarm, low temperature, testing
5. Audible alarm with silence switch.

C. Sensors:

1. High Alarm.
2. Fill Stop.
3. Fill Start.
4. Low Alarm.
5. Low-Low Alarm.
6. Temperature.

2.7 WATER LEVEL TRANSDUCER

A. Provide a submersible, moisture-proof, hydrostatic level transducer assembly, stainless steel waterproof housing.

2.8 AUTOMATIC FILL VALVE

A. Provide a supervised automatic fill valve sized to fill the tank within at least 8 hours. Minimum 2-inch, equal to the standpipe system demand., or equal to one and one-half times the rated capacity of the fire pump.

B. Fill valve to be electronically operated, proportional flow, pilot controlled, diaphragm type. Compatible with water level control system.

2.9 MANUAL FILL VALVE

A. In addition to the automatic fill valve, provide an approved manual method to fill the tank. or a separate manual supervised OS&Y gate or butterfly fill valve.

2.10 STILLING WELL

A. Provide stilling well(s).

B. Extend to within six-inches of the bank bottom, sized at least one-inch in diameter larger than the float to ensure proper float valve operation and to facilitate valve testing.

C. Provide pipe well drains for each pipe well at least four-inches in diameter, located not more than 2-feet above the tank bottom, arranged to discharge to a safe, frost-free location.

2.11 OVERFLOW PIPE

A. Provide an overflow pipe at least one pipe size larger than the fill line and equipped with an inlet, such as a concentric reducer, or equivalent, that is at least 2-inches larger in diameter.

2.12 TANK VENT

A. Provide a vent pipe with a cross-sectional area equal to a minimum of one-half the area of the discharge pipe(s) or fill pipe, whichever is larger.

B. Provide a, removable, weather-protected corrosion-resistant screen or perforated plate with 3/8-inch holes, to exclude animals and vermin. Provide a screen net area at least equal to the vent line and having a gross area at least one and one-half times the cross-sectional area of the discharge pipe or fill pipe(s), whichever is larger.

C. Weather hood above vent screen.

D. Overflow pipe is not considered to be the vent pipe.

2.13 HEATING SYSTEM

A. Provide supervised heating system, consisting of electric boiler, piping, and accessories as indicated on drawings.

2.14 PERSONNEL ACCESS HATCH

A. Provide a round or rectangular access hatch.

B. Ductile iron, with pull ring for lifting.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per code and manufacturer's instructions and recommendations.

B. Delivery, Handling and Storage: Provide protection from weather and construction before and after installation.

C. Coordinate the work of this Section with other trades. Provide adequate space for installation.

D. Prior to acceptance, thoroughly clean interior of tank of debris and foreign material.

E. System Tests:

1. Test entire system per code, manfacturer's recommendations, NFPA 22 and AHJ. Provide, arrange, and pay for testing required by Code of AHJ in order to obtain complete and final acceptance.
2. Arrange for tests to be witnessed by Owner, Owner's insurer, Fire Marshal, Architect, AHJ, and Engineer. Notify witnesses two weeks prior to test.
3. Tests:
   a. Conduct live test of the refill rate.
   b. Confirm the normal water tank level, minus unusable portions below the antivortex plate, minimum level of fire pump column submergence, or gallonage used for domestic, rainwater, or other purposes matches the approved required gallonage for secondary firefighting water supply approved by fire plan reviewer and documented on foundation plan.
   c. Fire alarm receipt of the low and high water supervisory signals fill valve supervisory signals along with the water temperature and normal water level signals, if equipped.
   d. Live test of the capability of the overfill protection.

F. Field Services: Instruct Owner in the maintenance, filling, draining, heating, and other required functions.

3.2 REINFORCED CONCRETE SUCTION TANK

A. Reference 3.01, General Installation Requirements.

3.3 LADDER

A. Reference 3.01, General Installation Requirements.

3.4 WATER LEVEL INDICATOR

A. Mount gauge to side of tank or pond securely and in a location where it can be easily read.

3.5 TANK WATER LEVEL CONTROLS

A. Connect to fire alarm system for monitoring high and low water levels, and water temperature.

B. Water Levels: Set low and high water level alarms to activate at 3-inches off normal.

3.6 WATER LEVEL TRANSDUCER

A. Connect to fire alarm system for monitoring high and low water levels, and water temperature.

B. Water Levels: Set low and high water level alarms to activate at 3-inches off normal.

3.7 AUTOMATIC FILL VALVE

A. Pipe the fill outlets so makeup enters the perpendicular to the water surface.

B. Locate fill outlets at the side opposite from the pump suction pipe, and a minimum of 15-feet horizontally from the pump suction pipe.

C. Terminate fill outlets at a height above the bottom of the tank that will have the least effect on turbulence and aeration. Fill outlets may extend to within 12-inches of the bottom of the tank.

D. Water Levels: Set low and high water levels alarms and fill/shutoff devices to activate at 3-inches off normal.

E. Connect to and coordinate with the fire alarm system.

F. Connect to tank water level control system.

3.8 MANUAL FILL VALVE

A. Pipe the fill outlets so makeup enters the tank perpendicular to the water surface.

B. Locate fill outlets at the side opposite from the pump suction pipe, and a minimum of 15-feet horizontally from the pump suction pipe.

C. Terminate fill outlets at a height above the bottom of the tank that will have the least effect on turbulence and aeration. Fill outlets may extend to within 12-inches of the bottom of the tank.

D. Locate manual fill valve where it can be easily accessed without a ladder, or provide a permanent ladder for access. Coordinate location with Architect.

E. Locate within line of sight of tank level gauge or water level transducer readout.

F. Connect to and coordinate with the fire alarm system.

3.9 STILLING WELL

A. For testing purposes and to make it impossible to close off the pipe wells, cut four 1-1/2-inch holes in each pipe well, located not more than 1-foot above the pipe well drains.

B. Opening the drain valves will allow testing of float valves by draining water from the pipe wells faster than it can be replenished through the four 1-1/2-inch holes in the pipe wells.

3.10 OVERFLOW PIPE

A. Pitch pipe to drain.

B. Discharge to daylight, where it will not create damage, including damage to landscaping or staining of sidewalks and the like.

C. Coordinate water sensor system with fire alarm system.

3.11 TANK VENT

A. Location above maximum water level.

B. Protect screen from accumulation of dirt, sleet and the like.

C. Provide a readily removable weather hood above the screen.

3.12 HEATING SYSTEM

A. Coordinate heating system with Division 26, Electrical and Division 28, Electronic Safety and Security.

3.13 PERSONNEL ACCESS HATCH

A. Coordinate location with Architect.

END OF SECTION 21 41 00

SECTION 22 00 00 - PLUMBING BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 22 00 00, Plumbing Basic Requirements applies to Division 22, Plumbing work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of plumbing systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 22, Plumbing Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:
   a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
   b. Drawings
   c. Addenda
   d. Owner/Architect Agreement
   e. Owner/Contractor Agreement
   f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, individual Division 22, Plumbing Sections and those listed in this Section.

B. State of Washington:

1. IBC - International Building Code
2. IFC - International Fire Code
3. IMC - International Mechanical Code
4. NEC - National Electrical Code
5. UPC - Uniform Plumbing Code
6. WAC - Washington Administrative Code
7. WSEC - Washington State Energy Code

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ADA - Americans with Disabilities Act
2. AHRI - Air-Conditioning Heating & Refrigeration Institute
3. ANSI - American National Standards Institute
4. ASCE - American Society of Civil Engineers
5. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers
6. ASHRAE Guideline 0, the Commissioning Process
7. ASME - American Society of Mechanical Engineers
8. ASPE - American Society of Plumbing Engineers
9. ASSE - American Society of Sanitary Engineering
10. ASTM - ASTM International
11. AWWA - American Water Works Association
12. CFR - Code of Federal Regulations
13. CGA - Compressed Gas Association
14. CISPI - Cast Iron Soil Pipe Institute
15. ETL - Electrical Testing Laboratories
16. EPA - Environmental Protection Agency
17. FM - FM Global
18. IAPMO - International Association of Plumbing and Mechanical Officials
19. GAMA - Gas Appliance Manufacturers Association
20. HI - Hydraulic Institute Standards
21. ISO - International Organization for Standardization
22. MSS - Manufacturers Standardization Society
23. NEC - National Electric Code
24. NEMA - National Electrical Manufacturers Association
25. NFGC - National Fuel Gas Code
26. NFPA - National Fire Protection Association
27. NRCA - National Roofing Contractors Association
28. NSF - National Sanitation Foundation
29. OSHA - Occupational Safety and Health Administration
30. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.
31. TEMA - Tubular Exchanger Manufacturers Association
32. TIMA - Thermal Insulation Manufacturers Association
33. UL - Underwriters Laboratories Inc.

D. See Division 22, Plumbing individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 22, Plumbing Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. At Contractor’s option, two separate submittals may be provided, consisting of underground work and building work. Deviations will be returned without review.
3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 22, Plumbing Sections.
4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
    a. Label submittal to match numbering/references as shown in Contract Documents and schedules. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
    b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference Division 22, Plumbing Sections for specific items required in product data submittal outside of these requirements.
    c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
    d. For vibration isolation of equipment, list make and model selected with operating load and deflection. Indicate frame type where required. Submit manufacturer's product data.
    e. See Division 22, Plumbing Sections for additional submittal requirements outside of these requirements.
5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to Contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet Section 22 05 48, Vibration and Seismic Controls for Plumbing Piping and Equipment. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 22, Plumbing Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
    a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
    b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
11. Shop Drawings: Provide coordinated Shop Drawings which include physical characteristics of all systems, equipment and piping layout plans, and control wiring diagrams. Reference individual Division 22, Plumbing Sections for additional requirements for Shop Drawings outside of these requirements.
    a. Provide Shop Drawings indicating sanitary and storm cleanout locations and type to Architect for approval prior to installation.
    b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.
13. Resubmission Requirements:
    a. Make any corrections or change in submittals when required. Provide submittals as specified. The Engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
        1) Resubmit for review until review indicates no exception taken or "make corrections as noted".
        2) When submitting drawings for Engineer's re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.
14. Operation and Maintenance Manuals, Owner's Instructions:

a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Include valve charts. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
   1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
   2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
   3) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
   4) Include copy of startup and test reports specific to each piece of equipment.
   5) Include copy of final water systems balancing log along with pump operating data.
   6) Include commissioning reports.
   7) Include copy of pressure, flow, leakage and purity test data and air and water systems test data, as applicable. Include copy of third-party and state and local jurisdiction inspection reports.
   8) Include copy of valve charts/schedules.
   9) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.
   10) Include product certificates of warranties and guarantees.
   11) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 22 00 00, Plumbing Basic Requirements article titled "Demonstration."

c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:
   a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
   b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for Project.
   c. At completion of project, input changes to original project on Revit Model and make one set of black-line drawings created from Revit Model in version/release equal to contract drawings. Submit Revit Model and drawings upon substantial completion.

d. Provide Invert elevations and dimensioned locations for water services, building waste, and storm drainage piping below grade extending to 5-feet outside building line.
e. See Division 22, Plumbing individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturers equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

G. Piping Insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

H. All potable water system components, devices, material, or equipment containing a weighted average of greater than 0.25 percent lead are prohibited, and shall be certified in accordance with current editions of the Safe Drinking Water Act (SDWA), NSF 61 & NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61.

I. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.

J. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty in Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings) to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.

B. Prepare Drawings as follows:

1. Drawings in Revit Model. Revit Model release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size and elevation above finished floor of equipment and distribution systems.
2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
3. Indicate plumbing system piping including fittings, hangers, access panels, valves, and bottom of pipe elevations above finished floor.
4. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible items. Drawings also to indicate proposed ceiling grid and lighting layout as shown on electrical drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork and piping.
5. Incorporate Addenda items and change orders.
6. Distribute drawings to trades and provide additional coordination as requested by other trades.

C. Advise Architect in the event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

1.8 WORK INCLUDED

A. Furnish and install sleeves, inserts and anchorage required for the installation, which are embedded in work of other trades. Sleeve, wrap and seal piping in concrete.

B. Electrical: For plumbing trim/devices/equipment, provide, from the line voltage connection by Division 26, the low voltage electrical connections and wiring as required for complete and operable system. Includes, but is not limited to: Low voltage electrical raceway, wiring and accessories, such as step-down transformers as necessary for function of sensors and automatic valve and faucet controls. Supply step-down transformers and size wiring as recommended by manufacturer of plumbing trim/faucets requiring electrical low voltage connection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to fixtures, pumps, drains and equipment.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or ETL listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of Washington, and Federal regulations relating to hazardous materials.
2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Install equipment requiring access (i.e., drain pans, drains, control operators, valves, motors, cleanouts and water heaters) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
   a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with the provisions of related earthwork Sections/divisions. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
   b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
   c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:
   a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.
2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:

1. Provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, Section 22 05 48, Vibration and Seismic Controls for Plumbing Piping and Equipment, and individual Division 22 Plumbing Sections.

B. Piping:

1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.

C. Provide means to prohibit excessive motion of plumbing equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground piping installation prior to backfilling.
2. Prior to covering walls.
3. Prior to ceiling cover/installation.
4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Bear responsibility and cost to make piping accessible, to expose concealed lines, or to demonstrate acceptability of the system. If Contractor fails to notify Architect at times prescribed above, costs incurred by removal of such work are the responsibility of the Contractor.

D. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Plumbing Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the plumbing systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftspeople of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing piping and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.5 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.6 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
3. Protect bright finished shafts, bearing housings and similar items until in service.

3.7 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.8 CLEANING

A. Confirm cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.9 INSTALLATION

A. Confirm installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

1. Do not place equipment in sustained operation prior to initial balancing of plumbing systems.
2. Provide pump impellers to obtain Basis of Design design capacities.

D. Provide miscellaneous supports/metals required for installation of equipment and piping.

3.10 PAINTING

A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 22, Plumbing Sections and the following:

1. Ferrous Metal: After completion of plumbing work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt for exterior or black enamel for interior, suitable for hot surfaces.
2. In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
3. See individual equipment Specifications for other painting.
4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
5. Piping: Clean, primer coat and paint exposed piping on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.11 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Sections in Division 22, Plumbing and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
   a. Testing and Balancing Reports
   b. Cleaning
   c. Operation and Maintenance Manuals

d. Training of Operating Personnel
e. Record Drawings
f. Warranty and Guaranty Certificates
g. Start-up/Test Document and Commissioning Reports

3.12 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 22 00 00, Plumbing Basic Requirements and individual Division 22, Plumbing Sections.

B. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.13 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that plumbing items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.14 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize plumbing equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

END OF SECTION 22 00 00

SECTION 22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Flexible Pipe Connectors, Copper Piping
2. Flexible Expansion Loop (for Thermal and Seismic Applications), Copper Piping
3. Expansion Joints, Two-Ply Bellows Type Copper Pipe

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements. Include items listed below.

B. In addition, provide:

1. Shop drawings for review and approval by Engineer. Illustrate Design Data and Expansion Joints items below on the Shop Drawing Submittal.
2. Design Data: Indicate selection calculations.
3. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
4. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.
5. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   a. Extra Packing for Packed Expansion Joints: One set for each joint.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Flexible Pipe Connectors, Copper Piping:

1. Mercer Rubber Company
2. Metraflex Company
3. Mason
4. Hyspan
5. Or approved equivalent.

B. Flexible Expansion Loop (for Thermal and Seismic Applications), Copper Piping:

1. Mercer Rubber Company
2. Metraflex Company
3. Mason
4. Hyspan
5. Or approved equivalent.

C. Expansion Joints, Two-Ply Bellows Type Copper Pipe:

1. Mercer Rubber Company
2. Metraflex Company
3. Mason
4. Hyspan
5. Or approved equivalent.

2.2 FLEXIBLE PIPE CONNECTORS, COPPER PIPING

A. Inner Hose: Bronze, close pitch, annular corrugated hose.

B. Exterior Sleeve: Braided bronze (piping over 2-inches to be 3-pound braided stainless steel).

C. Pressure Rating: 125 PSI at 70 degrees F with a 4 to 1 safety factor.

D. Joint: Sweat ends.

E. Size: Use pipe sized units.

F. Maximum offset: 3/8-inch on each side of installed center line.

G. Basis of Design: Metraflex Model BBS.

2.3 FLEXIBLE EXPANSION LOOP (FOR THERMAL AND SEISMIC APPLICATIONS), COPPER PIPING

A. Construction: Two flexible sections of hose and braid, two 90 degree elbows and a 180 degree return designed so piping does not change direction, but maintains course along a single axis. Use Vee Loop where space is limited. System to import no thrust loads to system support anchors or building structure.

B. Inner Hose: Bronze, close pitch, annular corrugated hose.

C. Exterior Sleeve: Braided bronze.

D. Pressure Rating: 125 PSI at 70 degrees F with a 4 to 1 safety factor.

E. Joint: Sweat ends.

F. Size: Use pipe sized units.

G. Support: Center support at bottom of 180 degree return.

H. Basis of Design: Metraflex Metraloop. Vee configuration Mason-Mercer VCPSB.

2.4 EXPANSION JOINTS, TWO-PLY BELLOWS TYPE COPPER PIPE

A. Construction: Laminated bellows ASTM A240 Type 321 stainless steel, copper tube ASTM B88, ASTM A240 Type 321 stainless steel housing and guide, anti-torque device, limit stops, internal guides

B. Working Pressure: 200 PSI.

C. Maximum Temperatures: 500 degrees F.

D. Maximum Compression: 2-inches.

E. Maximum Extension: 1/2-inch.

F. Joint: Sweat ends. ASME B16.22.

G. Size: Use pipe sized units. Maximum 4-inch pipe.

H. Basis of Design: Hyspan Model 8509, 8510.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Expansion/Contraction Fitting Installation:

1. Install expansion/contraction fittings according to manufacturer's written instructions.
2. Install expansion/contraction fittings in sizes matching pipe size in which they are installed.
3. Align expansion/contraction fittings to avoid end-loading and torsional stress.
4. Install in accordance with EJMA (Expansion Joint Manufacturer's Association) Standards.
5. Wood structures: install expansion/contraction fittings and guides at every floor.
6. Concrete structures: install expansion/contraction fittings and guides at interval spacing recommended by the manufacturers.

B. Pipe Bend and Loop Installation:

1. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
2. Attach pipe bends and loops to anchors.

a. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code Section IX, "Welding and Brazing Qualifications."
b. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.

C. Swing Connections:

1. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
2. Connect mains, risers and branch connections to equipment with at least four pipe fittings, including tee in riser.

D. Guide Installation:

1. Install guides on piping adjoining expansion fittings and loops.
2. Attach guides to pipe and secure to building structure.

E. Anchor Installation:

1. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
2. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
3. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
4. Install pipe anchors according to expansion fitting manufacturer's written instructions if expansion fittings are indicated.
5. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

F. Painting:

1. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA1 requirements for touching up field-painted surfaces.
   a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
2. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.2 FLEXIBLE PIPE CONNECTORS, COPPER PIPING

A. See General Installation Requirements above.

B. Install per manufacturer's written recommendations and requirements.

3.3 FLEXIBLE EXPANSION LOOP (FOR THERMAL AND SEISMIC APPLICATIONS), COPPER PIPING

A. See General Installation Requirements above.

B. Install per manufacturer's written recommendations and requirements.

3.4 EXPANSION JOINTS, TWO-PLY BELLOWS TYPE COPPER PIPE

A. See General Installation Requirements above.

B. Install per manufacturer's written recommendations and requirements.

END OF SECTION 22 05 16

22 05 17 – SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular pipe sleave sealing systems for pipe penetrating the treatment building concrete slab.

B. Related Requirements

1. Section 22 11 13 “Facility Water Distribution Piping (Water Supply).”
2. Section 33 11 00 “Water Utility Distribution Piping (Water Supply).”

1.2 REFERENCES

A. National Sanitation Foundation (NSF International):

1. NSF 61 - Drinking Water System Components – Health Effects

1.3 SUBMITTALS

A. See Section 01 33 00 “Submittal Procedures” for submittal requirements.

B. Section 01 77 00 “Closeout Procedures.”

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years of experience.

B. Installer: Company specializing in performing work of this section with minimum three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 60 00 “Product Requirements” for requirements for transporting, handling, storing, and protecting products.

B. Accept products on site in shipping containers with labeling in place. Inspect for damage.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.6 ENVIRONMENTAL REQUIREMENTS

A. See Section 01 60 00 “Product Requirements” for environmental conditions affecting products on site.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in adjacent areas.

1.7 MAINTENANCE MATERIALS

A. Section 01 78 23 “Operation and Maintenance Data.”

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All materials coming into contact with potable water shall be NSF 61 certified.

2.2 MODULAR PIPE SLEEVE SEALING SYSTEMS

A. System shall provide hydrostatic seal.

B. Seals shall be modular consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and penetration opening.

C. Pressure plates shall be reinforced nylon polymer.

D. Manufacturer:

1. Garlock Link Seal
2. Engineer approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

3.2 INSTALLATION

A. Core drill wall/floor before installation.

B. Install per manufacturer recommendations.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements.”

END OF SECTION 22 05 17

SECTION 22 05 19 - PLUMBING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Pressure Gauges
2. Thermometers
3. Water Hammer Arrestors (Shock Absorbers)
4. Trap Primers

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Pressure Gauges:

1. Dwyer Instruments, Inc.
2. Moeller Instrument Co., Inc.
3. Omega Engineering, Inc.
4. Trerice
5. Or approved equivalent.

B. Thermometers:

1. Ashcroft
2. Trerice

3. Weiss
4. Marshaltown
5. Weksler
6. Or approved equivalent.

C. Water Hammer Arrestors (Shock Absorbers):

1. Bellows Type:
   a. Amtrol
   b. J.R. Smith
   c. MIFAB
   d. Wade
   e. Zurn
   f. Or approved equivalent.
2. Piston Type:
   a. MIFAB
   b. PPP
   c. Sioux Chief
   d. Or approved equivalent.

D. Trap Primers:

1. J.R. Smith
2. MIFAB
3. PPP
4. Wade
5. Zurn
6. Or approved equivalent.

2.2 PRESSURE GAUGES

A. Pressure Gauges: ASME B40.100, phosphor-bronze bourdon type, dry type.

1. Case: Cast aluminum, stem-mounted, flange less.
2. Size: 4-1/2-inch diameter.
3. Window: Clear glass.
4. Connector: Brass.
5. Scale: White aluminum with black graduation and markings.
6. Pointer: Black, adjustable.
7. Mid-Scale Accuracy: One percent.
8. Scale: PSI and KPa.
9. Basis of Design: Trerice Model 600CB.

2.3 THERMOMETERS

A. Thermometers - Adjustable Angle: Red or blue appearing organic liquid in glass, ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9-inch scale.
2. Window: Acrylic.
3. Scale: Aluminum, white background, black graduations and markings.
4. Stem: 3/4-inch NPT brass (aluminum for installation in air ducts).

5. Accuracy: 2 percent, per ASTM E 77.
6. Calibration: 0-160 with 2 Degrees F graduations.
7. Basis of Design: Trerice BX9.

2.4 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

A. Bellows-type, stainless steel casing and bellows, pressure rated, tested and certified in accordance with PDI WH-201 or ASSE 1010.

B. Piston-type, copper, brass or stainless steel with O-ring piston, pressure rated, tested and certified in accordance with PDI WH-201 or ASSE 1010.

2.5 TRAP PRIMERS

A. Automatic trap primer assemblies meeting governing code requirements. Provide with air-gap fittings as required.

B. Electronic trap seal automatic primer valve with integral anti siphon protection and timer. Coordinate quantity, locations, and voltage characteristics or control points.

C. Trap seal primer valve (low lead) with integral automatic anti-siphon protection. The priming valve to discharge on both pressure drop and pressure spike. PPP CPO 500.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. For plumbing devices requiring access from access panels (i.e. trap primers, water hammer arrestors and the like) submit location/size of all access panels to Architect for approval prior to purchase and installation of access panel. See Section 22 00 00, Plumbing Basic Requirements for additional requirements.

B. Provide instruments with scale ranges selected according to service with largest appropriate scale.

C. Install per manufacturer recommendations.

3.2 PRESSURE GAUGES

A. Install pressure gauge where exposure to heat and vibration are minimal and where the dial can be easily read. It is also important to install the gauge in a location with undisturbed and continuous flow of the pressure medium.

B. Provide a needle valve or gauge cock, installed between the process and the pressure gauges.

C. Install pressure gauges in piping tee with pressure gauge cock, in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Locations: Install in the following locations, and elsewhere as indicated.

1. At each pump inlet and outlet.
2. At inlet and discharge of each pressure reducing valve.
3. At make-up water service outlets.
4. At inlets and outlets of all master mixing valves.

E. Adjust gauges to final angle, clean windows and lenses, and calibrate to zero.

F. Install per manufacturer recommendations.

G. Pressure Gauge Range/Graduations:

1. Cold Water: 0-100 PSI; graduation 1 PSI.
2. Hot Water: 0-100 PSI; graduation 1 PSI.

3.3 THERMOMETERS

A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2-inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

B. Install thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

C. Adjust thermometers to final angle, clean windows and lenses, and calibrate to zero.

D. Install per manufacturer recommendations.

E. Thermometer Range/Graduations:

1. Cold Water: 25-125 degrees F; graduation 1 degree F.
2. Hot Water: 30-240 degrees F; graduation 2 degrees F.

3.4 WATER HAMMER ARRESTORS (SHOCK ABSORBERS)

A. Install in upright position, in locations and of sizes in accordance with PDI WH-201 or ASSE 1010, and elsewhere as indicated.

B. Locate shock absorbers in supply pipe in accordance with recommendations of Plumbing and Drainage Institute PDI-WH201 or ASSE 1010. Install ahead of solenoid operated valves. Determine size of absorber by fixture unit value of fixture supplied, using PDI symbols to designate sizes. Provide access panel for each shock absorber.

C. Install per manufacturer recommendations.

3.5 TRAP PRIMERS

A. Flush supply line prior to installation.

B. Install valve plumb using caution to not over-tighten.

C. Effective operating range 20 to 80 PSIG (138 to 552 kPa).

D. Do not subject trap primer valve to pressure in excess of 125 PSI.

E. Install trap primer per manufacturer's instructions. Install primer outlets a minimum of 12-inches above finished floor. For installations with primer lines in excess of 20 feet in length, the primer assembly should be raised 12-inches for each additional 20 feet of length. Maximum 80 feet primer length unless specifically approved by design engineer.

F. Install primers at locations as indicated on Drawings. Extend primer lines to all trapped drains that are tied to sanitary.

G. Provide the number of primer assemblies required at each primer "location" to feed the number of primer lines at that location.

H. For electronic primers assemblies, coordinate required electrical connections with Division 26; coordinate required Building Automation System (BAS) with Division 23 "Controls."

END OF SECTION 22 05 19

22 05 19.2 – METERS AND GAUGES FOR PLUMBING PIPING (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following items installed inside the treatment building:

1. Pressure gauges
2. Pulse meters
3. Flow rate indicator

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME):

1. ASME B40.100 – Pressure Gauges and Gauge Attachments

B. National Sanitation Foundation (NSF International):

1. NSF 61 - Drinking Water System Components – Health Effects

1.3 SUBMITTALS

A. See Section 01 33 00 “Submittal Procedures” for submittal requirements.

B. Section 01 77 00 “Closeout Procedures.”

C. Project Record Documents: Record actual locations of gauges and meters.

D. Provide Operation and Maintenance Data for gauges and meters; include illustrations, installation instructions, maintenance instructions and parts lists.

E. Product Data: Submit manufacturer’s catalog information with gauge and meter data and ratings for each service.

F. Manufacturer’s Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves and accessories provided meet or exceed ASME standards and specification requirements

1.4 QUALITY ASSURANCE

A. Perform work in accordance with the project plans, AWWA, ASME, State, and County standards.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing work of this section with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 60 00 “Product Requirements” for requirements for transporting, handling, storing, and protecting products.

B. Accept products on site in shipping containers with labeling in place. Inspect for damage.

C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.7 ENVIRONMENTAL REQUIREMENTS

A. See Section 01 60 00 “Product Requirements” for environmental conditions affecting products on site.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in adjacent areas.

1.8 MAINTENANCE MATERIALS

A. Section 01 78 23 “Operation and Maintenance Data.”

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All materials coming into contact with potable water shall be NSF 61 certified.

2.2 PRESSURE GAUGES

A. Analog dial-type pressure gauge meeting or exceeding requirements of ASME B40.100.

B. Glycerin liquid-filled gauge.

C. Gauge Size: 2” or 2-1/2” diameter, 1/4" NPT connection.

D. Pressure range: as indicated on Plans.

E. Provide pressure gauge with 1/4" isolation ball valve.

2.3 PULSE METERS

A. Pulse meters shall be new and complete, front proof units conforming in all details to AWWA C700 for cold water displacement type meters or AWWA C708 for cold water multi-jet type meters.

B. Pulse meters shall have a pulsed output signal that is proportional to volume of water passing through meter.

C. Meters shall meet the following requirements:

1. Pulsed output: 1 gallon/pulse
2. Rate operating pressure: 150 psi
3. Accuracy: ±1.5% of reading
4. Minimum flowrate: 0.75 gpm (max.)
5. Maximum flowrate: 50 gpm (min.)

D. Manufacturers:

1. Seametrics MJNR-100-1G
2. Engineer approved equal

2.4 FLOW RATE INDICATOR

A. Flow rate indicator will accept pulse signal from pulse meter and display instantaneous flow rate and total flow.

B. Flow rate indicator shall meet the following requirements:

1. Accept pulsed signal from pulse meter
2. Display instantaneous flow rate (gallons per minute) and total flow (gallons)
3. Wall mount installation

C. Manufacturers:

1. Seametrics FT430
2. Engineer approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

B. Verify piping system is ready for meter and gauge installation.

3.2 INSTALLATION

A. Install meters so that manufacturer upstream and downstream straight pipe requirements are met.

B. Install flow rate indicator mounted on wall as shown in the Plans. Provide wiring from pulse meter. Provide power.

C. Install products with clearance for installation of insulation and allowing access.

3.3 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfection system in accordance with Section 33 13 00 “Disinfecting Water Utility Distribution Piping (Water Supply).”

3.4 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements” and Section 01 79 00 “Demonstration and Training.”

B. Perform pressure test on site water distribution system in accordance with Section 33 11 00 “Water Utility Distribution Piping (Water Supply).”

END OF SECTION 22 05 19

SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Valves, General
2. Balancing Valves
3. Ball Valves
4. Swing Check Valves
5. Backflow Prevention Assemblies
6. Pressure Regulating Valve - Domestic Water
7. Thermostatic Master Mixing Valves (ASSE 1017 Rated)
8. Thermostatic Point-of-Use Mixing Valves (ASSE 1070 Rated)

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NSF 61, Annex G and/or NSF/ANSI 372 for potable water services. Valves must be 3rd-party certified.
2. ISO 9001 Certified.
3. IAPMO Certified for Low Lead.

C. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

D. Model numbers indicated as Basis-of-Design indicate valve characteristics. All valves are to meet code Low Lead/Lead Free Standards.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

B. Valves, General:

1. Apollo
2. Armstrong
3. ASCO
4. Caleffi
5. Cla-Val
6. Conbraco
7. Crane
8. Clow
9. Griswold
10. Hammond
11. Hays
12. Jenkins
13. Josam
14. Kennedy
15. Milwaukee
16. Mueller
17. Nibco
18. Red-White Valve
19. Smith
20. Stockham
21. Tour Anderson
22. Wade
23. Watts
24. Wilkins
25. Zurn
26. Or approved equivalent.

C. Balancing Valves:

1. Caleffi
2. Griswold
3. Hays
4. Armstrong CBV
5. Tour Anderson
6. Or approved equivalent.

D. Ball Valves:

1. See Valves, General above.
2. NSF Valves:
    a. Clow
    b. Kennedy
    c. Nibco
    d. Or approved equivalent.

E. Swing Check Valves:

1. See Valves, General above.

F. Backflow Prevention Assemblies:

1. Backflow Preventers:
   a. Apollo
   b. Cla-Val
   c. Conbraco
   d. Watts
   e. Or approved equivalent.
2. Backflow Prevention Assemblies - Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications - 2-inches and Smaller:
   a. Febco 860-with 650A.
   b. Conbraco 40-210-AGD.
   c. Wilkins 375-XL-SAG.
   d. Watts 919-QT-S valve with 919AGC or 919AGF.
   e. Or approved equivalent.
3. Backflow Prevention Assemblies - Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications - 2-1/2-inches and Larger:
   a. Febco 860 with 758A.
   b. Conbraco Apollo 40-700 with 758A.
   c. Watts 909-S-NFA-NRS with AGC.
   d. Wilkins 375-FSC.
   e. Or approved equivalent.
4. Backflow Prevention Assemblies - Double Check Valve Assembly (DCVA) for Low Hazard Applications - 2-inches and Smaller:
   a. Febco 850-650A
   b. Conbraco Apollo 40-110-T2
   c. Watts 007-QT-FDA-S
   d. Wilkins 350-S-XL
   e. Or approved equivalent.
5. Backflow Prevention Assemblies - Double Check Valve Assembly (DCVA) for Low Hazard Applications - 2-1/2-inches and Larger:
   a. Conbraco Apollo 45-11-1
   b. Watts LF-709 with 77F-01-FDA-12
   c. Or approved equivalent.
6. Spill Resistant Pressure Vacuum Breaker:
   a. Febco
   b. Conbraco
   c. Watts
   d. Wilkins
   e. Or approved equivalent.
7. Atmospheric Vacuum Breakers:
   a. Febco
   b. Conbraco
   c. Watts
   d. Wilkins
   e. Or approved equivalent.

G. Pressure Regulating Valve-Domestic Water:

1. Cash Acme

2. Cla-Val
3. Watts
4. Wilkins
5. Or approved equivalent.

H. Thermostatic Master Mixing Valves (ASSE 1017 Rated):

1. Caleffi
2. Holby Tempering Valve
3. Lawler Series 66
4. Leonard Type TM
5. Powers LFMM430 (Lead Free)
6. Symmons Temp Control Series 5
7. Or approved equivalent.

I. Thermostatic Point-of-Use Mixing Valves (ASSE 1070 Rated):

1. Caleffi
2. Lawler
3. Leonard
4. Powers Hydroguard
5. Or approved equivalent.

2.2 VALVES - GENERAL

A. General:

1. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
2. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6-inches and smaller. Provide gear operators for quarter-turn valves 8-inches and larger and plug valves installed over 5-feet above finished floor.
3. Valve Identification: Manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

B. Valves in Insulated Piping: With 2-inch stem extension and following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation on valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.

C. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With thread according to ASME B1.20.1.

D. Valve Bypass and Drain Connections: MSS SP-45.

E. Building Service:

1. Shutoff and Isolation Valves:
   a. Pipe Sizes 3-inches and Smaller: Ball Valve.
2. Drain Service: Ball Valves.

3. Strainer Blow-Off: Ball Valve.
4. Check Valves: Swing.

2.3 BALANCING VALVES

A. Maximum 125 PSIG System Working Water Pressure.

B. Manual Set Balancing Valves:

1. Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
   a. Precise flow measurement.
   b. Precision flow balancing.
   c. Positive drip-tight shut-off.
2. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves have a minimum of five full 360 degree handwheel turns. 90 degree circuit-setter style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valves to be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi to have two 1/4-inch threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. Valves to be furnished with flow smoothing fins downstream of the valve seat and integral to the forged valve body to make the flow more laminar. The valve body, stem and plug to be brass. The handwheel to be high-strength resin.
3. 2-1/2-inch and Larger: Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
   a. Precise flow measurement.
   b. Precision flow balancing.
   c. Positive drip-tight shut off. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators location on the valve handwheel. Valves to have a minimum of five full 360 degree handwheel turns. 90 degree circuit-setter style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valve body to be either cast iron with integrated cast iron flanges (2-1/2-inch to 12-inch) or ductile iron with industrial standard grooved ends (2-1/2-inch to 12-inch). Valve stem and plug disc to be bronze with handwheel that permits multi-turn adjustments. Sizes 2-1/2-inch and 3-inch: five turns; sizes 4-inch to 6-inch: 6 turns; sizes 8-inch to 10-inch: 12 turns; and size 12-inch: 14 turns. Flange adapters to be provided to prevent rotation.

2.4 BALL VALVES

A. All ball valves on brazed piping are to be three-piece.

B. 2-1/2 Inches and Smaller: MSS SP-110, 400-600 PSI, two-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 77CLF 100 Series two-piece.

C. 3 Inches and Larger: MSS SP-110, 400-600 PSI, three-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 82-100/82A 140 Series three-piece.

D. Full Port Ball Valve: 2- to 4-inch ductile iron, ASTM A536, micro finish steel chrome plated or stainless steel ball and stem. TFE seats, 600 PSI.

2.5 SWING CHECK VALVES

A. 2-inches and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc. Nibco 413. MSS SP-80.

B. 2-1/2-inches and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Nibco F918. MMS SP-71.

C. Rubber Flapper Check Valve: Horizontal or vertical upward flow installation. Working pressure to 175 PSI. Ductile iron or cast iron body. Steel reinforced Buna-N rubber flapper epoxy coating on wetted parts. MSS SP-80.

D. Gruvlok Series 7800 Check Valve: Horizontal installation. Working pressure to 300 PSI, Type 304/302 Stainless Steel conforming to ASTM 167. Ductile body, ASTM A536, and stainless clapper, EPDM, nitrile or optional viton bumper and bonnet seals. Stainless wetted parts.

2.6 BACKFLOW PREVENTION ASSEMBLIES

A. General: Assemblies model numbers listed below are for general comparison. Project specific model numbers to be verified contractor as approved by jurisdiction where project is located.

B. Reduced Pressure Zone Backflow Preventer (RPBP) for High Hazard Applications:

1. 2-inches and Smaller: Assembly consists of shutoff ball valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and pressure-differential relief valve located between two positive seating check valves and comply with requirements of ASSE Standard 1013 and AWWA C511. Bronze construction, threaded ends, stainless steel internal parts, FDA strainer, and air gap fitting. Route pipe from air gap fitting to approved waste receptor.
2. 2-1/2-inches and Larger: Assembly consists of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and pressure-differential relief valve located between two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C511. Epoxy coated cast iron body construction, flanged ends, stainless steel internal parts, bronze seats, and FDA strainer.

C. Double Check Valve Assembly (DCVA) for Low Hazard Applications:

1. 2-inches and Smaller: Assembly consists of shutoff ball valves in inlet and outlet, and FDS strainer on inlet. Assemblies include test cocks and two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C510. Bronze construction, threaded ends, and stainless steel internal parts.
2. 2-1/2-inches and Larger: Assembly consists of shutoff OS&Y gate valves in inlet and outlet, and strainer on inlet. Assemblies include test cocks and two positive seating check valves and comply with requirements of ASSE Standard 1015 and AWWA C510. Epoxy coat cast iron body construction, strainer flanged ends, and stainless steel internal parts.

D. Spill Resistant Pressure Vacuum Breaker: Watts Model 800MCQT with 777S "Y" strainer.

E. Atmospheric Vacuum Breaker: Assembly consists of a bronze vacuum breaker body with silicone disc, and full size orifice. Device to be IAPMO listed, meet ASSE standard 1001, and ANSI standard A113.1.1 rough chrome plate finish.

2.7 PRESSURE REGULATING VALVE - DOMESTIC WATER

A. Water: Bronze body, diaphragm or piston type, spring actuated, with separate or integral stainless steel strainer, pressure range to suit conditions, approved for potable water use, low lead. Provide shutoff valves, pressure relief valves, unions, drain valve and bypass.

B. Water: Automatic control pressure regulating valve, stainless steel seat, stem and spring, diaphragm actuated with brass body, hydraulic control pilots with effluent operating temperature range 32 degrees F to 180 degrees F, FDA and AWWA approved.

C. Water: Bronze body construction, stainless steel strainer screen, thermal expansion bypass with renewable stainless steel seat and high temperature resisting diaphragm.

2.8 THERMOSTATIC MASTER MIXING VALVES (ASSE 1017 RATED)

A. Thermostatic type with bronze body construction, corrosion resistant materials, union end stops, check inlets with strainers, 0-200 degree F dial thermometer and discharge shut-off valve. Mixing valves to meet ASSE 1017.

B. Maximum required delta temperature differential between hot water supply temperature and delivery temperature is 15 degrees F. Set valve outlet temperature per drawing requirements.

C. Flow from the tempered water circulating pump to be split to mixing valve and building hot water heating system.

2.9 THERMOSTATIC POINT-OF-USE MIXING VALVES (ASSE 1070 RATED)

A. Thermostatic type with bronze body construction, corrosion resistant materials, union end stops, check inlets with strainers, 0-200 degree F dial thermometer and discharge shut-off valve. Mixing valves to meet ASSE 1070.

B. Maximum required delta temperature differential between hot water supply temperature and delivery temperature is 15 degrees F. Set valve outlet temperature per drawing requirements.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.
4. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Inspect the shipping container before unpacking to look for damage that could have occurred during transport, and report it to the transportation company immediately. After visual inspection, remove the valve from the shipping container. Make sure the faces are free of any scratches and that there is not any obvious damage to the actuator assembly or valve body.

D. Make sure to note the valve's model number during the unpacking process. The model number will need to be provided when purchasing replacement parts.

E. Purge and clean all piping to be connected to valve.

F. Install per manufacturer's recommendations.

G. Determine that the valve and its plumbing piping is adequately supported when installed. If a valve is not adequately supported, this could prevent the valve from operating and sealing correctly. Be sure that all mating flanges are in line and parallel to minimize straining on joints and valve body.

H. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

I. Do not attempt to repair defective valves; replace with new valves.

J. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

K. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose end adapter and cap on chain for each valve that must be installed with stem below horizontal plane. Ensure installation provides full stem movement.

L. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

M. Mechanical Actuators: Install with chain operators where indicated. Extend chains to 5-feet above floor and hook to clips to clear aisle passage.

N. Stem Selection: Outside screw and yoke stems, except provide inside screw, non-rising stem where space prevents full opening of OS&Y valves.

O. Seats: Renewable seats, except where otherwise indicated.

P. When soldering, use paste flux that are approved by the manufacturer for use with lead free alloys.

Q. If valve applications are not indicated on Drawings, use the following:

1. Shutoff Service: Ball valves.

R. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

S. Valves, except wafer/butterfly types, with the following end connections:

1. For Copper Tubing, 2-inches and Smaller: Threaded ends except where solder-joint valve-end.
2. For Copper Tubing, 2-1/2-inches to NPS 4-inches: Flanged ends except where threaded valve-end.
3. For Copper Tubing: 5-inches and Larger: Flanged ends.
4. For Steel Piping, 2-inches and Smaller: Threaded ends.
5. For Steel Piping, 2-1/2-inches to NPS 4-inches: Flanged ends except where threaded valve-end.
6. For Steel Piping, 5-inches and Larger: Flanged ends.

T. Valve Adjusting and Cleaning:

1. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
2. Valve Identification. Tag valves per Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.2 BALANCING VALVES INSTALLATION

A. See General Installation Requirements above.

B. Install with flow in the direction of the arrow on the valve body and installed at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the balancing valve should be free of any fittings. When installed, easy and unobstructed access to the valve handwheel and metering ports for adjustment and measurement are to be provided. Mounting of valve in piping must prevent sediment build-up in metering ports.

3.3 BALL VALVES INSTALLATION

A. See General Installation Requirements above.

3.4 SWING CHECK VALVES INSTALLATION

A. See General Installation Requirements above.

B. Swing Check Valve Installation: Install in horizontal position with hinge pin horizontally perpendicular to centerline of pipe. Install for proper direction of flow. Only install where there are 10 pipe diameters of straight pipe upstream of valve.

C. Ejector and Sump Pump-Discharge Check Valves:

1. 2-inches and Smaller: Bronze swing or spring-loaded lift check valves with bronze disc.
2. 2-1/2-inches and Larger: Rubber flapper swing check valves with lever and weight.

D. Domestic Water and Circulation Pump Discharge Check Valves:

1. 2-inches and Smaller: Bronze body, spring loaded, lead free, lift check.
2. 2-1/2-inches and Larger: Wafer style, silent lift check valve, lead free.

3.5 BACKFLOW PREVENTION ASSEMBLIES INSTALLATION

A. See General Installation Requirements above.

B. Install where indicated, and where required by code. Where practical, locate in same room as equipment being protected.

C. Submit product cut sheets to local AHJ for approval prior to purchase and installation.

D. Install as close to wall as possible with clearances for access and maintenance as required by AHJ.

E. Coordinate exact location of installation and type of backflow device serving a particular piece of equipment with AHJ and Architect prior to purchase and installation.

F. Provide wall/floor brackets that are of fully welded, hot dipped galvanized construction, fabricated to meet field conditions. Mount backflow preventer to brackets using cadmium plated "U" type bolts and nuts.

G. Contact local water district/backflow specialist and request backflow installation requirements. Install backflow devices per UPC and local water district/backflow specialist requirements.

H. Route waste piping from air gap waste fitting concealed within walls to point of air gap termination at indirect waste receptor.

I. Follow local codes for installation requirements. Pipe lines should be thoroughly flushed to remove foreign material before installing the unit. Provide a strainer ahead of backflow preventer to prevent disc from unnecessary fouling. Install valve in line with arrow on valve body pointing in the direction of flow. It is important that the valve be easily accessible to facilitate testing and servicing. Do not install in a concealed location.

3.6 PRESSURE REGULATING VALVE - DOMESTIC WATER INSTALLATION

A. See General Installation Requirements above.

B. Install valve in the line with arrow on valve body pointing in the direction of flow. This valve should be installed where it is accessible with sufficient clearance for cleaning, service or adjustment. Install the reducing valve before a sill cock line if possible. Before installing the reducing valve hose bibb, flush out the line to remove loose dirt and scale which might damage valve disc and seat.

C. Horizontal installation is recommended. However, valve can be installed in a vertical position. Regulator must be installed in an accessible location to facilitate servicing the regulator.

D. To readjust reduced pressures, loosen adjusting screw nut and turn adjusting screw clockwise to raise reduced pressure and counterclockwise to lower reduced pressure.

E. When reducing valve is used, it makes a closed system; therefore, pressure relief protection must be provided on the downstream side of the reducing valve to protect equipment.

F. Provide pressure relief valve and terminate discharge to indirect waste receiver.

G. Anytime a reducing valve is adjusted, the use of a pressure gauge is recommended to verify correct pressure setting. Do not bottom out adjusting screw or spring cage.

H. Provide inlet and outlet ball valves, and globe valve bypass. Provide pressure gauge on valve outlet.

I. Provide pressure relief valve piped full size to indirect waste receiver or floor drain.

J. Provide factory startup on automatic control valves.

3.7 THERMOSTATIC MASTER MIXING VALVES (ASSE 1017 RATED) INSTALLATION

A. See General Installation Requirements above.

B. Install mixing valve per manufacturer's instruction manual.

3.8 THERMOSTATIC POINT-OF-USE MIXING VALVES (ASSE 1070 RATED) INSTALLATION

A. See General Installation Requirements above.

B. Install mixing valve per manufacturer's instruction manual.

END OF SECTION 22 05 23

22 05 23.2 – GENERAL DUTY VALVES FOR PLUMBING PIPING (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Valves and other appurtenances inside the treatment building, including:
   a. PVC true union ball valves
   b. PVC true union ball check valves
   c. Isolation ball valves
   d. Flow control solenoid valve
   e. Air release valves
   f. Pressure relief valves
   g. Sample taps
   h. Couplers

B. Related Requirements:

1. Section 33 09 10 "Instrumentation and Control for Water Utilities (Water Supply)" for control of flow control solenoid valve.
2. Section 33 00 00 “Pipe and Pipe Fittings: General Statement (Water Supply).”
3. Section 33 13 00 “Disinfecting Water Utility Distribution Piping (Water Supply).”

1.2 REFERENCES

A. ASTM International:

1. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
2. ASTM D4101 – Standard Specification for Propylene Injection and Extrusion Materials.

B. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 110 – Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

C. National Sanitation Foundation (NSF International):

1. NSF 61 - Drinking Water System Components – Health Effects

1.3 SUBMITTALS

A. See Section 01 33 00 “Submittal Procedures” for submittal requirements.

B. Section 01 77 00 “Closeout Procedures.”

C. Project Record Documents: Record actual locations of valves.

D. Provide Operation and Maintenance Data for valves; include illustrations, installation instructions, maintenance instructions and parts lists. Indicate which valves should be opened and closed for treatment operations, treatment bypass, and filter to waste.

E. Product Data: Submit manufacturer's catalog information with valve data and ratings for each service.

F. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

G. Manufacturer's Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves and accessories provided meet or exceed AWWA Standards and specification requirements.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with the project plans, AWWA, State, and County standards.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing work of this section with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 60 00 "Product Requirements" for requirements for transporting, handling, storing, and protecting products.

B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.7 ENVIRONMENTAL REQUIREMENTS

A. See Section 01 60 00 "Product Requirements" for environmental conditions affecting products on site.

B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in adjacent areas.

1.8 MAINTENANCE MATERIALS

A. Section 01 78 23 "Operation and Maintenance Data."

B. Furnish packing kits for each size valve (as applicable) to owner.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All materials coming into contact with potable water shall be NSF 61 certified.

2.2 PVC True Union Ball Valves

A. Meet the following requirements
1. Meet requirements of ASTM D 1784
2. Schedule 80 PVC
3. Full-port
4. Pressure rating: 235 psi at 73 °F (1/2” to 2” valves), 150 psi 73 °F (2-1/2” to 6” valves)
5. EPDM or FKM O-rings
6. Double lever handle

B. Manufacturers:
1. Spears
2. Hayward
3. Engineer approved equal

2.3 PVC True Union Ball Check Valves

A. Meet the following requirements
1. Meet requirements of ASTM D 1784
2. Schedule 80 PVC
3. Full-port
4. Pressure rating: 235 psi at 73 °F (1/2” to 2” valves), 150 psi 73 °F (2-1/2” to 6” valves)
5. EPDM or FKM O-rings

B. Manufacturers:
1. Spears
2. Hayward
3. Engineer approved equal

2.4 Isolation Ball Valves

A. Metal Ball Valves (2 Inches and Smaller): MSS SP 110, bronze, three-piece body, type 316 stainless steel ball, full port, teflon seats, blow-out proof stem, threaded ends, lever handle with balancing stops.

B. Manufacturers:
1. Milwaukee Valve
2. Apollo
3. Engineer approved equal

2.5 Flow Control Solenoid Valve

A. See Section 33 09 10 Instrumentation and Control for Water Utilities (Water Supply)” for description of flow control solenoid valve operation.

B. Operation: valve shall go into flow control mode when solenoid is energized. While in flow control mode, valve shall limit flow of water through the valve to a pre-set flow rate. See plans for flow rate setting. Valve shall be closed when solenoid is not energized.

C. Valve requirements:

1. Valve body material: Epoxy coated ductile iron
2. Normally closed solenoid (when solenoid is not energized)
3. Opening and closing speed control
4. Size: 1.5-inch
5. Maximum headloss through valve: 1 psi at 35 gpm

D. Manufacturers:

1. Bermad 730-55-U EN Series
2. Engineer approved equal

2.6 Air Release Valves

A. Valves must comply with ANSI / AWWA C512.

B. Valve body shall be cast iron or ductile iron and have 1-in. NPT inlet.

C. Manufacturers:
1. Val-matic
2. Crispin
3. Engineer approved equal

2.7 Pressure Relief Valves

A. Meet or exceed all requirements of ASME Section VIII

B. Manufacturers:
1. Kunkle 900 Series
2. Engineer approved equal

2.8 Sample Taps

A. Water sampling taps shall meet the following requirements:
1. Point downward.
2. Be installed in a clean, accessible location.
3. Be at least 12 inches above the floor or ground level.
4. Be smooth nosed model with no interior or exterior threads, and no screen, aerator, or other attached appurtenances.
5. Install with isolation ball valve.

B. Manufacturer and Products
1. Boshart Industries 0874NL Series
2. Engineer approved equal

2.9 Couplers

A. Couplers connecting dissimilar metals shall be of the dielectric type with a plastic sleeve that inhibits galvanic corrosion.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install valves so that operation of the valve does not put strain on the adjacent piping or connections. Provide rigid pipe or otherwise secure valve to minimize deflection during operation.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible.

F. Provide valve boxes to provide access for valves installed underground.

G. Refer to Section 22 05 29 “Hangers and Support for Plumbing Piping and Equipment” for pipe hangers and supports.

H. Install Work in accordance with the project plans, AWWA, State, and County standards.

3.3 VALVE APPLICATIONS

A. Install valves at locations indicated on Construction Plans in accordance with this Section.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball valves for draining, flushing, or bypass operation.

D. Install ball valves in domestic water systems for shut-off service.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfection system in accordance with Section 33 13 00 “Disinfecting Water Utility Distribution Piping.”

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements” and Section 01 79 00 “Demonstration and Training.”

B. Perform pressure test on site water distribution system in accordance with Section 33 11 00 “Water Utility Distribution Piping.”

END OF SECTION 22 05 23

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Pipe Hangers and Supports for Plumbing Piping and Equipment
2. Wall and Floor Sleeves
3. Building Attachments
4. Flashing
5. Miscellaneous Metal and Materials

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.
2. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.
3. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
4. Install piping per SMACNA's requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

A. General - Provide pipe and equipment hangers and supports in accordance with the following:

1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for piping are not shown on the Drawings, the contractor is responsible for their design.
2. Connections to structural framing are not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems:

1. Support frames such as pipe racks or stanchions for piping and equipment which provide support from below.
2. Equipment and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.

D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting the combined weight of supported systems, system contents and test water.

E. Provide seismic restraint hangers and supports for piping and equipment. See Section 22 05 48, Vibration and Seismic Controls for Plumbing Piping and Equipment.

F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment. See Section 22 05 48, Vibration and Seismic Controls for Plumbing Piping and Equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Pipe Hangers and Supports for Plumbing Piping and Equipment:

1. Pipe Hangers/Supports:
   a. B-Line Systems Inc.
   b. Anvil International
   c. HOLDRITE
   d. Erico Co. Inc.
   e. Snappitz Thermal Pipe Shield Manufacturing
   f. Rilco Manufacturing Co. Inc.
   g. Nelsen-Olson Inc.
   h. Or approved equivalent.
2. Channel Support Systems:
   a. B-Line Systems Inc.
   b. Anvil International, Anvit-Strut
   c. Erico Hanger Co. Inc.; O-Strut Div.
   d. Unistrut Corp.
   e. HOLDRITE EZ-Strut Systems
   f. Or approved equivalent.
3. Thermal-Hanger Shield Inserts:
   a. Erico Hanger Co. Inc.
   b. Pipe Shields, Inc.
   c. Rilco Manufacturing Co. Inc.
   d. HOLDRITE Insulation Couplings
   e. Or approved equivalent.

4. Freestanding Roof Supports:
   a. Miro
   b. Nelson-Olsen Inc. / Quick "Pipe" Block
   c. Eaton / B-Line / Dura-Blok
   d. Mifab
   e. Or approved equivalent.
5. Pipe Alignment and Secondary Supports:
   a. HOLDRITE
   b. Starquick
   c. Or approved equivalent.

B. Wall and Floor Sleeves:

1. Below Grade and High Water Table Areas:
   a. Modular Link Sealing System at Pipe Sleeves:
      1) Thunderline Corporation
      2) Or approved equivalent.
2. Pre-Engineered Firestop Pipe Penetration Systems:
   a. HOLDRITE HydroFlame
   b. Proset
   c. Or approved equivalent.

C. Building Attachments:

1. Anchor-It
2. Gunnebo Fastening Corp.
3. ITW Ramset / Red Head
4. Masterset Fastening Systems, Inc.
5. Or approved equivalent.

D. Flashing:

1. Fastenal
2. Or approved equivalent.

E. Miscellaneous Metal and Materials:

1. See Miscellaneous Metal and Materials article below.
2. Powder-Actuated Fastener Systems:
   a. Gunnebo Fastening Corp.
   b. Hilti, Inc.
   c. ITW Ramset / Red Head
   d. Masterset Fastening Systems, Inc.
   e. Or approved equivalent.

2.2 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

A. Horizontal Piping Hangers and Supports - Horizontal and Vertical Piping, and Hanger Rod Attachments:

1. Factory fabricated horizontal piping hangers and supports to suit piping systems in accordance manufacturer's published product information.
2. Use only one type by one manufacturer for each piping service.

3. Select size of hangers and supports to exactly fit pipe size for bare piping and to exactly fit around piping insulation with saddle or shield for insulated piping.
4. Provide copper-plated hangers and supports for uninsulated copper piping systems.
5. Provide padded pipe hangers, clamps and supports for thermoplastic piping system.
6. Install no hub cast iron pipe and fittings per CISPI 301-09 Installation Procedures for Hubless Cast Iron Pipe and Fittings for Sanitary and Storm Drain Waste and Vent Piping Applications. Brace hubless cast iron pipe and fittings 5-inch and larger with HOLDRITE No Hub Pipe Restraints or approved equivalent.

B. Pipe Hangers, Guides and Channel Systems:

1. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.
2. Hanger Rod Couplings: Malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.
3. Pipe Rings for Hanger Rods: Pipe sizes 2-inch and smaller, MSS SP Type 6 or Type 10, or approved equivalent. Pipe sizes 2-1/2-inches and larger, clevis type hangers with adjustable nuts on rod. MSS SP Type 1. Pipe rings to have same finish as hanger rods.
4. Pipe Slides: Type 35 reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resists corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.
5. Pipe Guides:
   a. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Any contact with chilled water pipe is not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.
   b. Furnish and install guides approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.
6. Channel Type Pipe Hanging System: Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A1011 GR33; one side of channel to have a continuous slot with in-turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.

C. Pipe Saddles and Shields:

1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).

D. Thermal-Hanger Shield Inserts: 100-PSI (690-kPa) minimum compressive strength insulation, encased in sheet metal shield.

1. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier.
2. Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate.
3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.

4. For Clevis or Band Hanger: Insert and shield to cover lower 180 degrees of pipe.
5. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.
6. Thermal Hanger Shield Inserts should be provided at the hanger points and guide locations on pipes requiring insulation. The Inserts should consist of Polyisocyanurate (urethane or phenolic insulation) encircling the entire circumference of the pipe with a 360 degree PVC (1.524 mm thick) with a living hinge and J lock and installed during the installation of the piping system.

E. Roller Hangers:

1. Adjustable roller hanger. Black steel yoke, cast iron roller. MSS Type 41.

F. Concrete Inserts:

1. Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.

G. Continuous Concrete Insert:

1. Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.

H. Beam Clamps:

1. MSS Type 19 and 23, wide throat, with retaining clip.
2. Universal Side Beam Clamp: MSS Type 20.

I. Below Ground:

1. Pipe Hangers: Adjustable Clevis type, Federal Specification WW-H-171 (Type 1), UL listed, stainless steel Type 316. MSS Type 1. If PVC piping to be used, provide Type 1 hanger, coated for PVC piping.
2. Rod: 5/8-inch stainless steel Type 316.
3. Eyebolt: Stainless steel Type 316.
4. Nuts and Washers: Stainless steel Type 316.

J. Hangers for Pipe Size 2-inches and Smaller:

1. Adjustable swivel ring hanger, UL listed, Type 6 or Type 10.

K. Hangers for Pipe Size 2-1/2-inches and Larger:

1. Adjustable clevis type, UL listed, Type 1.

L. Riser Clamps:

1. Steel, UL listed. MSS Type 8.

M. Plumbers Tape:

1. Not permitted as pipe hangers or pipe straps.

N. Pipe Alignment and Secondary Support Systems:

1. Secondary Pipe supports for general applications (Non-Acoustical).
   a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
   b. Supports may be used when sound and/or vibration transfer is not a concern.
2. Secondary pipe supports for sound and vibration attenuation (Acoustical).
   a. Supports will be manufactured in compliance with IAPMO Product Standard PS 42-96. All products provided will be listed by IAPMO for secondary pipe support.
   b. Acoustical pipe supports will be manufactured and installed in compliance with International Organization for Standardization (ISO) 3822-1 with current amendments.
   c. Supports will be used when sound and/or vibration transfer is a concern. Locations where acoustical supports will be provided and include but are not limited to partition walls between living units, tenant spaces, retail units, mechanical rooms and lobbies.
   d. Support Products:
      1) Support to Wall Brace and Wall Stud Penetrations: HOLDRITE #261, #262, #263, and #264, or approved equivalent.
      2) Pipe Wrap for Pipe Clamps and Channel-Mounted Pipe Clamps: HOLDRITE #270, or approved equivalent.
      3) Pipe Wrap for Pipe Hangers: HOLDRITE #271, #272-2, and #272-4, or approved equivalent.
      4) Drop-Ear Fitting Support: HOLDRITE #265, or approved equivalent.
      5) Floor Riser Isolation Pads: HOLDRITE #275-T, or approved equivalent.
      6) Floor Isolation Pads (General Applications): HOLDRITE #274, #275, #276, and #278, or approved equivalent.

O. Freestanding Roof Pipe Supports:

1. Polyethylene high-density UV resistant block with foam pad or 100 percent UV resistant recycled rubber. With galvanized strut/channel.

2.3 WALL AND FLOOR SLEEVES

A. Below Grade and High Water Table Areas:

1. Modular Link Sealing System at Pipe Sleeves: Neoprene gasket links bolted together around an interior sleeve forming a watertight seal. Use a modular link sealing system at sleeves to continuously fill the annular space between the pipe and the wall opening. Provide Link-seal Type C unless otherwise noted. OS with S-316 stainless construction for continuous water/tank walls.
2. Sleeves through concrete foundation walls and floors. Ductile iron pipe. Class 50 or 51 pipe conforming to ANSI/AWWA C151/A21.51. Pipe sleeve will extend a minimum of 6-inches beyond outside perimeter of foundation. Final placement of sleeve will be confirmed with project's structural engineer. In areas with a high water table, provide AWWA C900, Class 235 plastic pipe in lieu of ductile iron pipe.

B. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

C. Insulating Caulking: Eagle or Pitcher Super 66 high temperature cement.

D. Fabricated Accessories:

1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide following minimum gauges for sizes indicated:
   a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.
   b. Sleeve Sizes 5-inches to 6-inches: 16 gauge.
   c. Sleeve Sizes 7-inches and Larger: 14 gauge.
   d. Fire-Rated Safing Material:
      1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 lbs./cu.ft. density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.
      2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.4 BUILDING ATTACHMENTS

A. General: Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project Structural Engineer. Provide anchor bolts suitable for cracked concrete.

B. Anchor Bolts:

1. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
2. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
3. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.

C. Beam Clamps:

1. MSS Type 19 and 23, wide throat, with retaining clip.
2. Universal Side Beam Clamp: MSS Type 20.

D. Powder-Actuated Drive Pin Fasteners:

1. Powder-Actuated Drive-Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

E. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

F. Grout: ASTM C1107, Grade B, factory mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Non-staining, noncorrosive, and non-gaseous.
3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

2.5 FLASHING

A. Steel Flashing: 26 gauge galvanized steel.

B. Safes: 8 mil thick neoprene.

C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

D. Provide hot dipped galvanized components for items exposed to weather.

2.6 MISCELLANEOUS METAL AND MATERIALS

A. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings, that are necessary for completion of the project. The Contractor is responsible for their design.

1. Fabricate miscellaneous units to size, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.

C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods and equipment required for fabrication.

G. Provide hot dipped galvanized components for items exposed to weather.

H. Use straps, threshold rods and wire with sizes required by SMACNA to support piping.

I. Grout: ASTM C1107, Grade B, factory mixed and packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Non-staining, noncorrosive, and non-gaseous.
3. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Examination:

1. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.

B. Preparation:

1. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall," "2-Hour Fire/Smoke Barrier," and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.

C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate with project structural engineer proper placement of inserts, anchors and other building structural attachments.

3.2 PIPE HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

A. Hangers and Supports:

1. Comply with MSS SP-58. Pipe Hanger and Support Installation: Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.
2. Pipe Ring Diameters:
    a. Uninsulated and Insulated Pipe, except where oversized pipe rings are specified: Ring inner diameter to suit pipe outer diameter.
    b. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.
3. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.
4. Pipe Support Brackets: Support pipe with pipe slides.
5. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.
6. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
    a. Field assemble and install according to manufacturer's written instructions.
7. Pipe Guides:
    a. Install on continuous runs where pipe alignment must be maintained. Provide a minimum of two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Any contact with chilled water pipe should not permit heat to be transferred in sufficient quantity to cause condensation on any surface.
    b. Install approximately 4 pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.
8. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field -fabricated, heavy-duty trapezes.

a. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
b. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1

9. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers.
10. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.
11. Do not support piping from other piping.
12. Fire protection piping will be supported independently of other piping.
13. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.
14. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.
15. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchor, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units.
16. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
17. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.
18. Insulated Piping: (comply with the following)
    a. Attach clamps and spacers to piping.
        1) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
        2) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
        3) Do not exceed pipe stress limits according to ASME B31.9.
    b. Install MSS SP-58, Type 39 protection saddles, if insulation without a vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
        1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
    c. Install MSS SP-58, Type 40 protective shields on cold piping having a vapor barrier. Shields to span arc of 180 degrees.
        1) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
    d. Shield Dimensions for Pipe, not less than the following:
        1) NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
        2) NPS 4 (DN100): 12-inches long and 0.06-inch thick.
        3) NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
        4) NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
        5) NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
    e. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
    f. Insert Material: Length at least as long as protective shield.
    g. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

19. Equipment Clearances: Do not route equipment or piping through electrical rooms, transformer vaults, elevator equipment rooms, IT rooms, MPOE rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear panels. Do not route piping or equipment above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact equipment or pipe routing to provide proper clearance with such items.
20. Pipe supports and hanger spacing (pipe supported from structure or floor-supported) to meet the requirements of References and Standards Article in Part 1 above.

B. Pipe Curb Assemblies:

1. Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (e.g., piping, electrical power and control wiring). Meet requirements of roof warranty.
2. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.
3. Piping above roof to be supported with freestanding roof pipe supports unless detailed otherwise. At roofing applications, the adhesion mastic is to be specifically submitted to and approved by the roofing system manufacturer/installer to maintain the integrity of all warranties.
4. At concrete floors, install a polyurethane mastic to the support block and adhere in place.

C. Vertical Piping:

1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
2. Riser clamps to be directly under fitting or welded to pipe. Provide neoprene pads for all systems except natural gas.
3. Riser to be supported at each floor penetration.
4. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.

D. Adjusting and Painting:

1. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping and equipment to proper level and elevations.
2. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

3.3 WALL AND FLOOR SLEEVES

A. "Link-Seal" Pipe Sleeves: Install at slab on grade floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations (except for DWV piping at slab on grade). Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.

B. Fabricated Pipe Sleeves:

1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirement, and by waterproofing requirements.
2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.
3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.
4. Seal each end airtight with a resilient nonhardening sealer, UL listed and fire rated per ASTM 814.

3.4 BUILDING ATTACHMENTS

A. Install within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints and at changes in direction of piping.

B. Attachment to Wood Structure: Provide MSS Type 34 for attachment to wooden beam or approved attachment for a wood structure.

C. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

D. Install concrete inserts before concrete is placed; fasten insert secure to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.

E. Install powder-actuated drive pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.

F. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.

G. Anchor Bolts:

1. Install anchor bolts for mechanical equipment and piping as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment and piping are hung.
2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

H. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.

I. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor wall, and through equipment room walls and floors.

J. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:

1. Install fabricated pipe sleeve.
2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.
3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814 sealant.

K. Piping Penetrations Through Fire-Rated (1 to 3 hour) Assemblies:

1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.
2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814. Use HOLDRITE HydroFlame or approved equivalent.

L. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

3.5 FLASHING

A. Flash and counter flash where piping passes through weather or waterproofed walls, floors and roofs.

B. Flash vent soil pipes with flashings per Division 01, General Requirements.

C. Flash floor drains over finished areas and roof drains, 10-inches clear on sides, minimum 36-inches by 36-inches sheet size. See Division 01, General Requirements. Fasten flashing to drain with clamping device.

D. Install built up fixtures (mop sinks, shower stalls, shower floors) with water sealing systems/membranes to meet Code and as prescribed by Division 01, General Requirements and Section 22 00 00, Plumbing Basic Requirements. Meet all Code testing requirements. Provide drainage devices with appropriate flanges, clamps, etc. to meet these installation requirements and ensure a water-tight installation.

3.6 MISCELLANEOUS METAL AND MATERIALS

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.

C. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete masonry or similar construction.

D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

E. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

1. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

F. Fabrication:

1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates and similar devices. Hot dip galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
2. Finishes:
    a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas with primer of same material before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
    b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials:
        1) Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
    c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

G. Metal Fabrication:

1. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
2. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
3. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of weld and methods used in correcting welding work, and with the following:
    a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    b. Obtain fusion without undercut or overlap.
    c. Remove welding flux immediately.
    d. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.
4. Provide hot dipped galvanized components for items exposed to weather.

END OF SECTION 22 05 29

SECTION 22 05 33 - HEAT TRACING FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Heat Trace Cable (Freeze Protection)

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1. Section 22 07 00, Plumbing Insulation

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 718K Pipe Heating Cable.
2. CSA Design 3A, 3B, 3C.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Project Record Documents: Record physical locations of thermostats.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Provide minimum heat tracing capacities per linear foot as scheduled on Drawings.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Heat Trace Cable (Freeze Protection):

1. FLX by Thermon
2. SRF by Chomalox
3. XL-Trace by Raychem
4. CLT by Nelson
5. Or approved equivalent.

2.2 HEAT TRACE CABLE (FREEZE PROTECTION)

A. General: Provide complete UL listed system of heating cables and components listed specifically for maintaining pipe temperature over entire piping system exposed to freezing temperatures.

B. Materials:

1. Cable: Self-regulating flat, flexible, low-heat density, parallel electric heater strip consisting of 2 stranded circuit conductors enclosed in semi-conductive, polymer core insulated with plastic jacket protected with tinned-copper braid. Ability to overlapped without creating hot spots and is suitable for application on plastic, copper or steel pipe.
2. Voltage: See electrical drawings. Provide power connections, end seals, splices tap-offs and tees for a complete system.
3. Controls: Thermostat with fixed setpoint of 40 degrees F, remote bulb and capillary sensor enclosed in a NEMA 4 enclosure.

C. Minimum Exposure Temperature: 150 degrees F continuous.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. General: Installation to be by Division 26, Electrical.

3.2 HEAT TRACE CABLE (FREEZE PROTECTION)

A. Location: Furnish heat trace and components for piping exposed to freezing conditions.

B. Insulate piping systems after installation and testing of heating cable.

C. Install cable parallel to pipe or spiral wrap to achieve power density per linear foot of pipe to prevent freezing.

D. Heat Trace and Components are to be installed per the following:

1. Attach heat trace cable to pipe with polyester tape; increments not exceeding 1-foot.
2. Install thermostat capillary and bulb to pipe with polyester tape assuring a firm bulb contact with pipe. Install bulb without contact to heat cable. Maximum 12-inch spacing between tape.
3. Install thermostat at accessible location adjacent to pipe with minimum of exposed capillary.

4. Labeling: Provide “Electric Traced” label to outside of the pipes thermal insulation on alternating sides. Locate labels at intervals of 5 to 15-feet over entire length of heat tracing.
5. Coordinate installation with work under Division 26, Electrical for electrical service to each thermostat.
6. Coordinate application of heat tape with pipe insulation and weather jacketing.

END OF SECTION 22 05 33

SECTION 22 05 48 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Seismic Bracing/Restraint Devices/Systems for Equipment and Piping

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
2. Section 22 30 00 - Plumbing Equipment

1.3 REFERENCES AND STANDARDS

A. References and standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Seismic Restraint:
   a. Shop Drawings: Show compliance with requirements of Quality Assurance article of this Section. Shop Drawings will be stamped by professional structural engineer licensed in state of Washington.
   b. Calculations: Submit seismic calculations indicating restraint loadings resulting from design seismic forces. Include anchorage details. Calculations will be certified by professional structural engineer licensed in the state of Washington.
   c. Certifications: For restraining devices submit pre-approval certification number from government agency. Where pre-approval is not available, submit testing performed by independent laboratory or calculations sealed by professional structural engineer licensed in state of Washington certifying isolators and restraints will withstand seismic forces encountered.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Seismic Restraint:

a. Seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure will be designed to resist total design seismic force prescribed in local building code:
   1) Floor- or roof-mounted equipment weighing 400 pounds or greater.
   2) Suspended, wall-mounted or vibration isolated equipment weighing 20 pounds or greater.
   3) Housekeeping slabs: provide reinforcement and anchorage to building structure.

b. Where required, seismic sway bracing of suspended piping will meet the following:
   1) Pipe runs requiring seismic bracing will have a minimum of two traverse braces and one longitudinal brace. A longitudinal (or a traverse) brace at 90 degree change in direction may act as traverse (or longitudinal) brace if located within 2-feet of change in direction.
   2) Seismic bracing may not pass through seismic separation joint. Pipe runs that pass through seismic separation joints must be restrained within 5-feet of both sides of the separation.
   3) Seismic brace assembly spacing will not exceed 40-feet transverse and 80-feet longitudinal.

c. Seismic sway bracing of suspended piping will be performed for the following:
   1) Piping 8-inches nominal diameter and larger and trapeze systems where total area of pipe exceeds 28 square inches.
   2) Piping 2-1/2-inches nominal diameter and larger and trapeze systems where total area of pipe exceeds 3 square inches.
   3) Piping 4-inches nominal diameter and larger, all cast iron and PVC piping and trapeze systems with total aggregate weight of 10 pounds/foot or greater.
   4) Piping 1-1/4-inches nominal diameter and larger and trapeze systems with total aggregate weight of 10 pounds/foot or greater.

d. Seismic restraints may be omitted from suspended piping if the following conditions are satisfied:
   1) For piping supported by individual rod hangers 12-inches or less in length from top of pipe to bottom of structural support. Top connections to structure will have swivel joints, eye bolts, or vibration isolation hangers for the entire length of the system run.
   2) Lateral motion of the system will not cause damaging impact with surrounding systems or cause loss of system vertical support.
   3) System must be welded steel pipe, brazed copper pipe, or similar ductile material with ductile connections.

e. Seismic restraints, including anchors to building structure, will be designed by registered professional structural engineer licensed in state of Washington. Design will include:
   1) Number, size, capacity, and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both unit to curb and curb to structure.
   2) Number, size, capacity, and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations, test data verifying the horizontal and vertical ratings of the seismic restraint devices.
   3) Number, size, capacity, and location of braces and anchors for suspended piping and ductwork on as-built plan drawings.
   4) Maximum seismic loads will be indicated on Drawings at each brace location. Drawings will bear stamp and signature of registered professional structural engineer who designed layout of braces.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Seismic Bracing/Restraint Devices/Systems for Equipment and Piping:

1. Amber-Booth.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.
4. Hilti, Inc.
5. Mason Industries, Inc.
6. Kinetics Noise Control.
7. Unistrut.
8. ISAT, Inc.
9. Or approved equivalent.

2.2 SEISMIC BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT AND PIPING

A. General Requirements for Restraint Components: Rated strengths, features, and applications will be as defined in reports by agency acceptable to authorities having jurisdiction.

B. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components will be at least four times the maximum seismic forces to which they will be subjected.

C. Anchor bolts for attaching to concrete will be seismic-rated, drill-in, and stud-wedge or female-wedge type. Provide anchor bolts suitable for cracked concrete.

D. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

E. Maximum 1/4-inch air gap, and minimum 1/4-inch thick resilient cushion.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Vibration isolators and seismic restraint systems must be installed in strict accordance with manufacturers written instructions and certified submittal data.
2. Set floor-mounted equipment on minimum 4-inch-high concrete housekeeping pads. Extend pad at least 6-inches beyond footprint of equipment in each direction.
3. Provide mounts for equipment installed outdoors for wind loads of 30-pounds psf applied to any exposed surface of isolated equipment.
4. Do not install equipment or pipe which makes rigid contact with building slabs, beams, studs, walls, etc.
5. Anchor baseplate to floor or structure. Provide rubber grommets and washers to isolate bolt from base plate. Under no circumstances will isolation efficiency be destroyed when bolting the isolators to floor.

6. Building Penetrations: Isolate water piping penetrating wall, ceilings, floors or shafts from the structure by piping isolator or by 3/8-inch thick foamed rubber insulation. Install units flush with finished structure face, using one for each side as required. Cut units to length if longer than structure thickness. Caulk around pipe at equipment room wall.
7. Pipe Hangers in Equipment Rooms: Support water and gas piping connected to rotating equipment within equipment rooms on spring and neoprene hangers. The first three hangers from a piece of vibrating equipment are to have a minimum of 1/2 static deflection of equipment isolators. Other isolators should have a minimum of 1/4 static deflection of equipment isolators.

3.2 SEISMIC RESTRAINTS

A. General:

1. Install and adjust seismic restraints so that equipment and piping supports are not degraded by restraints.
2. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.

B. Supported Equipment: Each vibration isolation frame for supported equipment will have a minimum of four seismic snubbers mounted as close as possible to vibration isolators and/or frame extremities.

C. Bracing of Pipes: Branch lines may not be used to brace main lines.

D. Suspended Equipment and Piping Cable Method:

1. Cables will be adjusted to the degree of slackness approved by Structural Engineer of Record.
2. Uplift and downward restraint nuts and washers for Type 5 spring hangers will be adjusted so that there is a minimum 1/4-inch clearance.

E. Vibration isolators and seismic restraint systems must be installed in strict accordance with manufacturers written instructions and certified submittal data.

END OF SECTION 22 05 48

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Plastic Nameplates
2. Tags
3. Plastic Pipe Markers

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, submit Valve Schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shutoff and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals. Provide schedules organized as follows:

1. Equipment Type:
    a. Identification:
    b. Background:
        1) Size:
        2) Color:
    c. Lettering:
        1) Size:
        2) Color:

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.

2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 22, Plumbing Sections. Where more than a single type is specified for application, provide single selection for each product category.

B. Plastic Nameplates:

1. Brady Corporation
2. Or approved equivalent.

C. Tags:

1. Brady Corporation
2. Brimar
3. Champion America Inc.
4. Craftmark
5. Seton Identification Products
6. Or approved equivalent.

D. Plastic Pipe Markers:

1. Brady Corporation
2. Brimar
3. Champion America Inc.
4. Craftmark
5. Seton Identification Products
6. Or approved equivalent.

2.2 PLASTIC NAMEPLATES

A. Description: Engraving stock melamine plastic laminate 1/8-inch thick, engraved with engraver's standard letter style of the sizes and wording indicated.

1. Letter Color: White.
2. Letter Height: 1/2 inch.
3. Background Color: Black.
4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.

6. Signage for hot water outlets on 140 degree F hot water systems not protected by ASSE 1070 mixing valves; hose bibbs, janitor sinks, and fixtures used by trained personnel.
   a. Manufacturer's standard 1/8-inch thick engraved plastic laminate signage 4 by 4-inches.
   b. Letter Color: Red.
   c. Letter Height: 1/2 inch.
   d. Background Color: White.
   e. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.3 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2-inch diameter.

B. Metal Tags: Polished Brass with stamped letters; tag size minimum 1-1/2-inch diameter with smooth edges.

C. Valve designations to be coordinated with existing valve identifications to ensure no repetitive designations are utilized.

D. Chart/Schedules: Valve Schedule Frames. For each page of a valve schedule, provide glazed display frame with removable mounting as appropriate for wall construction upon which frame is to be mounted. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

E. Valve Tag Fasteners: Solid brass chain (wire link or beaded type), or solid brass S-hooks.

F. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

   1. Size: Approximately 4- by 7-inches.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
   4. Color: Yellow background with black lettering.

2.4 PLASTIC PIPE MARKERS

A. Color: Conform to ASME A13.1 and ANSI Z535.1.

B. Plastic Pipe Markers (for external diameters of 6-inches and larger including insulation): Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers (for external diameters less than 6-inches including insulation): Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Lettering and Graphics:

1. General: Coordinate names, abbreviations and other designations used in plumbing identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
2. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).

B. Preparation: Degrease and clean surfaces to receive adhesive for identification materials.

C. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

D. Install valve schedule at each mechanical room.

E. Access Doors: Provide markers on each access door and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions.

3.2 PLASTIC NAMEPLATES

A. Identify pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body.

B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.

C. Install plastic nameplates with corrosive-resistant mechanical fasteners.

3.3 TAGS

A. Small devices, such as in-line pumps, may be identified with tags. Use metal tags on piping 3/4-inch diameter and smaller.

B. Identify valves in main and branch piping with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.

C. Coordinate with the facility maintenance personnel to ensure consistency with the existing tagging system.

D. Tag balancing valves with balanced GPM or CFM indicated after balancing is completed and accepted.

E. Install tags with corrosion resistant chain.

3.4 PLASTIC PIPE MARKERS

A. Install plastic pipe markers in accordance with manufacturer's instructions.

B. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

C. For exterior underground piping installations, install underground plastic pipe markers with tracer wire 6- to 8-inches below finished grade directly above buried pipe.

D. Identify piping, concealed or exposed, with plastic tape pipe markers. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20-feet (reduced to 10-feet in congested areas and mechanical equipment rooms) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction. Locate near branches, valves, control devices, equipment connections, access doors, floor/wall penetrations.

END OF SECTION 22 05 53

SECTION 22 05 93 - TESTING, ADJUSTING, AND BALANCING FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Balancing water flow within distribution systems of all Division 22, Plumbing Sections, including sub-mains, branches, and terminals, to indicated quantities according to specified tolerances.

B. Adjusting plumbing systems to provide indicated quantities.

C. Verifying that automatic control devices are functioning properly.

D. Reporting results of the activities and procedures specified in this Section.

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Acceptable Balance Firm:
    a. General:
        1) Procure services of independent Testing, Adjusting, and Balancing (TAB) agency to balance, adjust and test water circulating. Minimum Experience: 5 years.
    b. Industry Standards: Testing and Balancing will conform to NEBB, American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), and American National Standards Institute (ANSI) as follows:
        1) NEBB: Comply with Procedural Standards for Testing, Adjusting Balancing of Environmental Systems.
        2) ASHRAE: Comply with recommendations pertaining to measurements, instruments, and TAB.
    c. Test Observation: If requested, conduct tests in the presence of the Architect or the Architect's representative.
2. Provide proof of testing agency having successfully completed at least five projects of similar size and scope.

3. Code Compliance: Perform tests in the presence of the Authority Having Jurisdiction (AHJ) where required by the Authority Having Jurisdiction (AHJ).
4. Owner Witness: Perform tests in the presence of the Owner's representative.
5. Engineer Witness: The engineer or engineer's representative reserves the right to observe tests or selected tests to assure compliance with the specifications.
6. Simultaneous Testing: Test observations by the Authority Having Jurisdiction (AHJ), the Owner's Authorized Representative and the engineer's representative need not occur simultaneously.
7. Do not perform TAB work until plumbing equipment has been completely installed and is operating continuously as required.
8. Conduct TAB with clean filters in place. Clean strainers prior to performing TAB.
9. Agent Qualifications: Engage a TAB Agent certified by AABC or NEBB.
10. TAB Conference: Meet with the Owner's and the Architect's representatives on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, controls Installer, and other support personnel. Provide 7 days advance notice of scheduled meeting time and location.
    a. Agenda Items: Include at least the following:
        1) Submittal distribution requirements.
        2) TAB plan.
        3) Work schedule and Project site access requirements.
        4) Coordination and cooperation of trades and subcontractors.
        5) Coordination of documentation and communication flow.
11. Certification of TAB Reports: Certify the TAB field data reports. This certification includes the following:
    a. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
    b. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
12. TAB Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."
13. TAB Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
14. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.
15. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
16. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

A. Adjust: To regulate fluid flow rate at the equipment.

B. Balance: To proportion flows within the distribution system, including sub mains, branches, and terminals, according to design quantities.

C. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

D. Report Forms: Test data sheets for recording test data in logical order.

E. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

F. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

G. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

H. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

I. TAB: Testing, Adjusting, and Balancing.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of a system or equipment.

L. Testing, Adjusting, and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.

M. AABC: Associated Air Balance Council.

N. AMCA: Air Movement and Control Association.

O. CTI: Cooling Tower Institute.

P. NEBB: National Environmental Balancing Bureau.

Q. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.8 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, controls installers, and other mechanics to operate systems and equipment to support and assist TAB activities.

B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on piping distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

A. Non-Owner Occupancy: Complete balancing of building systems prior to Substantial Completion and owner occupancy.

3.2 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and existing building record documents (if available) to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
2. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of plumbing systems and equipment.

C. Examine equipment performance data including pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

D. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

E. Examine system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

F. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

G. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.

H. Examine equipment for installation and for properly operating safety interlocks and controls.

I. Examine automatic temperature system components to verify the following:

1. Valves, and other controlled devices operate by the intended controller.
2. Valves are in the position indicated by the controller.
3. Integrity of valves for free and full operation and for tightness of fully closed and fully open positions.
4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
5. Sensors are located to sense only the intended conditions.

6. Sequence of operation for control modes is according to the Contract Documents.
7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.

J. Report deficiencies discovered before and during performance of TAB procedures.

K. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Isolating and balancing valves are open and control valves are operational.

C. Hold a pre-balancing meeting at least one week prior to starting TAB work.

1. Attendance is required by installers whose work will be tested, adjusted, or balanced.

D. Provide instruments required for TAB operations. Make instruments available to Architect to facilitate spot checks during testing.

3.4 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform TAB procedures on each system according to the procedures contained in AABC national standards or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation for pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

C. Mark equipment settings with paint or other suitable, permanent identification material, including control positions, valve indicators and similar controls and devices, to show final settings.

3.5 ADJUSTMENT TOLERANCES

A. Piping Systems: Adjust to within plus or minus 10 percent of Design.

3.6 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings locations where other critical measurements were taken and cross reference location in final report.

3.7 FUNDAMENTAL PROCEDURES FOR PIPING SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 10 percent.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. Prepare systems for TAB according to the following, in addition to the general preparation procedures specified above:

1. Open manual valves for maximum flow.
2. Check expansion tank liquid level, or air charge if bladder type.
3. Check makeup-water-station pressure gauge for adequate pressure.
4. Check flow-control valves for specified sequence of operation and set at design flow.
5. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

3.8 FINAL REPORT

A. General: Computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into Sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified TAB engineer.

1. Include a list of the instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to the certified field report data, include the following:

1. Pump curves.
2. Field test reports prepared by system and equipment installers.
3. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB Agent.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.

9. Signature of TAB Agent who certifies the report.
10. Summary of contents, including the following:
    a. Design versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
11. Nomenclature sheets for each item of equipment.
12. Notes to explain why certain final data in the body of reports vary from design values.

E. Pump Test Reports: For pumps, include the following data. Calculate impeller size by plotting the shutoff head on pump curves.

1. Unit Data: Include the following:
    a. Unit identification.
    b. Location.
    c. Service.
    d. Make and size.
    e. Model and serial numbers.
    f. Water flow rate in gpm (L/s).
    g. Water pressure differential in feet of head or PSIG (kPa).
    h. Required net positive suction head in feet of head or PSIG (kPa).
    i. Pump rpm.
    j. Impeller diameter in inches.
    k. Motor make and frame size.
    l. Motor horsepower and rpm.
    m. Voltage at each connection.

END OF SECTION 22 05 93

SECTION 22 07 00 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Type 1, Glass Wool Pipe Insulation
2. Type 2, Flexible Elastomeric Insulation
3. Type 4, Cellular Glass
4. Type 5, Glass Wool Equipment Insulation
5. Type 6, Foamed Plastic Equipment Insulation
6. Type 7, ADA Accessible Lavatory/Sink Insulation Kit
7. Accessories
8. Pipe Fitting Insulation Covers

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 22 05 33, Heat Tracing for Plumbing Piping

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Piping insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Installer qualifications.
2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any) for each type of product indicated.
3. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
5. Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements apply to this Section.

B. In addition, meet the following:

1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.
3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
4. Installer to have minimum 5 years' experience in the business of installing insulation.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.7 FIRE HAZARD CLASSIFICATION

A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.

B. Test pipe insulation in accordance with requirements of current edition of UL "Pipe and Equipment Coverings."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Type 1, Glass Wool Pipe Insulation:

1. Johns Manville
2. Knauf
3. Owens-Corning
4. Or approved equivalent.

B. Type 2, Flexible Elastomeric Insulation:

1. Insulation:
   a. Armacell LLC Armaflex
   b. K-Flex
   c. Or approved equivalent.
2. Glue:
   a. Armacell LLC Armaflex Low VOC Adhesive
   b. K-Flex
   c. Or approved equivalent.
3. Paint:
   a. Armacell LLC Armaflex
   b. K-Flex
   c. Or approved equivalent.

C. Type 4, Cellular Glass:

1. Pittsburgh Corning
2. Or approved equivalent.

D. Type 5, Glass Wool Equipment Insulation:

1. Knauf
2. Owens-Corning
3. Johns Manville
4. Or approved equivalent.

E. Type 6, Foamed Plastic Equipment Insulation:

1. Armacell LLC Armaflex
2. Or approved equivalent.

F. Type 7, ADA Accessible Lavatory/Sink Insulation Kit:

1. IPS/Truebro
2. McGuire/Pro-Wrap
3. Plumberex/Pro-Extreme
4. Brocar Trap Wrap
5. Or approved equivalent.

G. Accessories:

1. ITW Insulation Systems
2. Or approved equivalent.

H. Pipe Fitting Insulation Covers:

1. Zeston Johns Manville
2. ITW Insulation Systems
3. Or approved equivalent.

2.2 TYPE 1, GLASS WOOL PIPE INSULATION

A. Glass Fiber: ASTM C547 Type I and IV; rigid molded, noncombustible.

1. Thermal Conductivity Value: 0.27 BTU*in/(hr*sf*F) at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F to 1000 degrees F.
3. Vapor Retarder Jacket: White Kraft paper reinforced with glass fiber and bonded to aluminum foil, with self-sealing longitudinal laps and butt strips or vapor barrier mastic.

2.3 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION

A. Elastomeric Foam: ASTM C534; flexible, cellular elastomeric, molded or sheet.

1. Thermal Conductivity Value: 0.25 BTU*in/(hr*sf*F) at 75 degrees F.
2. Maximum Service Temperature of 220 degrees F.
3. Maximum Flame Spread: 25.
4. Maximum Smoke Developed: 50 (3/4-inch thick and below).
5. Connection: Waterproof vapor retarder adhesive as needed.

6. UV Protection: UV outdoor protective coating per manufacturer's requirements.

B. Glue: Contact adhesive specifically manufactured for cementing flexible elastomeric foam.

C. Paint: Nonhardening high elasticity type, specifically manufactured as a protective covering of flexible elastomeric foam insulation for prevention of degradation due to exposure to sunlight and weather.

2.4 TYPE 4, CELLULAR GLASS

A. Cellular Glass Insulation: Pittsburgh Corning Foamglas pipe insulation fabricated in accordance with ASTM C552 and C585. Thermal conductivity of 0.33 BTU*in/(hr*sf*F) at 50 degrees F.

2.5 TYPE 5, GLASS WOOL EQUIPMENT INSULATION

A. Flexible Glass Wool Blanket: ASTM C612; flexible.

1. Thermal Conductivity Value: 0.24 BTU*in/(hr*sf*F) at 75 degrees F.
2. Maximum Service Temperature: 450 degrees F.

2.6 TYPE 6, FOAMED PLASTIC EQUIPMENT INSULATION

A. Flexible elastomer, closed cell foam insulation. Maximum thermal conductivity of 0.27 BTU*in/(hr*sf*F) at 75 degrees F mean temperature.

2.7 TYPE 7, ADA ACCESSIBLE LAVATORY/SINK INSULATION KIT

A. P-traps, trap arms, tail pieces, hot water and cold water insulating guards meeting ASTM C1822. Molded closed cell insulation with vinyl cover and nylon fasteners, paintable. Provide accessories as required for complete installation covering all exposed waste piping, water piping, stops and supplies. Color white.

2.8 ACCESSORIES

A. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

B. Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have same flame and smoke component ratings as insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide non-water soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

2.9 PIPE FITTING INSULATION COVERS

A. PVC Plastic Fitting Covers: Schuller Zeston 2000, Knauf Proto Fitting or approved equivalent. One-piece molded type fitting covers and jacketing material, gloss white. Connections: Tacks; pressure sensitive color matching vinyl tape.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION INFORMATION

A. Verification of Conditions:

1. Do not apply insulation until pressure testing and inspection of piping has been completed. Do not apply insulation over heat tracing temperature maintenance until system has been tested.
2. Examine areas and conditions under which insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Preparation: Clean and dry surfaces to be insulated.

C. Installation:

1. Insulation: Continuous through walls, floors, and partitions except where noted otherwise.
2. Piping and Equipment:
   a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.

D. Provide accessories as required. See Part 2 Article "Accessories" above.

E. Protection and Replacement: Protect installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

F. Labeling and Marking: Provide labels, arrows and color coding on piping. Attach labels and flow direction arrows to jacketing per Section 22 05 53, Identification for Plumbing Piping and Equipment.

G. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 1-1/2-inches and larger (hot and cold piping).

H. Piping Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Pipe Size	Insulation Thickness
Hot Water Piping Above Grade (105F to 140F)	1	Runouts =<1-1/4-inch (uncirculated branches located in partitions within conditioned spaces) Mains =<1-1/4-inch	1-inch 1-inch

		Mains >1-1/4-inch	1-1/2-inch
Hot Water Circulation Piping Above Grade (105F to 140F)	1	Mains =<1-1/4-inch Mains >1-1/4-inch	1-inch 1-1/2-inch
Cold Water Piping Above Grade	1	=<1-1/2-inch >1-1/2-inch	1/2-inch 1-inch
Water Piping Exposed to Weather	1, 2, 4	All	1-1/2-inch
Piping with Heat Tracing	1, 2, 4	Same as circulated hot water based on pipe size and service temperature.	
Above Grade Roof Drain/Overflow Drain Piping	1, 2	All	1/2-inch
Roof Drain Underbodies	5, 6	N/A	1-inch
Overflow Roof Drain Underbodies	5, 6	N/A	1-inch
ADA Accessible Lavatory/Sink	7	All	As Listed
Condensate Drain Piping	1, 2	All	1/2-inch

3.2 TYPE 1, GLASS WOOL PIPE INSULATION

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions for below grade installation.

C. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.

D. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.

E. Above Grade Roof Drain/Overflow Drain Piping: Cover all roof drain piping and overflow drain piping with sectional pipe covering.

3.3 TYPE 2, FLEXIBLE ELASTOMERIC INSULATION

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions for below grade installation.

C. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and undergrade with two coats of finish as recommended by manufacturer.

D. Above Grade Roof Drain/Overflow Drain Piping: Cover all roof drain piping and overflow drain piping with sectional pipe covering.

E. Flexible Elastomeric Tubing: Slip insulation over piping or if piping is already installed, it should be slit and snapped over piping. Joints and butt ends must be adhered with 520 adhesive.

3.4 TYPE 4, CELLULAR GLASS

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

C. Install in accordance with manufacturer's instructions for below grade installation.

D. Install in accordance with manufacturer's instructions for below grade installation and exposed weather installation with jacketing.

E. Insulated Pipe Exposed to Weather: Where piping is exposed to weather, cover cellular glass insulation with aluminum jacket. Seal watertight jacket per manufacturer's recommendations. Install metal jacket with 2-inch overlap at longitudinal and butt joints with exposed lap pointing down. Secure jacket with stainless-steel draw bands 12-inches on center and at butt joints.

3.5 TYPE 5, GLASS WOOL EQUIPMENT INSULATION

A. See General Installation Requirements above.

B. Apply insulation and accessories to roof drain underbodies per manufacturer's recommendations.

C. Roof Drain/Overflow Drain Underbodies: Cover underside of drain body with glass wool insulation; attached with adhesive and supported externally with 26 gauge galvanized flat strapping anchored to structure.

D. Storage Tanks: Cover with glass wool, 2-inches thick. Finish with canvas jacket and adhesive. Overlap joints minimum of 4-inches. Apply two coats latex paint; color selected by Architect.

3.6 TYPE 6, FOAMED PLASTIC EQUIPMENT INSULATION

A. See General Installation Requirements above.

B. Apply insulation and accessories to roof drain and overflow drain underbodies per manufacturer's recommendations.

C. Roof Drain/Overflow Drain Underbodies: Cover underside of drain body with glass wool insulation; attached with adhesive and supported externally with 26 gauge galvanized flat strapping anchored to structure.

3.7 TYPE 7, ADA ACCESSIBLE LAVATORY/SINK INSULATION KIT

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

C. Provide lavatory/sink insulation kit. Install on waste fittings, hot and cold water stops and supplies.

3.8 ACCESSORIES

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

C. Furnish and install accessories for all insulation types listed in this Section.

3.9 PIPE FITTING INSULATION COVERS

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

END OF SECTION 22 07 00

SECTION 22 08 00 - COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. See Division 01, General Requirements for overall objectives and comply with requirements.
2. This section covers the Contractor's responsibilities for commissioning; installer responsible for installation of a particular system or equipment item to be commissioned is responsible for commissioning activities relating to that system or equipment item.
3. Plumbing systems to be commissioned will include the following:
    a. Sanitary Waste and Vent.
    b. Roof and Storm Drainage.
    c. Sump/ejector pumps.
    d. Domestic water booster pumps.
    e. Domestic water heaters.
    f. Domestic hot water circulating pumps.
    g. Domestic cold water distribution.
    h. Domestic hot water distribution.
    i. Plumbing fixtures.
4. Pre-Functional Checklist and Functional Test requirements specified in this Section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. Meet requirements of ASHRAE Guideline 0, The Commissioning Process.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, provide Pressure Tests, Flushing Reports, and Startup Reports. Submit for approval of Commissioning Authority.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Commissioning, inspecting, and testing will not modify terms or time periods of mechanical equipment, systems, and controls warranties including related equipment and system, and adjacent work.
2. Control system warranty period starts from date of Commissioning Agent acceptance.

1.7 COORDINATION

A. Reference Section 01 91 13, General Commissioning Requirements for requirements pertaining to coordination during the commissioning process.

1.8 PURPOSE

A. Purpose of commissioning process is to provide Owner assurance that systems have been installed in prescribed manner and will operate within performance guidelines. Commissioning is intended to enhance quality of system startup and aid in orderly transfer of systems to beneficial use by Owner.

B. Commissioning procedures and results will be observed by Commissioning Authority or Owner's staff. Contractor is expected to verify functional readiness of systems to be tested prior to performing the tests in presence of Owner's witness. A high rate of test failure will indicate that Contractor has not adequately verified readiness of systems.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become property of Owner.

B. Specialized tools, test equipment, and instruments required to execute Start-up, checkout, and testing of equipment are to be of sufficient quality and accuracy to test and/or measure system performance within specified tolerances. A testing laboratory must have calibrated its test equipment within the previous 12 months. Calibration to be NIST traceable. Contractor must calibrate test equipment and instruments according to manufacturer's recommended intervals and whenever the test equipment is dropped or damaged. Calibration tags must be affixed to the test equipment or certificates readily available.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become property of Owner.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cooperate with Commissioning Authority in development of the Pre-Functional Checklists and Functional Test Procedures.

B. As part of required submittals for contract, within three months of award of contract, submit for each piece of equipment and controls, manufacturer's startup and installation procedures as well as controls point-to-point and sequence checkout and provide in check list format.

C. Furnish additional information requested by the Commissioning Authority.

D. Prepare a preliminary schedule for plumbing pipe systems testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update schedule as appropriate.

E. Notify Commissioning Authority when pipe system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that Commissioning Authority has scheduling information needed to efficiently execute commissioning process.

F. Put equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

G. Provide temperature and pressure taps in accordance with Contract Documents.

H. Provide a pressure/temperature plug at each water sensor which is an input point to control system.

3.2 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the Commissioning Authority.

B. Participate in Plumbing systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the Commissioning Authority.

C. Provide information requested by the Commissioning Authority for final commissioning documentation.

D. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.

E. Prepare preliminary schedule for Plumbing system orientations and inspections, operation and maintenance manual submissions, training sessions, pipe and duct system testing, flushing and cleaning, equipment startup, testing and balancing and task completion for Owner. Distribute preliminary schedule to commissioning team members.

F. Update schedule as required throughout the construction period.

G. During the startup and initial checkout process, execute the related portions of the Pre-Functional Checklists for commissioned equipment.

H. Contractor to participate and complete checklists using the Commissioning Authority's web based commissioning software Facility Grid. A desktop, laptop, tablet, or iPad will be required.

I. Assist the Commissioning Authority in verification and Functional Performance Tests.

J. Gather operation and maintenance literature on equipment and assemble in binders as required by the Specifications. Submit to Commissioning Authority 45 days after substantial completion.

K. Coordinate with the Commissioning Authority to provide 48 hour advance notice so that the witnessing of equipment and system startup and testing can begin.

L. Notify the Commissioning Authority a minimum of one week in advance of the time for the start of the balancing work.

M. Participate in, and schedule vendors and contractors to participate in the training sessions.

N. Provide written notification to the CM/GC and Commissioning Authority that the following work has been completed in accordance with the Contract Documents, and that the equipment, systems, and sub-system are operating as required.

1. Plumbing equipment including domestic water heaters, pumps, plumbing fixtures, and other equipment furnished under this Division.
2. Gas piping, sanitary waste and vent piping, storm drainage piping, sump pumps and automatic sprinkler system.

O. Provide training of the Owner's operating staff using expert qualified personnel, as specified.

P. Reference Section 01 91 13, General Commissioning Requirements, for additional contractor responsibilities.

3.3 OWNER'S RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for Owner's responsibilities.

3.4 DESIGN PROFESSIONAL'S RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for the Architect, Mechanical, Electrical, and Plumbing Engineer's responsibilities.

3.5 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for the Commissioning Authority's responsibilities.

3.6 TESTING PREPARATION

A. Certify, in writing, to the Commissioning Authority that plumbing instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pre-test setpoints have been recorded.

B. Certify, in writing, that discrepancies discovered during the test and balance process have been resolved and that testing, adjusting, and balancing is completed.

C. Set systems, subsystems, and equipment into operating mode to be tested (e.g. normal auto position, normal manual position, unoccupied mode, emergency power and alarm conditions.

D. Inspect and verify the position of each device and interlock identified on checklists.

E. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode operation.

3.7 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of Plumbing.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine capabilities of the control system toward completing TAB.

D. Provide necessary unique instruments and instruct TAB technicians in their use; such as handheld control system interface, etc.

E. Have required Pre-Functional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate controls to assist TAB technicians or provide sufficient training for TAB technicians to operate system without assistance.

3.8 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of Commissioning Authority.

B. Scope of Plumbing testing to include entire Plumbing installation. Testing to include measuring capacities and effectiveness of operational and control functions.

C. Test operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The Commissioning Authority along with the Plumbing contractor, balancing subcontractor to prepare detailed testing plans, procedures, and checklists for Plumbing systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever applicable.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the Commissioning Authority and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The Commissioning Authority may direct that setpoints be altered when simulating conditions is not practical.

H. The Commissioning Authority may direct that sensor values be altered with a signal generator when design or simulating conditions and altering setpoints are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the Plumbing system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

3.9 PLUMBING SYSTEMS, SUBSYSTEMS AND EQUIPMENT TESTING PROCEDURES

A. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment: Test requirements are specified in Division 22, Plumbing Piping sections. Plumbing Contractor to prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the Commissioning Authority. Plan should include the following.

1. Sequence of testing procedures for each section of pipe to be tested, identified by pipe zone or sector identifications marker. Markers to be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors to be formatted to allow each section to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing velocity.

B. Functional Performance Tests: Tests will be fully documented with test procedures, expected results for each procedure, and documented in either pass or fail. Tests are written by the Commissioning Authority and performed by the Contractor. The Commissioning Authority documents the results of the test.

3.10 DEFICIENCIES / NON-CONFORMANCE AND COST OF RETESTING

A. The Commissioning Authority documents the results of the tests. Corrections of minor deficiencies identified are made during the tests at the discretion of the Commissioning Authority. The Commissioning Authority documents the testing results on the Functional Performance Testing document. Deficiencies or non-conformance issues are noted and reported to the GC and Owner via the Master Cx Issues/Resolutions Log. The Contractor with then correct deficiencies, notify the Commissioning Authority of the correction, and then schedule retesting of the issue with the GC and Commissioning Authority. For areas in dispute of the issue between the Commissioning Authority and Contractor to go directly to the A/E. A/E to provide direction of the design intent and expected result to clear up the dispute.

B. If the Plumbing contractor fails to demonstrate proper sequence of operation in any of the second round of Functional Performance Tests, the Commissioning Authority's costs for witnessing further demonstration of that test procedure may be assigned to the Plumbing contractor by the Owner as a deduct to their contracted price. The Plumbing contractor will not be responsible for costs related to failure due to design or other factors beyond their control, though it is expected to call any design concerns (and other factors beyond their control that might cause failure) to the attention of the GC and Commissioning Authority.

C. Reference Section 01 91 13, General Commissioning Requirements for additional contractor responsibilities

3.11 OPERATION AND MAINTENANCE MANUALS

A. See Division 01, General Requirements for additional requirements.

B. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

C. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.12 DEMONSTRATION AND TRAINING

A. See Division 01, General Requirements for additional requirements.

B. Demonstrate operation and maintenance of Plumbing systems to Owner's personnel; if during any demonstration, system fails to perform in accordance with information included in Operations and Maintenance (O&M) manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Pre-Functional Checklists and demonstrations to Commissioning Authority during Functional Testing.

D. Training:

1. Submit a written training plan to the Owner and Architect/Engineer for review and approval. Contractor's training plan to cover the following elements:
    a. Equipment included in training.
        1) Intended audience.
        2) Location of training.
        3) Objectives.
    b. Subjects covered.
    c. Duration of training on each subject.
    d. Instructor for each subject.
    e. Methods (classroom lecture, video, Site walk-through, actual operational demonstrations, written hand outs, etc.).
    f. Instructors and qualifications.
2. Contractor is to have the following training responsibilities:
    a. Provide a training plan ten calendar days prior to the scheduled training, in accordance with Division 01, General Requirements.
    b. Provide Owner personnel with comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of commissioned mechanical equipment or system.
    c. Training to start with classroom sessions, if necessary, followed by hands-on training on each piece of equipment, which will illustrate the various modes of operation, including start-up, shutdown, fire/smoke alarm, power failure, etc.
    d. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
    e. The appropriate trade or manufacturer's representative will provide the instructions on each major piece of equipment. This representative may be the Start-up technician for the piece of equipment, the installing contractor, or the manufacturer's representative. Practical building operating expertise, as well as in-depth knowledge of modes of operation of the specific piece of equipment, is required. More than one party may be required to execute the training.

E. Provide the services of manufacturer representatives to assist instructors where necessary.

END OF SECTION 22 08 00

SECTION 22 10 00 - PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Buried Within 5-feet of Building
2. Sanitary, Drainage (Rain/Stormwater) DWV Piping, Above Grade
3. Water Piping, Buried Within 5-feet of Building
4. Hot and Cold Domestic Water Above Grade
5. Condensate Piping
6. Primer Piping
7. Piping Specialties
8. Cleanouts

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NSF 61, Annex G.
2. Steel pipe to conform to ASTM and ANSI Standards as specified in this Section.
3. Copper piping to conform to ASTM B88, B306 and B208 and the standards of Copper Development Association (CDA), and American Welding Society, (AWS).
4. Cast Iron Piping to conform to standards of ASTM A-74, CISPI 301 and FM 1680.
5. Manufacturer's Standards Society (MSS) for valving and support reference standard.
6. American Water Works Association (AWWA) for Valving Assembly Standards.
7. American Society of Sanitation Engineers (ASSE) for Valving Standards.
8. American National Standards Institute (ANSI) for Piping Standards.
9. NFPA Standard 51B - “Fire Prevention in Use of Cutting and Welding Processes.”
10. Crosslinked polyethylene (PEX) pipe conforming to ASTM F876, F877 and CSA B1375, or DIN 16892 and 16893.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. See component manufacturers listed in individual articles below.

B. ADS

C. American-USA

D. Cerro

E. Charlotte

F. Clamp-All

G. Conbraco/Apollo Press

H. Elkhart

I. Enfield

J. Fuseseal

K. Gruvlok

L. Husky

M. Ideal

N. Mifab

O. Mission

P. Mueller

Q. Nibco

R. Orion

S. Shurjoint Mechanical Couplings

T. Sioux Chief

U. Spears

V. Tyler

W. Uponor

X. Viega

Y. Zurn

Z. Or approved equivalent.

AA. Cleanouts:

1. J.R. Smith
2. Mifab
3. Sioux Chief
4. Wade
5. Watts
6. Zurn
7. Or approved equivalent.

BB. Firestopping Penetrations in Fire Rated Wall Floor Assemblies:

1. Hilti
2. Proset
3. Or approved equivalent.

2.2 GENERAL

A. Provide pipe, tube, and fittings of the same type, fitting requirements, grade, class, and the size and weight indicated or required for each service, as indicated in other Division 22, Plumbing Specifications. Where type, grade, or class is not indicated, provide proper selection as determined by installer for installation requirements, and comply with governing regulations and industry standards.

B. Manufactured materials delivered, new to the project site and stored in their original containers.

C. Product Marking: Furnish each item with legible markings indicating name brand and manufacturer, manufacturing process, heat number and markings as required per ASTM and UL/FM Standards.

2.3 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, BURIED WITHIN 5-FEET OF BUILDING

A. PVC Pipe: ASTM D 2665 IPS Schedule 40, **SOLID WALL** piping for drainage/waste and vent (DWV).

1. Fittings: PVC DWV ASTM D2665.
2. Joints: Solvent welded, with ASTM D2564 solvent cement, 2-step glue (primer and glue) is required.

2.4 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE

A. PVC Pipe: ASTM D 2665 IPS Schedule 40, **SOLID WALL** piping for drainage/waste and vent (DWV).

1. Fittings: PVC DWV ASTM D2665.

2. Joints: Solvent welded, with ASTM D2564 solvent cement, 2-step glue (clear primer and glue) is required.

2.5 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

A. Copper Pipe: ASTM B88, hard drawn, Type K (A).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
2. Joints: Brazed - BCuP2.

B. Ductile Iron Pipe: AWWA C151/A21.51.

1. Fittings: Ductile or gray iron, standard thickness.
2. Joints: AWWA C111/A21.11, rubber gasket with 3/4-inch diameter rods, mega lug type.

2.6 HOT AND COLD DOMESTIC WATER ABOVE GRADE

A. Copper Tube: 3-inches and above. ASTM B88 (ASTM BA88m), Type K (A), Drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: Brazed BCuP2.

B. Copper Tube: 2-1/2-inches and smaller. ASTM B88 (ASTM B88M), Type L (B), Drawn.

1. Fittings: ASME B16.18 copper.
2. Joints: ASTM B32, alloy Sn95 solder.

C. Cross-Linked Polyethylene Tubing - Type "A" - Engle Method - Fittings and Accessories (except exposed locations).

1. Tubing:
   a. Cross-linked polyethylene (PEX) tubing complies with requirements of ASTM F876 and F877, and cross-linking method must be Type A (hot) method.
   b. PEX tubing to have minimum working pressure of not less than 160 PSI for water at 73.4 degrees F, 100 PSI for water at 180 degrees F and 80 PSI for water at 200 degrees F determined in accordance with Plastic Pipe Institute Technical Report TR-3/92, and listed in Plastic Pipe Institute Technical Report TR-4/95.
   c. Co-extruded – “colored piping” (blue/red) is not to be utilized.
2. Fittings:
   a. Fittings: Engineered Plastic Fittings for above grade applications. Engineered plastic fittings for below grade applications. Serrated type with reinforcement rings.
   b. Reinforcement Rings: Manufactured using "Engel Method" to ensure that viscoelastic stress regenerative properties are sufficient to produce pressure tight seal.
   c. Fitting Insert: Of such dimension in that tubing must be expanded in order to facilitate insertion of fitting into tube.
   d. Accomplish expansion of tubing and ring by an expansion tool designed expressly for that purpose.
   e. Fittings complies with requirements of ASTM F877.
3. Manifolds: Provide premanufactured copper manifolds of same manufacturer as piping.
4. Stub-out Ells and Stub-out Brackets: Provide premanufactured Type L copper stub-out ells and copper stub-out brackets.

2.7 CONDENSATE PIPING

A. Copper Tube: ASTM B 88 (ASTM B898M), Type K (A), L (B), or M (C).

1. Fittings: ASME B16.29, wrought copper.
2. Joints: ASTM B32, alloy Sn50 solder.

B. Use chemical resistant piping for drainage of condensate from combustion fuel sources (such as condensing boilers and water heaters), as noted in this Section for area of application.

C. CPVC (Chlorinated Polyvinyl Chloride) Pipe and Fittings - Except Exterior of the Building and in Plenums and Rated Assemblies:

1. Pipe and Fittings: Schedule 40, NSF-14, ASTM 439, IAPMO IS20-96, socket fittings, solvent weld.

2.8 PRIMER PIPING

A. Above Ground: Type L hard-drawn copper tubing with wrought sweat fittings and soldered joints.

B. Below Ground: Type L soft annealed copper tubing with wrought sweat fittings and brazed joints.

C. Below Ground: Cross-linked polyethylene (PEX) and engineered plastic fittings.

2.9 PIPING SPECIALTIES

A. Pipe Escutcheons:

1. Provide pipe escutcheons as specified with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime zinc base paint finish for unoccupied areas.
2. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide stainless steel, cast brass or sheet brass escutcheons, solid or split hinged.
3. Pipe Escutcheons for Dry Areas: Provide stainless steel escutcheons, solid or split hinged.

B. Low Pressure Y-Type Pipeline Strainers:

1. Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 percent of the working pressure of piping system with Type 304 stainless steel screens made with 1/16-inch perforations on 4-inch and smaller strainers, and 1/8-inch perforations on 6-inch and larger strainers.
2. Threaded Ends, 2-inch and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with plus.
3. Flanged Ends, 2-1/2-inch and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with hose bibb.

C. Air Vent with Valves:

1. Install automatic air vents in all closed and open-loop water systems at high points and at any other point necessary to free system of air. Provide shut-off valve in riser to each automatic vent valve to facilitate servicing. Manual type vent may be used in lieu of automatic type, where specifically shown on the Drawings.
2. Manufacturer: Hoffman #79.

D. Dielectric Waterways:

1. Provide standard products recommended by manufacturers in service indicated, which effectively isolate ferrous from non-ferrous piping (eliminating electrical conductance) to prevent galvanic action and stop corrosion.
2. Provide dielectric waterways or brass nipple fitting for transitions between dissimilar metal piping.

E. Unions:

1. Unions to comply with the following schedule:
   a. Black Steel, 2-inch and smaller: 150 PSI screwed malleable iron, ground joint, brass to iron seat.
   b. Black Steel, 2-1/2-inch and larger: 150 PSI cast iron screwed flanged, flat faced, full faced gasket.
   c. Soldered Copper or Brass Pipe, 2-inch and smaller: 150 PSI cast bronzed or copper, ground joint, non-ferrous seat with soldered ends.
   d. Screwed Copper or Brass Pipe, 2-inch and smaller: 150 PSI cast brass, ground joint, brass to brass seat, threaded ends.
   e. Flanged Copper or Brass Pipe, 2-1/2-inch and larger: Two 150 PSI cast bronze flanges.
   f. Manufacturer: EPCO, Mueller, Stanley G. Flagg, Watts, or approved equivalent.

F. Flexible Piping Connectors - Expansion Loops or Seismic Joints:

1. Provide flexible expansion loops of size and material noted on Drawings. Design flexible loops to impart no thrust loads on the anchors. The loop consists of two flexible sections of hose and braid, two 90 degree elbows, and a 180 degree return. Install loops in a neutral, precompressed, or pre-extended condition as required for the application. Provide drain plug for loops installed hanging down. Loops installed straight up may be fitted with an automatic air release valve to purge air from the high point of the loop. Loops installed in any position other than hanging down must have the 180 degree return supported.
2. Copper Pipe: Copper fittings, bronze hose and braid sweat solder ends, Metraloop Series MLS 8000.
3. Steel Pipe: Schedule 40 carbon steel fittings, stainless steel hose and braid.
4. Threaded Ends: Metraloop Series MLT 80000.
5. Flanged Ends: Metraloop Series MLF 80000.
6. Welded Ends: Metraloop Series MLW 80000.
7. Grooved Ends: Metraloop Series MLG 80000.
8. Gas Lines, CSA Approved: Metraloop - Gas MLT or MLF Series.
9. Provide expansion joints by Mason, Flexionics, or Shur Fit, for vertical and horizontal straight run hot water and domestic hot water recirculation piping exceeding 1,000-feet. Install per manufacturer's installation directions.

2.10 CLEANOUTS

A. Locate cleanouts as shown on Drawings and as required by local code. Cleanouts same size as pipe except that greater than 4-inches will not be required. Plastic components not allowed, except unless specifically noted.

B. Types:

1. Tile Floor Cleanouts: J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread, ABS plug and standard screws.
2. Carpeted Floor Cleanout: J. R. Smith 4020-X with carpet clamping frame, round heavy-duty nickel bronze top, taper thread, ABS plug, carpet clamping device and standard screws.
3. Concrete Floor Cleanout (General): J. R. Smith 4020 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard screws.
4. Parking, Drives and Concrete Floor Cleanouts (Heavy Load): J. R. Smith 4100 with round heavy-duty nickel bronze top, taper thread and ABS plug with standard screws.
5. Wall Cleanout: J. R. Smith 4472-U, countersunk bronze taper thread plug, stainless steel shallow cover and vandalproof screws.
6. Outside Area Walks: J. R. Smith 4020-U with round heavy-duty nickel bronze top, taper thread, ABS plug and top secured with vandalproof screws. Install in 18- by 18- by 6-inch deep concrete pad flush with grade.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Underground Piping Systems:

1. Examination: Verify that excavations are to required grade, dry, and not over-excavated.
2. Perform necessary excavation and backfill required for installation of plumbing work. Repair piping or other work at no expense to Owner.
3. Water: Keep excavations free of standing water. Re-excavate and fill back excavations damaged or softened by water or frost to original level with sand, crushed rock or other approved material at no expense to Owner.
4. Tests: During progress of work for compacted fill, Owner reserves right to request compaction tests made under direction of testing laboratory.
5. Trench Excavation: Excavate trenches to necessary depth and width, removing rocks, unstable soil (muck, peat), roots and stumps. Excavation material is classified as "base fill" and "native." Base fill excavation material consisting of placed crushed rock may be used as backfill above "Pipe Zone." Remove and dispose off site native excavation material. Adequate width of trench for proper installation of piping or conduit.
6. Support Foundations:
    a. Foundations: Excavate trenches located in unstable ground areas below elevation required for installation of piping to depth which is determined by Architect as appropriate for conditions encountered. Place and compact approved foundation material in excavation up to "Bedding Zone." Dewatering, placement, compaction and disposal of excavated materials to conform to requirements contained in other Specification Sections or Drawings.
    b. Over-Excavations: Where trench excavation exceeds required depths, provide, place and compact suitable bedding material to proper grade or elevation at no additional cost to Owner.

c. Foundation Material: Where native material has been removed, place and compact necessary foundation material to form base for replacement of required thickness of bedding material.

	Class A		Class B	
Material Passing	**Min.**	**Max.**	**Min.**	**Max.**
3/4-inch Square Opening	**27**	**47**	**0**	**1**

d. Bedding Material: Full bed piping on sand, pea gravel, or 3/4-inch minus crushed rock. Place minimum 4-inch deep layer of sand, pea gravel, or crushed rock on leveled trench bottom for this purpose. Remove bedding to necessary depth for piping bells and couplings to maintain contact of pipe on bedding for its entire length. Provide additional bedding in excessively wet, unstable, or solid rock trench bottom conditions as required to provide firm foundation.

7. Backfilling:
   a. Following installation and successful completion of required tests, backfill piping in lifts.
      1) In "Pipe Zone" place backfill material and compact in lifts not to exceed 6-inches in depth to height of 12-inches above top of pipe. Place backfill material to obtain contact with entire periphery of pipe, without disturbing or displacing pipe.
      2) Place and compact backfill above "Pipe Zone" in layers not to exceed 12-inches in depth.
   b. Backfill Material:
      1) Backfill Material in "Pipe Zone": 3/4-inch minus crushed rock, sand or pea gravel.
      2) Crushed rock, fill sand or other backfill material approved elsewhere in Specifications may be used above "Pipe Zone."
8. Compaction of Trench Backfill:
   a. Where compaction of trench backfill material is required, use one of following methods or combination thereof:
      1) Mechanical tamper,
      2) Vibratory compactor, or
      3) Other approved methods appropriate to conditions encountered.
   b. Architect to have right to change methods and limits to better accommodate field conditions. Compaction sufficient to attain 95 percent of maximum density at optimum moisture content unless noted otherwise on Drawings or elsewhere in Specifications. Water "puddling" or "washing" is prohibited.

B. General Installation:

1. Work performed by experienced journeyman plumbers. No exceptions.
2. Provide access panels for concealed valves, shock arrestors, trap primers and the like.
3. Install pipes and pipe fittings in accordance with recognized industry practices and manufacturer's recommendations.
4. Align piping accurately at connections, within 3/32-inch misalignment tolerance. Comply with ANSI B31 Code for Pressure Piping.

5. Locate piping runs, as indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details, and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2-inch where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1-inch clearance outside insulation. Whenever possible in finished and occupied spaces, conceal piping from view by locating it in column enclosures, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as indicated.
   a. Do not run piping through transformer vaults, telephone, elevator, electrical or electronic equipment spaces or enclosures unless indicated on Drawings.
   b. Concealed Piping Above Suspended Ceiling: Plan and coordinate to avoid interferences; install to maintain suspended ceiling heights shown on Architectural Drawings. Allow sufficient space above removable ceiling panels for panel removal. Locate piping so that valves are visible and accessible within 24-inches horizontally and vertically from point of access to the ceiling space. Provide plenum rated materials for ceiling spaces which are being used as plenums.
   c. Exposed Work: Run pipes parallel to the closest wall unless otherwise shown on Drawings; maintain maximum headroom; avoid light fixtures.
   d. Insulation Space Allowance: In piping work, allow space for pipe insulation and jackets. If interferences occur, move the piping to accommodate insulation thickness specified.
   e. Pipe Lengths: Do not use short lengths or nipples at locations where a full length of pipe will fit.
   f. Alignment Prior to Supporting and Anchoring: Place piping in proper alignment and position prior to connection to anchors, expansion loops, and equipment. Furnish jacking devices, temporary steel structural members, and assembled structures as necessary. Remove temporary equipment and structures supplied by contractor at completion; such items to remain Contractor property.
   g. Valve and Equipment Connections: Piping not to place undue stress on flanged valves and equipment connections. Install mating flange faces true and parallel to each other and not requiring springing of piping for assembly. Pipe hangers and supports to carry the full weight of the pipe and fluid.
   h. Piping Leaks: Correct immediately; use new materials; leak-sealing compounds or peening not permitted.
   i. Pressure Ratings of Fittings, Valves, and Devices in Piping Systems: Pressure rating to be equal to, or greater than, the maximum working pressure of the system.
   j. Equipment Vents and Drains: Provide for coils and vessels which contain water. Provide isolation valves and outlet valves at piping high and low points to permit venting and draining of the vessel without venting and draining connected piping. Provide hose connections and caps on drain lines.
   k. Escutcheon Plates: Where exposed insulated and uninsulated piping passes through walls, floors or ceilings; provide spring clip type. Provide plates on both sides of wall or floor.

C. Testing:

1. General:

a. Provide temporary equipment for testing, including pumps, compressors, tanks, and gauges, as required. Test piping systems before insulation (if any) is installed and remove or disengage control devices before testing. Where necessary, test sections of each piping system independently, but do not use piping valves to isolate sections where test pressures exceed local valve operating pressure rating. Fill each section with water, compressed air, or nitrogen and pressurize for the indicated pressure and time.
b. Notify Architect and local Plumbing Inspector 2 days before tests.
c. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.
d. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.
e. Send test results to Architect for review and approval and include in Operation and Maintenance Manual.

2. Testing of Pressurized Systems:
   a. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.
   b. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.
3. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.

D. Corrosive Soil Conditions:

1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's recommendations.
2. Provide epoxy coated cast iron pipe and fittings for drainage systems.
3. Obtain and review project soils report for verification of requirements concerning corrosive soils.

E. Protection:

1. Keep pipe openings closed by means of plugs or caps to prevent entrance of foreign matter. Protect piping, ductwork, fixtures, equipment and apparatus against dirty water, chemical or mechanical damage both before and after installation. Restore to its original condition or replace fixtures, equipment or apparatus damaged prior to final acceptance of work.

F. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:

1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

G. Cut piping squarely, free of rough edges and reamed to full bore. Insert piping fully into fittings.

H. Provide joints of type indicated in each piping system.

I. Thread pipe in accordance with ANSI/ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Remove excess cutting oil from piping prior to assembly. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

J. Sleeves:

1. Pipe Sleeves:
   a. Layout work in advance of pouring concrete, furnish, and set sleeves necessary to complete work.
   b. Floor Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Extend sleeve 1-inch above finished floor. Caulk pipes passing through floor with non-shrinking grout or approved caulking compound (Except DWV Piping penetrating a concrete slab set on finish grade), provide "Link-Seal" sleeve sealing system for concrete/slab penetrations which are below grade. Caulk/seal piping passing through fire rated building assembly with UL rated assemblies. Provide fire-rated assemblies per local AHJ requirements
   c. Wall Sleeves: Provide sleeves on pipes passing through concrete or masonry construction. Provide sleeve flush with finished face of wall. Caulk pipes passing through walls with non-shrinking caulking compound. Provide modular link sealing system for concrete penetrations which are below grade. Caulk/seal piping passing through fire-rated assemblies per local AHJ requirements.
   d. Beam Sleeves: Coordinate with trades for locations of pipe sleeves in reinforced concrete and steel beams. Indicate penetrations on structural shop drawings. See Drawings and Specifications for specific sleeve location limitations. Plumbing Drawings are diagrammatic. Offset piping as required to meet these limitations. Pipe sleeve locations must be indicated on reinforced concrete and steel beam shop drawings. Field cutting of beams not allowed without written approval of structural engineer. No extra costs allowed for failure to coordinate beam penetrations prior to reinforced concrete and steel beam shop drawing submittal.
2. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:
   a. Install fabricated pipe sleeve.
   b. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification.
   c. Seal each end airtight with a resilient nonhardening seal per code.
3. Piping penetrations through fire-rated (1 to 3 hour) assemblies:
   a. Select and install pre-engineered pipe penetration system in accordance with UL listing and manufacturer's recommendation.
   b. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E84.

3.2 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, BURIED WITHIN 5-FEET OF BUILDING

A. Excavation and Backfill:

1. See General Installation Requirements above.

B. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

C. Corrosive Soil Conditions:

1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.
2. Provide epoxy coated cast iron pipe and fittings for drainage systems.

D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

E. Sanitary and Storm Drainage:

1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.
2. Drains:
   a. Install drains to suit finished floor. Install drains and components per manufacturer's instructions. Slope flooring to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
   b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.

F. Epoxy Coated Cast Iron Pipe and Fittings: Coat the piping terminus of any cut piping with an applied epoxy per manufacturer's instructions. Denso Protal 7200 fast-cure epoxy repair coating.

3.3 SANITARY, DRAINAGE (RAIN/STORMWATER) DWV PIPING, ABOVE GRADE

A. Drainage, Waste and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

B. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:

1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

C. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.

D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

E. Sanitary and Storm Drainage:

1. Grade piping at a uniform pitch of 2 percent unless otherwise noted on Drawings.
2. Indirect Waste or Drain Piping: Extend piping to discharge as shown on Drawings. Maintain minimum air gap. Provide traps on indirect waste or drain piping exceeding 60-inches.
3. Fixture Carriers: Concealed fixture carriers for wall hung plumbing fixtures are specified in Section 22 40 00, Plumbing Fixtures.
4. Drains:
   a. Install drains to suit finished floor or roof surface. Install drains and components per manufacturer's instructions. Slope flooring to floor drain or sink a minimum of 1/2-inch below finished floor elevation.
   b. Install P-traps for hub drains, floor drains and floor sinks. P-traps to be of the same materials as soil and waste piping. Provide trap primer assembly for each drain or floor sink.
5. Wall Access Panel: Secure to wall framing and install so that flange forms a close fitting joint with the finished wall surface.
6. Heat trace and insulate P-traps exposed to freezing conditions. Provide heat trace and electronic components to Division 26 for installation.
7. Insulate horizontal branch lines from floor sinks, receptors and drains receiving cold discharge from equipment and appliances.

3.4 WATER PIPING, BURIED WITHIN 5-FEET OF BUILDING

A. Excavation and Backfill:

1. See General Installation Requirements above.

B. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.

C. Domestic Water:

1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
4. Use unions for piping connections to equipment.
5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.

6. Use reducers or increasers. Use no bushings.
7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.
8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
9. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.
10. Make ferrous to non-ferrous connections with dielectric fittings.
11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.
12. Through-Wall Pipes: Type 'L' copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ears in wall at through-wall pipes.
13. Provide drain valves at base of risers and at low points on the system.
14. Backflow Preventers: Pipe relief to nearest drain. Slope at 2 percent.

D. Sterilization of Domestic Water System:

1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.
3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.
4. Provide water line disinfections performed by a licensed contractor with training in potable water line disinfections.

E. Buried Pre-Insulated Pipe Installation:

1. Installation and Testing: Install and test products in accordance with manufacturer’s installation instructions.
2. Manufacturer’s installation instructions are to describe the following:
   a. Storage and handling of pipes.
   b. Trench preparation.
   c. Installing pipe.
   d. Installing accessories.
   e. Installing fittings.
   f. Building penetrations.
   g. Field insulation kits.
   h. Testing.

3.5 HOT AND COLD DOMESTIC WATER ABOVE GRADE

A. Water Piping: Eliminate air from system. Fill and test at 125 PSIG or minimum 1-1/2 times static pressure at connection to serving utility main for period of two hours with no loss in pressure.

B. Testing of Pressurized Systems:

1. Test each pressurized piping system at 150 percent of operating pressure indicated, but not less than 125 PSIG test pressure.

2. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 2 percent of test pressure.

C. Test hot and cold domestic water piping systems upon completion of rough-in and before connection to fixtures at hydrostatic pressure of 125 PSIG.

D. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:

1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

E. Solder copper tube and fitting joints with lead free nickel/silver bearing solder meeting ASTM Std. B-32, in accordance with IAPMO Is 3-93, ASTM B-828 and Copper Development Association recommended procedures. Clean joints by other than chemical means prior to assembly. "Shock" cooling is prohibited. Fluxes to be water soluble for copper and brass potable water applications, and meeting CDA standard test method 1.0 and ASTM B813-91. Apply solder until a full fillet is present around the joint. Do not apply solder and flux in such excessive quantities as to run down interior of pipe. Lead solder or corrosion flux not to be present at the jobsite.

F. Braze copper tube and fitting socket with BCuP series filler metal without flux. Use listed brazing flux for joining of copper tube to brass or bronze fittings, meeting AWS FB3A or FB3C. "Shock" cooling is prohibited. A continuous fillet is to be visible around the completed joint. After cooling, thoroughly remove flux residue with warm water and a brush prior to testing. Do not use BCuP filler on copper alloys containing over 10 percent nickel. Cap or plug piping during construction to prevent entry of foreign material.

G. Domestic Water:

1. "Piping" to include pipes, fittings, nipples, valves and accessories connected thereto.
2. Run piping generally parallel to the axis of the building, arranged to conform to the building requirements and to suit the necessities of clearance for other mechanical ducts, flues, conduits and work of other trades, and as close to ceiling or other construction as practical, free of unnecessary traps or bends.
3. Grade water supply piping for complete drainage of the system. Install hose bibbs at low points.
4. Use unions for piping connections to equipment.
5. Provide sufficient elbows, swings and offsets to permit free expansion and contraction.
6. Use reducers or increasers. Use no bushings.
7. Ream or file each pipe to remove burrs. Inspect each length of pipe and each fitting for workmanship and clear passageways.
8. Cover, cap or otherwise protect open ends of piping during construction to prevent damage to threads or flanges and prevent entry of foreign matter. Disinfect and sterilize water supply piping as specified. Furnish written report on final water quality results.
9. Install exposed connections to equipment with special care, showing no tool marks or threads at fittings and piping. No bowed or bent piping permitted.
10. Make ferrous to non-ferrous connections with dielectric fittings.
11. Use extra heavy pipe for nipples, where unthreaded portion is less than 1-1/2-inches. Use no close nipples. Use only shoulder-type nipples.
12. Through-Wall Pipes: Type 'L' copper tubing for through-wall pipes which connect to exposed stops at wall surface. Anchor the pipes in the wall; attach pipe with U-bolts to steel back-up plates or steel angles anchored in the wall. Provide wrought copper elbow which securely anchors ears in wall at through-wall pipes.

13. Provide drain valves at base of risers and at low points on the system.
14. Backflow Preventers: Pipe relief to nearest drain. Slope at 2 percent.

H. Sterilization of Domestic Water System:

1. General: Upon completion of tests and necessary replacements, thoroughly flush and disinfect domestic water piping.
2. Method: After thoroughly flushing system with water to remove sediment, fill system with a solution containing 50 parts per million of chlorine for not less than 24 hours or 200 parts per million of chlorine for not less than 3 hours. After retention, drain, reflush and return system to service.
3. Certification: Provide copy of domestic water chlorination certificate in each operations and maintenance manual.
4. Provide water line disinfections performed by a licensed contractor with training in potable water line disinfections.

3.6 CONDENSATE PIPING

A. Firestopping Penetrations in Fire-Rated Wall/Floor Assemblies:

1. Provide proper sizing when providing sleeves or core-drilled holes to accommodate penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet requirements of ASTM E814.

3.7 PRIMER PIPING

A. Excavation and Backfill:

1. See General Installation Requirements above.

B. Testing:

1. See General Installation Requirements above.

3.8 PIPING SPECIALTIES

A. Excavation and Backfill:

1. See General Installation Requirements above.

B. Drainage, Waste, and Vent Piping: Test in accordance with governing plumbing code or as follows: Test drainage and venting systems, with necessary openings plugged, to permit system to be filled with water and subjected to water pressure of minimum of 5 PSI head. System to hold water without water level drop greater than 1/2 pipe diameter of largest nominal pipe size within 24-hour period. Test system in sections if minimum head cannot be maintained in each section. 5 PSI head to be minimum pressure at highest joint.

C. Corrosive Soil Conditions:

1. Wrap steel, iron, copper or other metal piping materials/fittings with Protecto Wrap 200, 30 mils or greater. Maintain a 1/2-inch overlap and install per manufacturer's requirements.
2. Provide epoxy coated cast iron pipe and fittings for drainage systems.

D. Cast-Iron Joints: Comply with coupling manufacturer's Cast Iron Soil Pipe Institute Standards and installation instructions.

3.9 CLEANOUTS

A. Install in aboveground piping and building drain piping as indicated, as required by code; at each change in direction of piping greater than 135 degrees; at minimum intervals of 100-feet; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping. Select type to match adjacent building finish. Provide shop drawings to Architect to coordinate locations and types of cleanouts with Architect prior to installation.

B. Install wall cleanout at each urinal as required by code.

END OF SECTION 22 10 00

22 11 13 – FACILITY WATER DISTRIBUTION PIPING (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Piping inside the treatment building.

B. Related Requirements:

1. Section 22 05 17 “Sleeves and Sleeve Seals for Plumbing Piping (Water Supply).”
2. Section 22 05 29 "Hangers and Supports for Plumbing Piping.”
3. Section 33 00 00 “Pipe & Pipe Fittings: General Statement (Water Supply).”
4. Section 33 11 00 “Water Utility Distribution Piping (Water Supply).”

1.2 REFERENCES

A. National Sanitation Foundation (NSF International):

1. NSF 61 - Drinking Water System Components – Health Effects

1.3 SUBMITTALS

A. See Section 01 33 00 “Submittal Procedures.”

B. Product Data: Provide data on pipe materials, pipe fittings, expansion joint fittings, flex fittings, valves, accessories and miscellaneous products. Provide manufacturer’s catalog information and manufacturer’s certification. Indicate valve and data ratings.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Pressure test results on all piping systems, see “Section 33 11 00 “Water Utility Distribution Piping (Water Supply)” for requirements.

1.4 Project Record Documents: Record actual locations of pipe, valves, and connections. Contractor records and drawings shall be submitted with as-built submittals. Contractor to maintain as-built throughout the project duration during construction on-site.

1.5 Operation and Maintenance Manuals consistent with Section 01 79 00 “Demonstration and Training.”

1.6 QUALIFICATIONS

A. Installer: All water system work outlined shall be performed by a company specializing in performing work of this section with a minimum of 5 years documented experience. This includes documented experience with plumbing piping in interior buildings.

1.7 DELIVERY, STORAGE, PROTECTION AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Deliver and store piping covered to protect piping from ultraviolet UV exposure.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of the completed system.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. All materials coming into contact with potable water shall be NSF 61 certified.

2.2 WATER PIPE

A. PVC Pipe

1. ASTM D 1785 schedule 80.
2. Solvent Weld.

2.3 FITTINGS

A. General: Bolts, nuts and washers used for securing fittings shall be of similar materials. Steel bolts shall meet the requirements of ASTM A 307 or ASTM 568 for carbon steel or ASTM F 593 or ASTM F 738 for stainless steel. Nuts shall meet the requirements of ASTM A 563 for carbon steel or ASTM F 594 or ASTM F 836 for stainless steel. Iron bolts and nuts shall meet the requirements of ASTM A 536, grade 65-45-12.

B. PVC Pipe: Fittings for PVC pipe shall be schedule 80 solvent weld and meet the requirements of ASTM D2467.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The contractor shall inspect each pipe and fitting prior to installation to ensure that there are no damaged portions of the pipe. Pipe damage prior to completion of the project shall be repaired or replaced by the Contractor.

B. Handling: Pipe, fittings and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition.

C. Storage: Pipe should be stored, if possible, at the job site in unit packages provided by the manufacturer. Pipe should be stored in such a way as to prevent sagging or bending and

protected from exposure to direct sunlight by covering with an opaque material while permitting adequate air circulation above and around the pipe.

D. Ensure piping is sufficiently supported to bear weight of valves when installed.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or mechanical joints.

3.3 INSTALLATION

A. Maintain separation of non-potable water main from potable water sources in accordance with State code.

B. Install pipe to allow for expansion and contraction without stressing pipe or joints.

3.4 CONNECTIONS TO EXISTING WATER PIPE

A. Connection to existing water pipes shall be made where and as indicated on the drawings and as directed by the engineer. The sizes of pipe, fittings, valves and appurtenant items required to make connection shall correspond to the sizes of existing pipe and of project pipe.

B. Determine actual conditions of existing pipe and all fittings and appurtenant items required to make the connection; and have all materials needed on site prior to any shut down or cutting into existing pipes.

C. Connection which involves cutting into existing pipelines include: cutting and removing sections of existing pipe and fittings as required; cleaning and preparing ends of existing pipe as required for connection; furnishing and installing all new pipe, fittings and valves required to make the connection of project pipe to the existing pipe as indicated; and all appurtenant work required to complete the connection.

D. Connection to existing pipe shall be made at such times and within the time limits and according to the directions as agreed upon between the Contractor and the Engineer.

E. Contractor shall dispose of removed pipe in an approved manner.

3.5 CLEANING

A. Clean interior of piping systems thoroughly before installing.

B. Maintain pipe in clean condition during installation.

C. Before joining piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.

D. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.

E. At completion of work and prior to final acceptance, thoroughly clean work installed under these specifications. Clean fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes.

3.6 PRESSURE TEST

A. See “Section 33 11 00 “Water Utility Distribution Piping (Water Supply)” for requirements.

3.7 DISINFECTION OF WATER PIPING

A. See “Section 33 13 00 “Disinfecting Water Utility Distribution (Water Supply)” for requirements

END OF SECTION 22 11 13

22 12 23 – FACILITY STEEL, INDOOR POTABLE-WATER STORAGE PRESSURE TANKS (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bladder pressure tank in the treatment building.

B. Related Requirements:

1. Section 22 05 23.2 "General-Duty Valves for Plumbing Piping (Water Supply)" for pressure relief valve accompanying pressure tank.
2. Section 33 00 00 “Piping & Pipe Fittings: General Statement (Water Supply).”

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME):

1. ASME Section VIII – Boiler and Pressure Vessel Code - Pressure Vessels

B. National Sanitation Foundation (NSF International):

1. NSF 61 - Drinking Water System Components – Health Effects

1.3 SUBMITTALS

A. Submit for review and approval by Engineer before installation:

1. Manufacturer product info.
2. Manufacturer installation instructions.
3. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

B. Submit for review and approval by Engineer prior to project closeout:

1. Project Record Documents: Record actual locations of valves and equipment
2. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the project plans, State, and County standards.

B. All piping and components used in contact with drinking water shall comply with ANSI/NSF 61, Drinking Water System Components - Health Effects.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept equipment on site in shipping containers with labeling in place. Inspect for damage.

B. Protect equipment from entry of foreign materials and other damage by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 EXTRA MATERIALS

A. Provide manufacturer-recommended spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 BLADDER PRESSURE TANKS

A. Meet the following requirements:

1. Steel shell
2. Butyl rubber diaphragm
3. Stainless steel system connection
4. Maximum working pressure: 125 psi (minimum)
5. Pre-charged

B. Valves: Furnish gate, ball, or butterfly valves on waterline to each tank as shown in the drawings.

C. Pressure Relief Valves: Provide ASME Section VIII pressure relief valve between tank and isolation valve as shown on the Drawings.

D. Couplers: Provided couplers as shown on the Drawings to allow tanks to be easily removed for servicing.

E. Manufacturer:

1. Well-x-trol WX-202
2. Engineer approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install per manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

A. Section 01 40 00 "Quality Requirements" and Section 01 79 00 "Demonstration and Training."

END OF SECTION 22 12 23

SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Water Heaters Tank-Less Electric
2. Air Source Heat Pump Water Heaters
3. Domestic Expansion Tanks Non-ASME
4. Domestic Circulation Pumps - Close-Coupled, In-Line
5. Packaged Domestic Booster Pump System with Variable Speed Drive

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Seismic anchor details and calculations signed and stamped by licensed Washington structural engineer with equipment data.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NSF 61, Annex G compliant.
2. ISO 9001 Certified.
3. IAPMO Low Lead Certification.

C. Products approved for installation by state authorizing agency, no exceptions.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Water Heaters Tank-Less Electric:

1. Chronomite InstaFlow Micro Model M
2. EEMax
3. Stiebel Eltron
4. Or approved equivalent.

B. Air Source Heat Pump Water Heaters:

1. American
2. Aegis
3. Nyle
4. Laars
5. Or approved equivalent.

C. Domestic Expansion Tanks Non-ASME:

1. Bell and Gossett Series PT
2. American Wheatley
3. Amtrol
4. Armstrong
5. Watts
6. Or approved equivalent.

D. Domestic Circulation Pumps - Close-Coupled, In-Line:

1. Bell and Gossett Series
2. Armstrong
3. Grundfos
4. Paco
5. Taco
6. Or approved equivalent.

E. Packaged Domestic Booster Pump System with Variable Speed Drive:

1. System: ITT Bell and Gossett Series 70V Booster Pump System as manufactured by FlowTherm Systems.
2. EnviroSep
3. Federal Pump
4. Grundfos
5. QuantumFlo
6. Paco
7. Peerless
8. Precision
9. Syncro Flo
10. Or approved equivalent.

2.2 GENERAL

A. Reference Drawings for capacities and specific model numbers.

2.3 WATER HEATERS TANK-LESS ELECTRIC

A. System: Domestic water.

B. Factory assembled packaged tank-less electric water heater utilizing microprocessor for temperature control. Heat water ways with high temperature coil electrical heating elements. 150 PSI working pressure. Cast aluminum or steel jacket with baked enamel finish. Pilot light to indicate when unit is operating. Prewire heaters ready for single electrical connection and bear UL label. Heater capable of operation within minimum and maximum operating flow rates and pressures of fixtures served and system operating pressure

2.4 AIR SOURCE HEAT PUMP WATER HEATER

A. Construction

1. The system to be constructed of sheet metal, with RAL 9018 epoxy-polyester coating with removeable panels for ease of access during maintenance and installation.
2. All refrigerant piping to be TIG welded stainless steel.
3. The system to be suitable for indoor or outdoor installation and to operate at ambient temperatures as low as -4 degrees F without the need for supplemental heat and as high as 113 degrees F.
4. The heat pump water heating system to have an optional coil coating treatment option for coastal or poor air quality areas to protect against salt spray.
5. The system to have an optional cool recovery option available for the simultaneous production of hot and cold water.

B. Components

1. Compressor - Compressor to be a semi-hermetic piston type purposely design to be used for heating with refrigerant R744. The compressor to be equipped with thermal protection, oil level indicator light and crankcase electrical heater and is mounted on rubber vibration dampers to reduce the transmission of vibrations to the unit. The compressor to also be equipped with an internal oil cooling system.

C. Source Side Heat Exchanger (Evaporator)

1. The source side heat exchanger to consist of a coil with copper pipes and aluminum fins with a large exchange surface. De-icing resistance electric heaters to be integrated into the evaporator to be used during defrost cycles. An antifreeze resistance heater to be fitted at the bottom of the condensation collection tray to ensure the outflow of water is towards the drain. The finned tube bundle to be protected by metal mesh.

D. User Side Heat Exchanger (Gas Cooler)

1. The user side heat exchanger to consist of brazed plates made of AISI 316 stainless steel with closed cell thermal insulation along with a temperature probe for frost protection, connected to the control. The exchange of heat to take place in countercurrent to optimize the coefficient of performance (COP) and to allow the unit to reach high temperatures.

E. Optional: Cool Recovery

1. If selected, the cool recovery option provides a water source heat exchanger (evaporator), three-way water valve, flow switch, inlet and outlet temperature sensor, and control logic to select between air-source and water-source operation.
2. The cool recovery heat exchanger to consist of brazed plates made of AISI 316 stainless steel with closed cell thermal. The exchange of heat to take place in countercurrent flow to optimize the unit COP.

F. Fans

1. Axial fans to be directly coupled to the 6-pole electric motor with external rotor, protection rating IP 54. Each fan to be housed in shaped nozzles and include a protective safety grille in compliance with UNI EN 294.
2. Optional: An optional electrically commutated (EC) fan can be provided instead of the standard alternating current (AC) fans.

G. Refrigeration Circuit

1. Circuit to include the compressor, system side plate heat exchanger (gas cooler), regenerative heat exchanger, source side finned tube bundle (evaporator), inlet valves, electronic thermostatic expansion valve, high- and low-pressure switches, low pressure safety valve, high pressure safety valve, liquid receiver, and service taps.

H. Refrigerant Type

1. System to operate on the refrigerant type R744, also known as carbon dioxide (CO_2), and to have a global warming potential (GWP) of 1 and an ozone depletion potential (ODP) of 0.

I. Hydraulic Circuit

1. Optional: Circuit to feature an optional variable speed circulator pump on the system (primary) side. The circulator will be directly controlled by the control unit. Depending on the required water outlet set point, the flow rate will vary in order to reach the set temperature and to maximize the COP value.

J. Electrical Panel

1. Electrical panel to be able to control the utility set point temperature and manage the primary and domestic (secondary) circulator/pumps.
2. Panel to consist of a circuit breaker and isolating switch and fuses to protect the auxiliary and power circuits, compressor contractor, fan revolution regulator for condensation control, a pump relay or motor protection and contractor, and a microprocessor control with display of the main functions.

K. Dynamic Defrost Protection

1. Heat pump must have dynamic defrost cycle based on evaporation temperature with option for fixed defrost temperature option.
2. Defrost must be accomplished by integral resistance heating elements. Units that defrost based on a reverse cycle will not be accepted.
3. Unit must include an antifreeze resistance heating element fitted at the bottom of the condensation collection tray to ensure the outflow of water towards the drain.

L. Electronic High Pressure Control Valve

1. The valve to have a maximum operating temperature of at least 2031 psi and a maximum operating pressure difference of at least 1233 psi.
2. Control valve to ensure precise control even in operation at part loads.
3. Control valve to be constructed without the use of gears.

M. Circulation Pump

1. Optional: If selected, the circulation pump to be an internally mounted brushless variable speed pump powered by an EC motor with automatic power adjustment.

N. Electronic Control System

1. The controller to provide the option for external control by a central Building Management System.
2. Control system to feature an LCD touchscreen display, digital and probe inputs, analog and digital outputs, ethernet, USB, and mini-USB ports, and an internal clock.

O. Communications

1. The heat pump water heater to be an integrated component of a high-speed, peer-to-peer internetwork of ANSI/ASHRAE Standard 135, BACnet using native BACnet communications via RTU or IP/MSTP. System to also support Modbus networking.
2. The integrated LCD display to provide fast commissioning via user-friendly menu driven configuration.

P. Optional Aegis Sequencing Controller

1. Sequencer can control between two and six separate units installed in parallel.
2. Single point of connection for all system temperature sensors
3. System can manage secondary side (DHW) pump and optional anti-Legionella disinfection cycles.
4. Device can detect the thermal demand of the tank system, in order to activate the suitable number of units.
5. Automatically rotate lead-lag units to balance total run hours.
    a. Includes (9) 10 kΩ RTD temperature probes for installation in tanks and return piping to detect the water temperature stratification in the tank system.
    b. Digital I/O to dialogue with third party systems.
    c. Capable of operating on 120 VAC or 240 VAC single phase power. Maximum current draw 0.5 A.
    d. Sequencer communicates with Aegis heat pumps via Modbus IP ethernet connection.
    e. UL listed enclosure with IP 66 protection.
    f. The sequencer to provide the option for external control by a central Building Management System (BMS) via Modbus or BACnet.

2.5 DOMESTIC EXPANSION TANKS NON-ASME

A. Welded steel, constructed, tested and stamped in accordance with IAPMO Standards for working pressure of 125 PSI. Support floor mounted tanks with steel legs or base. Provide single flexible diaphragm securely sealed into tank to separate air charge from system water, to maintain design expansion capacity. Provide pressure gauge and air-charging fitting, and drain fitting. Diaphragm: Removable and replaceable in line.

2.6 DOMESTIC CIRCULATION PUMPS - CLOSE-COUPLED, IN-LINE

A. System: Domestic water

B. Description: Factory-assembled and tested, single-stage, close-coupled, in-line, seal-less centrifugal pump.

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
2. Casing: Bronze/stainless steel, with threaded companion-flange connections.
3. Impeller: Corrosion-resistant material.
4. Motor: Non-overloading at any point on pump curve, Single speed, unless otherwise indicated. Comply with requirements in Division 22 Section "Common Motor Requirements."

C. Capacities and Characteristics as per Drawings.

D. See detail on Drawings for pump controls.

2.7 PACKAGED DOMESTIC BOOSTER PUMP SYSTEM WITH VARIABLE SPEED DRIVE

A. System: Domestic Cold Water

B. Entire unit is to be delivered complete with operating controls and require only plumbing and electrical service connections.

C. Furnish and install prefabricated water pressure booster system. System capable of automatically providing constant system pressure.

D. System is based on a design pressure of 40 PSI residual and 35 PSI static. Contractor to field verify flow test numbers are correct.

E. Pressure for BP-1 set at 35 and 30 PSI - 4-feet above top of highest roof level.

F. System factory assembled, wired, electrically tested, hydrostatic pressure tested and shipped ready for field piping connection and wiring. Field startup by manufacturer is required for final acceptance.

G. Factory Test Certification: Factory certifies in writing that water pressure booster system and its component parts have undergone complete electric and hydraulic test prior to shipment. Test includes system operating flow test from zero to 100 percent design flow rate under specified suction and net system pressure conditions. Certification includes copies of test data as recorded by X-Y plotter. System test may be witnessed by Owner, Architect, or Engineer by reporting intent to do so to factory.

H. System furnished with suction and discharge headers constructed of welded stainless steel Schedule 10 pipe. Header pipe sizing designed for maximum of 8 fps velocity. Connections to headers flanged. Pipe welding performed by ASME Section IX certified welders. Piping built to ASME/ANSI B31.9 specifications.

I. Pressure gauges supplied on suction and discharge manifold headers and provided with stainless steel cases, glycerin filled, and rated for plus 1 or minus 1 percent accuracy. Gauges selected for operation at mid-scale.

J. System furnished with three pumps as listed on project schedule. Standard Bell and Gossett Series 1531 single stage centrifugal pumps with bronze-fitted construction and internally flushed mechanical seals. Pump casings to have vent and drain ports at top and bottom of casings.

K. Each pump fitted with isolation valves and union connections or flanges to facilitate future service requirements. Each pump furnished with silent check valve with bronze trim.

L. Common pump discharge header includes thermally activated purge valve built into header system for booster pumps to allow water to be purged to remote drain in event of system control failure.

M. Single point disconnect panel skid mounted and factory wired. Factory wiring includes variable frequency drive wiring, motor wiring, differential pressure switch wiring and low suction pressure switch wiring. Pressure transducer shipped loose for field installation at high point in system as standard for optimal performance. Transducer located next to hydropneumatic tank at 31st Level.

N. An ITT Bell and Gossett Technologic 500 Pump Logic Controller provided as pressure booster control panel. This is to be combination Pump Controller and Variable Frequency Drive in single enclosure.

O. Technologic pump logic controller assembly listed by and bear label of Underwriter's Laboratory, Inc. (UL) and Canadian Underwriter's Laboratory (CUL) and CE marked. Controller specifically designed for variable speed pump applications. Controller functions to proven program that safeguards against damaging hydraulic conditioning including:

1. Pump flow surges.
2. Hunting
3. Low suction pressure.
4. System over pressure.

P. Pump logic controller microcomputer based and hold its software in EPROM. On-line field modified data entries, such as setpoint, stored in EEPROM. EEPROM memory storage prevents accidental loss of data due to voltage surge or spike. In event of complete power outage, field preset values remain stored and able to be recalled by operator.

Q. Pump logic controller capable of receiving up to two discrete analog inputs from transmitters indicated on Drawings. It will then select analog signal that has deviated greatest amount from its setpoint. This selected signal will be used as command feedback input for hydraulic stabilization function to minimize hunting. Each input signal capable of maintaining different set point value. Controller capable of controlling up to three pumps in parallel. Scan and compare rate that selects command setpoint and process variable signal continuous and automatically set for optimum operation. Each sensor scanned every 2 milliseconds.

R. Controller have fused door interlock disconnect, local-off-remote switch, motor overload protection, diagnostic display, manual and automatic alternation, auto start of lag pump on lead failure and accept pump differential pressure switch signals for pump fail notification.

S. External transmitters furnished by ITT Bell and Gossett powered by Technologic Pump Logic Controller through quality integral 24 volt dc power supply and protected from reverse polarity of analog inputs. Overvoltage and short circuit protection on board. Hydraulic stabilization programs utilize proportional integral derivative control function. Proportional, integral and derivative values user adjustable over an infinite range. Pump logic controller self prompting. Fault messages displayed in plain English. Operator interface have following features:

1. Multi-fault memory and recall of last 10 faults and related operational data.
2. Red fault light, Yellow warning light, and Green power on light.
3. Soft-touch membrane keypad switches.

T. Display four lines, with 20 characters on three lines and eight large characters on one line. Actual pump information displayed indicating pump status.

U. Controller capable of performing the following pressure booster functions:

1. Low suction pressure cut-out to protect pumps against operating with insufficient suction pressure. This function resets automatically.
2. High system pressure cut-out to protect piping system against high pressure conditions. This function requires manual reset.
3. No flow shut down to turn the pumps off automatically when system demand is low enough to be supplied by hydropneumatic tank. No flow shutdown requires external flow meters, flow switches, nor pressure switches to determine when no flow condition exists.

V. The following hardwire communication features provided to BAS:

1. Remote system start/stop non-powered digital input.
2. Failure of any system component. Output closes to indicate alarm condition.
3. One 4-20 mA output with selectable output of:
    a. Frequency
    b. Process Variable
    c. Output Current
    d. Output Power

W. Entire booster system, including piping, wiring, and controls, UL listed.

X. Entire system pre-assembled onto heavy duty structural steel frame constructed of 4-inch minimum angle iron with channel iron pump bases. Frame welded in accordance with AWS D1.1 Specifications. Frame includes sturdy lifting and bolt-down clips.

Y. Provide remote hydropneumatic tank for domestic water system and included as part of booster pump system.

Z. Components pre-piped, wired, and tested prior to shipment. System hydrostatic tested, cleaned, flushed, and painted with an industrial grade of epoxy based enamel.

AA. Field plumbing connections required will be system suction and discharge headers, temp probe drain line, piping of hydropneumatic pressure tank with union ball valve, pressure gauge and drain provided.

BB. Field electrical connections required will be input power supply to the control panel and remote pressure transducer control wiring.

CC. Coordinate location of unit and electrical characteristics with Division 26, Electrical work.

DD. Unit mounted on housekeeping pad. Provide seismic anchor calculations for this equipment, stamped and signed by licensed Washington structural engineer.

EE. Manufacturer's representative provides system check and start-up service for the system.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

C. Orients so controls and devices needing service and maintenance have adequate access.

D. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

E. Connect water piping to units with shutoff valves and unions.

F. Equipment Rigging: Heavy duty rigging eye bolts for Crosby Group swivel hoist rings installed over pump access covers for removal or maintenance.

G. Equipment Start-Up:

1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
2. Start-up performed by authorized manufacturer's representative or agent. Provide credentials of start-up personnel to Architect and Owner's Authorized Representative for approval.
3. Remove and replace filters when start-up testing is executed.
4. Manufacturer adjusts operating parameters of equipment to compensate to elevation of 500-feet above sea level.
5. Architect, Commissioning Agent, and Owner's Authorized Representative will be notified 10 days prior to start-up and will be present at start-ups.
6. Provide written report from manufacturer's representative on results of start-up within 48 hours.
7. Technical Training of maintenance staff includes two hours minimum per each piece of equipment.
8. Seismic Verification:
    a. Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
    b. Contractor's Structural Engineer will test and verify in writing that seismic restraints have been installed in accordance with their details.

3.2 WATER HEATERS TANK-LESS ELECTRIC

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

C. Orients so controls and devices needing service and maintenance have adequate access.

D. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

E. Connect water piping to units with shutoff valves and unions.

3.3 AIR SOURCE HEAT PUMP WATER HEATERS

A. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

B. Connect water piping to units with shutoff valves and unions.

C. Equipment Start-Up:

1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
2. Start-up performed by authorized manufacturer's representative or agent. Provide credentials of start-up personnel to Architect and Owner's Authorized Representative for approval.
3. Remove and replace filters when start-up testing is executed.
4. Manufacturer adjusts operating parameters of equipment to compensate to elevation of 500-feet above sea level.
5. Architect, Commissioning Agent, and Owner's Authorized Representative will be notified 10 days prior to start-up and will be present at start-ups.
6. Provide written report from manufacturer's representative on results of start-up within 48 hours.
7. Technical Training of maintenance staff includes two hours minimum per each piece of equipment.
8. Seismic Verification: Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.

3.4 DOMESTIC EXPANSION TANKS NON-ASME

A. Precharge tank per manufacturers recommendation.

B. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

C. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

D. Orients so controls and devices needing service and maintenance have adequate access.

E. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

F. Connect water piping to units with shutoff valves and unions.

3.5 DOMESTIC CIRCULATION PUMPS - CLOSE-COUPLED, IN-LINE

A. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Orients so controls and devices needing service and maintenance have adequate access.

C. Connect water piping to units with shutoff valves and unions.

D. Provide lift check valves 5 diameters downstream of pump discharge for circulating pumps piped in a parallel configuration.

E. Equipment Start-Up:

1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
2. Architect, Commissioning Agent, and Owner's Authorized Representative will be notified 10 days prior to start-up and will be present at start-ups.
3. Seismic Verification:
    a. Contractor will retain structural engineer who will submit stamped and signed anchoring and restraint details on plumbing equipment with submittal data in accordance with Division 22, Plumbing requirements.
    b. Contractor's Structural Engineer will test and verify in writing that seismic restraints have been installed in accordance with their details.

3.6 PACKAGED DOMESTIC BOOSTER PUMP SYSTEM WITH VARIABLE SPEED DRIVE

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

C. Orients so controls and devices needing service and maintenance have adequate access.

D. Certificates: Submit appropriate Certificates of Shop Inspection and Data Report as required by provisions of ASME Boiler and Pressure Vessel Code.

E. Connect water piping to units with shutoff valves and unions.

F. Equipment Rigging: Heavy duty rigging eye bolts for Crosby Group swivel hoist rings installed over pump access covers for removal or maintenance.

G. Equipment Start-Up:

1. Start-up, test, and adjust equipment in accordance with manufacturer's start-up instructions. Check and calibrate controls.
2. Start-up performed by authorized manufacturer's representative or agent. Provide credentials of start-up personnel to Architect and Owner's Authorized Representative for approval.
3. Remove and replace filters when start-up testing is executed.

4. Manufacturer adjusts operating parameters of equipment to compensate to elevation of 500-feet above sea level.
5. Architect, Commissioning Agent, and Owner's Authorized Representative will be notified 10 days prior to start-up and will be present at start-ups.
6. Provide written report from manufacturer's representative on results of start-up within 48 hours.
7. Technical Training of maintenance staff includes two hours minimum per each piece of equipment.

END OF SECTION 22 30 00

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. General Plumbing Fixtures:
    a. China Fixtures, White Only
    b. Faucet Fittings
    c. Molded Resin or Stone Fixtures
    d. Shower Valves
    e. Stainless Steel Fixtures
    f. Thermostatic Mixing Valves
    g. Trench Drains
2. Carriers
3. Downspout Boot/Nozzle/Cover
4. Electric Water Coolers
5. Fixture Trim
6. Floor Drains
7. Floor Sinks
8. Flushometers - Water Closet/Urinal
9. Hose Bibbs
10. Hub Drains
11. Roof/Overflow Drains
12. Water Closet Seats
13. Drain Boxes
14. Water Supply Boxes

1.2 RELATED SECTIONS

A. Contents of Division 22, Plumbing and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Comply with lead free (less than or equal to 0.25 percent) products in drinking water systems.

2. NSF 61, Annex G, Drinking Water System Components, Compliant.
3. ISO 9001, Quality Management Standard Certified.
4. IAPMO Low Lead Certification.
5. Provide fixtures, faucets and accessories to meet barrier free requirements of the governing code with respect to plumbing fixtures provided for the physically handicapped.
6. Items approved for use by State of Washington.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 22 00 00, Plumbing Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. "Or approved equivalent" as defined in 22 00 00, Plumbing Basic Requirements. Substitution process requirements apply to approved equivalent products.

B. General Plumbing Fixtures: See Schedule on Drawings for type.

1. China Fixtures - White Only:
   a. American Standard
   b. Kohler
   c. Sloan
   d. Or approved equivalent.
2. Faucet Fittings:
   a. Public:
      1) American Standard
      2) Chicago
      3) Delta Commercial
      4) Moen Commercial
      5) Sloan
      6) Symmons
      7) T & S Brass
      8) Toto
      9) Or approved equivalent.
3. Molded Resin or Stone Fixtures:
   a. Fiat
   b. Mustee
   c. Stern Williams
   d. Or approved equivalent.
4. Shower Valves:
   a. Acorn
   b. Chicago
   c. Delta
   d. Moen
   e. Powers
   f. Symmons
   g. Zurn
   h. Or approved equivalent.
5. Stainless Steel Fixtures:
   a. Amerisink
   b. Elkay

c. Haws
d. Just
e. Moen
f. Or approved equivalent.

6. Thermostatic Mixing Valves:
   a. Bradley
   b. Powers
   c. Symmons
   d. Holby
   e. Or approved equivalent.
7. Trench Drains:
   a. Channel-Slope
   b. DuraTrench
   c. JR Smith
   d. PolyDrain
   e. Polycast
   f. Quazite
   g. Zurn
   h. Or approved equivalent.

C. Carriers:

1. JR Smith
2. Zurn
3. Or approved equivalent.

D. Downspout Boot/Nozzle/Cover:

1. JR Smith
2. Mifab
3. Sioux Chief
4. Zurn
5. Or approved equivalent.

E. Electric Water Coolers:

1. Elkay
2. Halsey-Taylor
3. Haws
4. Murdock
5. Oasis
6. Sunroc
7. Or approved equivalent.

F. Fixture Trim:

1. McGuire
2. Dearborn Brass
3. Oatey
4. Or approved equivalent.

G. Floor Drains:

1. Mifab

2. Sioux Chief
3. Smith
4. Wade
5. Watts
6. Zurn

H. Floor Sinks:

1. Commercial Enameling
2. Mifab
3. Sioux Chief
4. Smith
5. Wade
6. Watts
7. Zurn
8. Or approved equivalent.

I. Flushometers - Water Closet/Urinal:

1. American Standard
2. Delaney
3. Kohler
4. Sloan
5. Zurn
6. Or approved equivalent.

J. Hose Bibbs:

1. Chicago
2. JR Smith
3. Mifab
4. Wade
5. Woodford
6. Zurn
7. Or approved equivalent.

K. Hub Drains:

1. JR Smith
2. Zurn
3. Or approved equivalent.

L. Roof/Overflow Drains:

1. JR Smith
2. Mifab
3. Sioux Chief
4. Watts
5. Zurn
6. Or approved equivalent.

M. Water Closet Seats:

1. American Standard

2. Bemis
3. Kohler
4. Sloan
5. Or approved equivalent.

N. Drain Boxes:

1. IPS
2. Oatey
3. Sioux Chief
4. Or approved equivalent.

O. Water Supply Boxes:

1. IPS
2. Oatey
3. Sioux Chief
4. Or approved equivalent.

2.2 GENERAL PLUMBING FIXTURES

A. Review substitution request requirements in Division 01, General Requirements and 22 00 00, Plumbing General Requirements.

B. Reference Architectural Details for mounting height and location of fixtures.

C. Provide factory fabricated fixtures of type, style and material indicated on the plumbing fixture connection schedule shown on the Drawings. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by manufacturer, or required for complete installation. Where more than one type is indicated, selection is installer's option; but, fixtures of same type must be furnished by a single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

D. Provide fixtures complete with fittings, supports, fastening devices, bolt caps, faucets, valves, traps, stops and appurtenances.

E. Plumbing Fixture Thermostatic Mixing Valves:

1. Lavatories provide ASSE 1070 compliant mixing valves or multiple lavatories served by a single ASSE 1070 compliant mixing valve.
2. Sinks serviced with a single ASSE 1070 mixing valve or multiple sinks served by a single ASSE 1070 mixing valve.
3. Commercial kitchen handsinks provide ASSE 1070 mixing valves.
4. Janitor sinks or process/maintenance type sinks do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.
5. Hot water hose bibbs do not require ASSE 1070 mixing valves if operated by trained personnel. Provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

2.3 CARRIERS

A. Wall Hung Urinal: Zurn Z-1218-WS or Z-1222-WS. (JR Smith 637). Coupling type or plate type with bearing plate 200 lb. capacity.

B. Wall Hung Lavatory: Zurn Z-1231 (D). (JR Smith 700). Concealed arm or Plate type, 250 lb. capacity.

C. Wall Hung Drinking Fountain: Zurn Z-1225-BL (JR Smith 834-97-98). Plate type. 300 lb. capacity.

2.4 DOWNSPOUT BOOT/NOZZLE/COVER

A. See Schedule on Drawings for type.

2.5 ELECTRIC WATER COOLERS

A. See Schedule on Drawings for type.

2.6 FIXTURE TRIM

A. Traps: Provide heavy duty commercial grade traps on fixtures except fixtures with integral traps. Exposed traps will be chromium plated cast brass or 17 gauge chromium plated brass tubing.

1. Sink: McGuire 8912CDF.
2. Lavatory: McGuire 8902CDF.

B. Supplies and Stops: Lead free heavy duty commercial grade, chrome plated with brass stems. Stops: T-handle or Loose Key type.

1. Lavatory: McGuire LFH2165LK.
2. Sink: McGuire LFH2167LK.
3. Water Closets: McGuire.

C. Lavatory Grid Strainer: McGuire 155A.

D. Sink Grid Strainer: McGuire 152N.

E. Shower Grid Strainer: McGuire 1266.

F. Sink Basket Strainer: McGuire 151.

G. Trim barrier-free wrap for P-traps and supplies by McGuire, Pro-Wrap, Plumberex or True-bro.

H. Escutcheons: McGuire wrought brass deep bell.

I. Wax Rings and Toilet Bolts: WM Harvey No Seep No. 1 053065-N.

2.7 FLOOR DRAINS

A. See Schedule on Drawings for types.

2.8 FLOOR SINKS

A. See Schedule on Drawings for types.

B. Plastic components are not allowed.

2.9 FLUSHOMETERS - WATER CLOSET/URINAL

A. See Schedule on Drawings for types.

2.10 HOSE BIBBS

A. See Schedule on Drawings for types.

2.11 HUB DRAINS

A. See Schedule on Drawings for type.

2.12 ROOF/OVERFLOW DRAINS

A. See Schedule on Drawings for type.

B. Plastic components are not allowed.

2.13 WATER CLOSET SEATS

A. See Schedule on Drawings for type.

2.14 DRAIN BOXES

A. See Schedule on Drawings for type.

B. Provide fire rated ASTM E-84 rated boxes where required by building construction.

2.15 WATER SUPPLY BOXES

A. See Schedule on Drawings for type.

B. Provide fire rated ASTM E-84 rated boxes where required by building construction.

PART 3 - EXECUTION

3.1 GENERAL PLUMBING FIXTURE INSTALLATION INFORMATION

A. Verification of Conditions:

1. Examine rough-in work of water supply and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping and other unsatisfactory conditions for installation of plumbing fixtures.
2. Examine walls, floors and cabinets for suitable conditions where fixtures are to be installed.

3. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings and pertinent codes and regulations, design and referenced standards.
4. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
5. Install a stop valve in a readily accessible location in water connection to each fixture.
6. Install escutcheons at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Seal fixtures to walls and floors using silicone sealant Dow Corning No. 780 or approved equivalent. Match sealant color to fixture color.
8. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
9. Inspect each unit for damage prior to installation. Replace damaged fixtures.
10. Replace washers or cartridges of leaking or dripping faucets and stops.
11. Clean fixtures, trim and strainers using manufacturer's recommended cleaning methods and materials.
12. During construction, cover installed fixtures, drains, sinks and water coolers with cardboard and wrap with sheet plastic.
13. Provide trap primers for floor drains, floor sinks, trench drains and hub drains.
14. Install roof and overflow roof drains per architectural details. Cover drains during roof construction to protect drain. Provide offsets or expansion joints at each roof/overflow drain.
15. Do not use lead flashing.

B. Owner Furnished Equipment:

1. Rough-in and make final connections to Owner furnished equipment. Provide necessary items to complete installation.
2. Comply with requirements of this Section and Drawings for installation procedures.

C. Adjusting and Cleaning: Clean plumbing fixtures, trim, and strainers of dirt and debris upon completion of installation. Adjust water pressure at drinking fountains, faucets, shower valves and flush valves to provide proper flow stream and specified GPM. Repair leaks at faucets and stops.

D. Extra Stock: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner.

E. Field Quality Control: Upon completion of installation of plumbing fixtures, test fixtures to demonstrate capability and compliance with Specifications. Correct or replace malfunctioning units at site, then retest to demonstrate compliance.

F. Protection: Protect fixtures and equipment from damage. Cover finished fixtures with cardboard and sheet plastic. Fixtures are not to be used during construction. Replace damaged items with new.

G. Signage: For fixtures that do not have ASSE 1070 mixing valve protection for hot water temperature, provide signage per Section 22 05 53, Identification for Plumbing Piping and Equipment.

3.2 CARRIERS INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

C. Coordinate wall thickness so carrier has adequate depth to be concealed.

3.3 DOWNSPOUT BOOT/NOZZLE/COVER INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.4 ELECTRIC WATER COOLER INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.5 FIXTURE TRIM INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.6 FLOOR DRAINS INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.7 FLOOR SINK INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid. Set fixture rim/grate flush with surrounding finish surface unless specifically noted otherwise.

3.8 FLUSHOMETERS - WATER CLOSET/URINAL INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.9 HOSE BIBB INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.10 HUB DRAINS INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.11 ROOF/OVERFLOW DRAINS INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.12 WATER CLOSET SEAT INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.13 DRAIN BOX INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

3.14 WATER SUPPLY BOX INSTALLATION

A. Install components in accordance with manufacturer's instructions and approved product data submittals.

B. Set plumb, level and rigid.

END OF SECTION 22 40 00

22 45 19 – SELF-CONTAINED EYEWASH EQUIPMENT (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Self-contained emergency eyewash station located in the treatment building.

1.2 REFERENCES

A. American National Standards Institute (ANSI).

B. American Society of Mechanical Engineers (ASME).

C. National Fire Protection Association (NFPA).

D. Occupational Safety and Health Administration (OSHA).

E. Underwriters Laboratories, Inc. (UL).

1.3 SUBMITTALS

A. Submit as specified in Section 01 33 00 “Submittal Procedures.”

B. Product Data: Submit data on eyewash station and associated appurtenances.

C. Manufacturer’s Certificate: Submit Statement of Compliance, supporting data, from material supplies attesting that eyewash station and accessories provided meet or exceed AWWA Standards and specification requirements.

D. Requirements for warranties: Section 01 77 00 “Closeout Procedures.”

E. Furnish manufacturer’s warranty for eyewash station.

1.4 QUALITY ASSURANCE

A. Regulatory requirements:

1. As applicable, equipment of this Section shall comply with the requirements of state and local jurisdictions, as well ASME, NFPA, OSHA and UL regulations.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping: Deliver to the job site in manufacturer's original containers.

B. Delivery: After wet operations in building are completed.

C. Storage and protection:

1. Store materials in original, unopened containers in compliance with manufacturer's printed instructions.
2. Keep materials dry until ready for use.
3. Keep packages of material off the ground, under cover, and away from sweating walls and other damp surfaces.
4. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with a protective covering.

PART 2 - PRODUCTS

2.1 SELF-CONTAINED EMERGENCY EYEWASH STATION

A. General design requirements:

1. Wall mounted, gravity flow portable eyewash with dual spray heads.
2. Material: Polyethylene.
3. 16-gallon solution tank.
4. Eyewash flow rate: 8 gallons over 15 minutes, minimum.
5. Wastewater drain built into unit.
6. Meet or exceed all requirements of ANSI Z358.1, current edition.
7. Provide ANSI compliant identification sign and markings.

B. Manufacturers and Products:

1. Guardian G1540.
2. Engineer approved equal.

PART 3 - EXECUTION (Not Used)

END OF SECTION 22 45 19

SECTION 23 00 00 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC) BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 23 00 00, HVAC Basic Requirements applies to Division 23, HVAC work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of heating, ventilating and air conditioning systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work provided.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 23, HVAC Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:
   a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
   b. Drawings
   c. Addenda
   d. Owner/Architect Agreement
   e. Owner/Contractor Agreement
   f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 01, General Requirements, individual Division 23, HVAC Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of Washington:
   a. IBC - International Building Code
   b. IFC - International Fire Code
   c. IMC - International Mechanical Code
   d. NEC - National Electrical Code
   e. UPC - Uniform Plumbing Code
   f. WAC - Washington Administrative Code
   g. WSEC - Washington State Energy Code

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABMA - American Bearing Manufacturers Association
2. ADA - Americans with Disabilities Act
3. AHRI - Air-Conditioning Heating & Refrigeration Institute
4. AMCA - Air Movement and Control Association
5. ANSI - American National Standards Institute
6. ASCE - American Society of Civil Engineers
7. ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers
8. ASHRAE Guideline 0, The Commissioning Process
9. ASME - American Society of Mechanical Engineers
10. ASPE - American Society of Plumbing Engineers
11. ASSE - American Society of Sanitary Engineering
12. ASTM - ASTM International
13. AWWA - American Water Works Association
14. CFR - Code of Federal Regulations
15. CGA - Compressed Gas Association
16. CISPI - Cast Iron Soil Pipe Institute
17. EPA - Environmental Protection Agency
18. ETL - Electrical Testing Laboratories
19. FM - FM Global
20. GAMA - Gas Appliance Manufacturers Association
21. HI - Hydraulic Institute Standards
22. IAPMO - International Association of Plumbing & Mechanical Officials
23. IFGC - International Fuel Gas Code
24. ISO - International Organization for Standardization
25. MSS - Manufacturers Standardization Society
26. NEC - National Electric Code
27. NEMA - National Electrical Manufacturers Association
28. NFPA - National Fire Protection Association
29. NFGC - National Fuel Gas Code
30. NRCA - National Roofing Contractors Association
31. NSF - National Sanitation Foundation
32. OSHA - Occupational Safety and Health Administration
33. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Inc.

34. TEMA - Tubular Exchanger Manufacturers Association
35. TIMA - Thermal Insulation Manufacturers Association
36. UL - Underwriters Laboratories, Inc.

D. See Division 23, HVAC individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as specific individual Division 23, HVAC Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail and be native/searchable PDF format. Scanned copies are not acceptable. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. At Contractor’s option, four separate submittals may be provided, consisting of long lead items, underground/site work, building work, and building automation system. Deviations will be returned without review.
3. Product Data: Provide Manufacturer's descriptive literature for products specified in Division 23, HVAC Sections.
4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the Specifications and Drawings.
    a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
    b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 23, HVAC Specification Sections for specific items required in product data submittal outside of these requirements.
    c. Provide pump curves, operation characteristics, capacities, ambient noise criteria, etc. for equipment.
    d. For vibration isolation of equipment, list make and model selected with operating load and deflection.

e. See Division 23, HVAC individual Sections for additional submittal requirements outside of these requirements.

5. Maximum of two reviews of submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required by Division 23, HVAC Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
    a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
    b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties proposing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent," a substitution request must be submitted to Engineer for approval prior to bid.
11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, equipment, ductwork and piping layout plans, and control wiring diagrams. Reference individual Division 23, HVAC Specification Sections for additional requirements for shop drawings outside of these requirements.
    a. Provide Shop Drawings indicating access panel locations for items that require Code or maintenance access, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.
13. Resubmission Requirements:
    a. Make any corrections or change in submittals when required. Provide submittals as specified. The Engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
        1) Resubmit for review until review indicates no exception taken or make "corrections as noted."

2) When submitting drawings for Engineer's re-review, clearly indicate changes on drawings and "cloud" any revisions. Submit a list describing each change.

14. Operation and Maintenance Manuals, Owner's Instructions:
    a. Submit, at one time, electronic files (native/searchable PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
        1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
        2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: belts, motors, lubricants, and filters.
        3) Include Warranty per Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Sections.
        4) Include product certificates of warranties and guarantees.
        5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
        6) Include copy of startup and test reports specific to each piece of equipment.
        7) Include copy of final air and water systems balancing log along with pump, fan and distribution system operating data.
        8) Include commissioning reports.
        9) Include copy of valve charts/schedules.
        10) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
    b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 23 00 00, HVAC Basic Requirements Article titled "Demonstration."
    c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
15. Record Drawings:
    a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of cleanouts, and location of concealed mechanical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
    b. Record Drawings are to include equipment and fixture/connection schedules, control dampers, fire smoke dampers, fire dampers, valves, bottom of pipe, duct and equipment elevations and dimensioned locations for all distribution systems (hydronic and air). Invert elevations and dimensioned locations for underground systems below grade to 5-feet outside building that accurately reflect "as constructed or installed" for project.

c. At completion of project, input changes to original project Revit Model and make one set of black-line drawings created from Revit Model in version/release equal to contract drawings. Submit Revit Model and drawings upon substantial completion.
d. See Division 23, HVAC individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., piping) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturers' written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

G. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

H. ASME Compliance: ASME listed water heaters and boilers with an input of 200,000 BTUH and higher, hot water storage tanks which exceed 120 gallons, and hot water expansion tanks which are connected to ASME rated equipment or required by code or local jurisdiction.

I. Provide safety controls required by National Boiler Code (ASME CSD 1) for boilers and water heaters with an input of 400,000 BTUH and higher.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Contracting and Procurement Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, prepare and submit coordinated layout drawings (composite drawings), to coordinate installation and location of ductwork, grilles, diffusers, piping, fire sprinklers, plumbing, lights, and electrical services. Composite Drawings show services on single sheet. Key Drawings to structural column identification system. Prior to completion of Drawings, coordinate proposed installation with architectural and structural requirements, and other trades (including plumbing, HVAC, fire protection, electrical, ceiling suspension, and ceiling tile systems, etc.), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.

B. Prepare Drawings as follows:

1. Drawings in Revit model. Revit model release equal to design documents. Drawings to be same sheet size and scale as Contract Drawings and indicate location, size, and elevation above finished floor of equipment and distribution systems.
2. Review and revise, as necessary, section cuts in Contract Drawings after verification of field conditions.
3. Indicate hydronic and air distribution system piping including fittings, hangers, access panels, valves, and bottom of pipe and duct elevations above finished floor.
4. Indicate inverts and provision for piping that must be graded to have right-of-way over more flexible items. Drawings also to indicate proposed ceiling grid and lighting layout as shown on electrical drawings and architectural reflected ceiling drawings and HVAC equipment, ductwork and piping.
5. Incorporate Addenda items and change orders.
6. Distribute drawings to trades and provide additional coordination as requested by other trades.

C. Advise Architect in event conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer, including but not limited to pumps, fans, valves, control devices, air handlers, vibration isolation devices, etc.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL or ETL listed and labeled or be approved by State, County, and City authorities prior to procurement and installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of Washington, and Federal regulations relating to hazardous materals.
2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Install equipment having components requiring access (i.e., drain pans, drains, control operators, valves, motors and vibration isolation devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions including all appurtenances recommended in manufacturer's installation instructions, at no additional charge to Owner. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:
   a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
   b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
   c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Pipe Installation:

1. Provide installation of piping systems coordinated to account for expansion and contraction of piping materials and building, as well as anticipated settlement or shrinkage of building. Install work to prevent damage to piping, equipment, and building and its contents. Provide piping offsets, loops, seismic flexible joints, expansion joints, sleeves, anchors or other means to control pipe movement and minimize forces on piping. Verify anticipated settlement and/or shrinkage of building with Project Structural Engineer. Verify construction phasing, type of building construction products and rating for coordinating installation of piping systems.
2. Include provisions for servicing and removal of equipment without dismantling piping.

G. Plenums:

1. Plenums: Materials within plenums shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84 or UL 723. Immediately notify Architect/Engineer of any discrepancy.

H. Provide miscellaneous supports/metals required for installation of equipment, piping, and ductwork.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, Section 23 0548, Vibration and Seismic Controls for HVAC Equipment, and individual Division 23 HVAC Sections.

B. Piping and Ductwork:

1. Per "Seismic Restraints Manual Guidelines for Mechanical Systems" latest edition published by SMACNA or local requirements.

C. Provide means to prohibit excessive motion of mechanical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground system installation prior to backfilling.
2. Prior to covering walls.

3. Prior to ceiling cover/installation.
4. After major equipment is installed.
5. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Mechanical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the mechanical systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CUTTING AND PATCHING

A. Confirm Cutting and Patching requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftspeople of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.5 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

B. Maintain design intent where equipment other than as shown as Basis of Design in Contract Documents is provided. Where equipment requires ductwork or piping arrangement, controls/control diagrams, or sequencing different from that indicated in Contract Documents, provide at no additional cost to Owner.

3.6 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage to be replaced before installation.
2. Protect equipment and pipe to avoid damage. Close pipe openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
3. Protect bright finished shafts, bearing housings and similar items until in service.

3.7 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.8 CLEANING

A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.9 START UP

A. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

1. Do not place equipment in sustained operation prior to initial balancing of HVAC systems.

3.10 PAINTING

A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in mechanical rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
2. After acceptance by Authority Having Jurisdiction (AHJ), In a mechanical room, on roof or other exposed areas, machinery and equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
3. See individual equipment Specifications for other painting.
4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
5. Piping and Ductwork: Clean, primer coat and paint exposed piping and ductwork on roof or at other exterior locations with two coats paint suitable for metallic surfaces and exterior exposures. Color selected by Architect.
6. Covers: Covers such as manholes, cleanouts and the like will be furnished with finishes which resist corrosion and rust.

3.11 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 23, HVAC Sections and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
   a. Testing and Balancing Reports
   b. Cleaning
   c. Operation and Maintenance Manuals
   d. Training of Operating Personnel
   e. Record Drawings
   f. Warranty and Guaranty Certificates
   g. Start-up/Test Document
   h. Commissioning Reports

3.12 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 23 00 00, HVAC Basic Requirements and individual Division 23, HVAC Sections.

B. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.
2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.13 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that HVAC items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.14 ELECTRICAL INTERLOCKS

A. Where equipment motors are to be electrically interlocked with other equipment for simultaneous operation, utilize equipment wiring diagrams to coordinate with electrical systems so that proper wiring of equipment involved is affected.

3.15 TEMPORARY HEATING, COOLING AND HUMIDITY CONTROL

A. Provide temporary heating, cooling, controls, humidification and dehumidification as required to facilitate the construction of the project. Size and select temporary system based on the requirements of the various trades during construction. This includes, but is not limited to, drywall, case work, wood flooring and wood finishes that are subject to warping. Size and install system to prevent mold growth. Coordinate the location of the temporary system. The house system can be used. Develop a procedure for how the house system will be used including a sketch depicting the house system, how filtration will be used to prevent construction debris from entering the system and how often the filters will be changed, how the ductwork will be cleaned after use to ensure a clean system is turned over to the Owner and how the units are sized. Submit this procedure to the Mechanical Engineer for review. Follow National Air Duct Cleaners Association (NADCA) duct cleaning procedures and guidelines. Warranties for the house system, if new, to commence when the Owner moves in if house system is used as the means to maintain the climate within the building during construction. Include this warranty requirement in the original bid or proposal amount. Coordinate and provide any temporary power, controls, ductwork, piping, plumbing anchorage, miscellaneous steel and structural supports required to support the temporary system. Installation of the system to comply with all applicable codes and be acceptable to the Authority Having Jurisdiction (AHJ).

END OF SECTION 23 00 00

SECTION 23 00 05 - HEATING, VENTILATING AND AIR CONDITIONING PRE-CLOSEOUT CHECKLIST

PART 1 - GENERAL

1.1 WORK INCLUDED

A. HVAC System Controls

B. Energy Metering

C. BAS Graphics

D. Piping for Hydronic Piping System

E. Pumps

F. Ductwork

G. Fans

H. High Volume Low Speed Fans

I. Dryer Booster Fan

J. Diffusers/Grilles

K. Boilers

L. Heat Exchanger

M. Packaged Rooftop Unit/Air-to-Air Heat Pump

N. Energy Recovery Ventilator

O. Condensing Units

P. Chiller/Heat Pump

Q. Energy Recovery Unit

R. Air Handling Units

S. Make-Up Air Unit

T. Mini-Split Air Conditioning Unit

U. Fan Coil Units

1.2 PRE-CLOSEOUT CHECKLIST SUBMITTAL

A. Two weeks prior to the Engineer's Punch-Walk request, complete and submit Pre-Closeout Checklist to document compliance with the Contract Documents and that systems are functionally operational and ready for Closeout Inspection.

B. A Closeout/Punch-Walk inspection will only be scheduled after completion of Pre-Closeout Checklist and Engineer's acceptance of its completeness.

C. The Pre-closeout Checklist is a general guide to document compliance with the Contract Documents and is not an all-inclusive list of Contract requirements, and it is the responsibility of the Contractor to ensure the installation is complete and in full conformance with the Contract Documents.

D. Complete and submit Pre-Closeout Checklist, as indicated in Part 3.

E. Unless all similar equipment have exactly the same level of completeness, reproduce the Checklist as needed and submit one checklist for each equipment.

PART 2 - EQUIPMENT - NOT USED

PART 3 - INSTALLATION

3.1 PRE-CLOSEOUT CHECKLIST

A. HVAC System Controls:

1. Installation:

Yes	No	N/A	Task	Comment
			As-built shop drawings submitted.	
			Controls system commissioned and Sequence of Operations, implemented and commissioned.	
			Framed instructions mounted in or near control panel.	
			Control wiring and tubing labeled at all terminations, splices, and junctions.	
			Shielded wiring used on electric sensors.	
			Temperature sensors installed in each room specified.	
			Carbon dioxide sensors installed in each room specified.	
			Graphical Screens completed.	
			Web based access completed, and credentials provided to Owner.	
			Uninterruptable Power System (UPS) has been provided for the	

			Operator Workstation.	
			Portable Terminal has been provided to the Owner.	
			Specified training of Owner staff has been scheduled or already conducted.	

2. Electrical/IT:

Yes	No	N/A	Task	Comment
			120-volt AC power provided to controllers and servers.	
			Where specified, emergency power provided to controllers.	
			Data drop has been provided.	

B. Energy Metering - BAS:

1. Installation:

Yes	No	N/A	Task	Comment
			Proper meter has been installed in the right location.	
			Meter is reading properly and values are within expected range.	
			Meter display can be easily read.	
			Meter is properly sized for its application.	
			CT is sized properly for its operation (electrical).	

2. Hydronic Water Energy Metering:

Yes	No	N/A	Task	Comment
			Water supply and return temperatures along with the water flow to the building are monitored and provided on an energy metering graphic to show the current energy demand.	
			BAS monitors and records the peak high and low demand reading from the water flow meter. Readings are recorded on a daily, month to date, and year to date basis.	
			BAS monitors and records the hot water energy readings to provide a history of energy use. Usage readings are recorded on a daily, month to date, and year to date	

			basis.	
			An alarm is generated at the OWS whenever a sensor indicates an invalid demand value.	

3. Domestic Hot Water Energy Metering:

Yes	No	N/A	Task	Comment
			Domestic hot water supply and return temperatures along with the water flow to the building are monitored and provided on an energy metering graphic to show the current energy demand.	
			BAS monitors and records the peak high and low demand reading from the water flow meter. Readings are recorded on a daily, month to date, and year to date basis.	
			BAS monitors and records the domestic hot water energy readings to provide a history of energy use. Usage readings are recorded on a daily, month to date, and year to date basis.	
			An alarm is generated at the OWS whenever a sensor indicates an invalid demand value.	

4. Electrical Metering:

Yes	No	N/A	Task	Comment
			BAS is interfaced with the electrical switchgear to monitor the normal and emergency power demand and consumption on a continual basis.	
			BAS monitors and records the peak high and low demand reading from the electrical meter. Readings are recorded on a daily, month to date, and year to date basis.	
			BAS monitors and records the electric meter readings to provide a history of power consumption. Usage readings are recorded on a daily, month to date, and year to date basis.	
			An alarm is generated at the OWS whenever a sensor indicates a loss	

			of pulse output from the electric meter.	

5. Water Use Metering:

Yes	No	N/A	Task	Comment
			BAS is interfaced with the water meter to monitor water consumption on a continual basis.	
			BAS monitors and records the peak high and low demand reading from the water meter. Readings are recorded on a daily, month to date, and year to date basis.	
			BAS monitors and records the water meter readings to provide a history of water consumption. Usage readings are recorded on a daily, month to date, and year to date basis.	
			An alarm is generated at the OWS whenever a sensor indicates a loss of pulse output from the water meter.	

C. BAS Graphics:

1. Graphics

Yes	No	N/A	Task	Comment
			Graphics provided are the most current format available at time of control system programming.	
			Building graphic, typically a photograph of the building, with links to each floor plan is complete.	
			Central plant graphic with equipment (water source heat pump, pumps, valves, storage tanks, etc.), temperature sensors, pressure sensors, BTU meters, and flow sensors complete.	
			Floor plans with temperature sensors, pressure sensors, temperature control zones, heating/cooling zones, ventilation zones, and supply air zones identified	

			Floor plan graphic zones have a temperature symbol that changes color over the range from low (blue) through normal (green) to high (red) and indicate an alarm (flashing red). The zone temperature and or pressure symbol(s) to be a link to a zone control pop-up graphic. Individual floor plan graphics to provide links to related mechanical systems. The mechanical room plan graphics to show the relative location of, and provide links to, either the equipment pop-up or flow and control graphic for mechanical equipment monitored or controlled by the BAS.	

2. Energy and Weather Data Reporting:

Yes	No	N/A	Task	Comment
			Energy monitoring graphics page complete. Graphic displays graph showing yearly use of all sub-metered BTU data showing how much heating and cooling is used and where. At close of project, provide the mechanical engineer with a “read only” access to view and track the building's EUI and energy use graph.	
			Consumption and Peak usage values provided. System to display archived data in tabular format form for both consumption and peak values. Data shown in hourly, daily, weekly, monthly and yearly formats. In each format the user able to select a specific period of data to view.	
			Electrical Meter Report: Provide monthly report showing daily electrical consumption and peak electrical demand with time and date stamp for equipment (such as chillers) and variable frequency drives. Provide an annual (12-	

			month) report showing monthly electrical consumption and peak electrical demand with time and date stamp for each individual meter.	
			Weather Data Report: Provide monthly report showing daily minimum, maximum, and average outdoor air temperature (dry bulb, wet bulb) and humidity. Provide annual (12-month) report showing minimum, maximum, and average outdoor air temperature for month.	

D. Piping for Hydronic Piping System:

1. Installation:

Yes	No	N/A	Task	Comment
			Piping complete.	
			As-built drawings submitted.	
			Piping flushed and cleaned, and Report issued min one week in advance.	
			Strainers cleaned.	
			Valves installed as required.	
			Piping insulated as required.	
			Thermometers and gauges installed as required.	
			Air vents installed as specified.	
			Flexible connectors installed as specified.	
			Verify that piping has been labeled and valves are identified as specified.	
			Piping properly supported.	

2. Testing, Adjusting and Balancing:

Yes	No	N/A	Task	Comment
			Hydrostatic test complete and Report submitted.	
			TAB operation complete, report submitted to Architect/Engineer, comments received, and closeout items resolved.	

E. Pumps:

1. General:

Yes	No	N/A	Task	Comment
			Vibration isolation devices installed and functional.	
			Seismic restraints installed.	
			Piping system installed.	
			Piping system pressure tested.	
			Pump not leaking.	
			Couplings aligned to meet manufacturer's prescribed tolerances.	
			Pressure and temperature gauges properly installed.	
			Test ports installed at inlet and outlet of pumps.	
			Automatic control valves operational.	

2. Electrical:

Yes	No	N/A	Task	Comment
			Power available to pump disconnect.	
			Pump rotation verified.	
			Control system interlocks functional.	
			Power disconnect is located within sight of the unit it controls.	
			VFD is installed and connected.	
			Maintenance power outlet provided.	

3. Testing, Adjusting and Balancing:

Yes	No	N/A	Task	Comment
			Water balance complete.	
			Water balance with design maximum flow.	
			TAB report submitted.	
			TAB closeout items resolved.	

F. Ductwork:

1. Installation:

Yes	No	N/A	Task	Comment
			Ductwork complete.	
			As-built shop drawings submitted.	
			Ductwork leak/pressure test, complete.	

			Fire dampers, smoke dampers, and access doors installed as required.	
			Ductwork leak test complete.	
			Thermometers and gauges installed as required.	
			Verify open/closed status of dampers.	
			Flexible connectors installed as specified.	

2. Testing, Adjusting and Balancing:

Yes	No	N/A	Task	Comment
			TAB operation complete.	
			TAB checklist items resolved.	

G. Fans:

1. Installation:

Yes	No	N/A	Task	Comment
			Fan belt is adjusted.	
			Vibration isolation devices installed.	
			Inspection and access doors are operable and sealed.	
			Casing is undamaged.	
			Manufacturer’s required maintenance clearance provided.	

2. Electrical:

Yes	No	N/A	Task	Comment
			Power available to fan disconnect.	
			Power disconnect is located within sight of the unit it controls.	
			VFD is installed and connected.	
			Proper motor rotation verified.	
			Maintenance power outlet provided.	

3. Controls:

Yes	No	N/A	Task	Comment
			Control interlocks properly installed.	
			Connections to BMS confirmed.	
			Control interlocks operable.	

4. Garage Exhaust Fan Controls:

Yes	No	N/A	Task	Comment
			Nitrogen dioxide low/high level interlocks and alarms operational.	

			Carbon monoxide low/high level interlocks and alarms operational.	
			NOx and CO sensors calibrated.	
			Gas concentrations are displayed at gas detector.	

H. High Volume Low Speed Fans:

1. Unit:

Yes	No	N/A	Task	Comment
			Mounting/support system and vibration isolation installed as specified.	
			Seismic restraints installed.	
			Fan rotates freely.	
			Equipment tag installed.	

2. Electrical:

Yes	No	N/A	Task	Comment
			All electrical connections complete.	

3. Controls:

Yes	No	N/A	Task	Comment
			Confirm fan speed is adjustable from manufacturer-provided controller.	
			Confirm connection to BMS and incorporation into Graphical screens, where specified.	
			Confirm unit shut down by FACP for units 6-foot diameter and larger.	

I. Dryer Booster Fan:

1. Unit:

Yes	No	N/A	Task	Comment
			Lint trap is installed between booster fan and dryer.	
			Fan securely mounted and secured.	
			Ductwork is complete.	

2. Electrical:

Yes	No	N/A	Task	Comment
			All electrical connections complete.	
			Fan is interlocked with the operation of the dryer.	

J. Diffusers/Grilles:

1. Installation:

Yes	No	N/A	Task	Comment
			Register mounting at T-bar or gyp-board ceiling is secure.	
			Flexible duct connection is secure with clamp around register collar.	
			(If hard duct connection) duct connection is secured with at least 3 sheet metal screws.	
			There is no leak at duct collar connection.	
			Flexible duct has good smooth radii.	
			Flexible duct is provided with hanger strap secured to structure.	
			Volume damper is provided at branch ductwork.	

2. With Sheet Metal Boot and Side Connection:

Yes	No	N/A	Task	Comment
			Boot is connected to collar with 2 sheet metal screws on each side.	
			Boot is provided with hanger strap secure to structure.	
			There is no leak at collar connection (boot) and flexible connection (to boot).	

3. Round Exposed Diffuser:

Yes	No	N/A	Task	Comment
			Diffuser is secured to supply/return duct.	
			Supply/return duct is provided with hanger support secured to structure.	

4. Wall-Type Linear-Type Register

Yes	No	N/A	Task	Comment
			Sheet metal boot is provided and secured to register.	
			Flexible duct is secured to duct collar connection (boot).	
			Linear blades are adjusted as designed to correct angle of diffusion.	

K. Boilers:

1. Mounting:

Yes	No	N/A	Task	Comment
			Vibration isolation devices installed.	
			Unit is installed per plans and specifications.	

2. Unit:

Yes	No	N/A	Task	Comment
			Equipment identification plate intact.	
			Equipment tag provided.	
			Chemical cleaning and treatment, complete.	

3. Piping:

Yes	No	N/A	Task	Comment
			Piping connection provided with union or flexible connector.	
			Valves and fittings installed per piping diagram (and boiler manufacturer recommendation).	
			Pressure and temperature gauges provided.	
			Makeup water PRV set at specified setting.	
			Relief valve set at relief/release pressure.	
			Relief valve piped to floor sink/drain.	
			Integral boiler circulator accessible (if provided).	
			Piping pressure tested.	
			Piping inlet-outlet connection matched with supply-return flow.	
			Safety interlocks, operational.	
			Shutoff valves installed per local boiler code.	

4. Air Separator:

Yes	No	N/A	Task	Comment
			Air separator supported adequately.	
			Air separator installed in correct flow direction.	
			Strainer installed in correct flow direction (if provided at air separator).	

5. Expansion Tank:

Yes	No	N/A	Task	Comment
			Expansion tank has adequate mounting support.	
			Piping connection coupling provided.	
			Isolation valve provided.	
			Tank pressure set at required pressure.	

6. Gas Supply:

Yes	No	N/A	Task	Comment
			Local isolation valve provided at boiler.	
			Gas train piping supported.	
			Gas piping properly supported.	

L. Heat Exchanger:

1. General:

Yes	No	N/A	Task	Comment
			Equipment ID and capacity match schedule.	
			Unit mounting is per detail.	
			Support is provided at pipe inlet/outlet sections.	
			Valve, fitting, and piping assembly are installed per detail.	
			Drain valve is provided at bottom of tank and is piped directly to drain.	
			Equipment is provided with equipment ID.	
			Piping is provided with pressure and temperature gauges.	
			Pressure/temperature/flow sensors are installed at correct locations.	
			Unit is completely insulated.	
			Pipe connections are installed in counterflow arrangement.	

M. Packaged Rooftop Unit/Air-to-Air Heat Pump:

1. General:

Yes	No	N/A	Task	Comment
			Vibration isolation devices installed and released from shipping restraints.	

			Filters clean and tight fitting.	
			Unit is provided with disconnect switch and convenience power outlet.	
			Damper linkages are connected.	
			Duct connections have flexible connectors.	
			Filters are clean.	
			Dampers move freely / close tightly. Linkages have minimum play.	
			Combination Fire & Smoke dampers in distribution ductwork close when unit is off and open before unit starts.	
			Condensate drain has trap and is vented.	
			Equipment tag is affixed, name plate ID and tag capacity information matches submittal/schedule.	

2. General - Gas Heating:

Yes	No	N/A	Task	Comment
			Gas supply has isolation valve.	
			Piping has drip leg with threaded cap.	
			Flexible connection is provided at unit.	

3. General - Hydronic Heating or Cooling:

Yes	No	N/A	Task	Comment
			Valve and fitting assembly are per design drawings.	
			Pipe has adequate support.	
			Piping penetration through roof has flashing.	
			Control valve is wired to unit’s or BMS control panel.	
			Piping is completely insulated.	

4. Roof Curb:

Yes	No	N/A	Task	Comment
			Unit roof curb is pre-fabricated; curb flashing is sealed all around unit.	
			(for spring isolated roof curb) spring locks are removed from	

			curb.	

5. Controls:

Yes	No	N/A	Task	Comment
			Unit mounted temperature and pressure sensors properly located and wired.	
			Airflow measuring stations installed and programmed.	
			Sequence of operation, tested and operation confirmed per controls submittal.	
			Graphical screens are 100% complete.	

6. Electrical:

Yes	No	N/A	Task	Comment
			Power available to unit disconnect.	
			Power available to unit control panel.	
			Proper motor rotation verified.	

N. Energy Recovery Ventilator:

1. Unit:

Yes	No	N/A	Task	Comment
			Adequate maintenance access to all components including removing the heat wheel and coils if necessary.	
			Access doors close tightly, gaskets installed.	
			Filters clean and tight fitting.	
			Energy wheel moves freely without obstruction.	
			Dampers move freely/close tightly. Linkages have minimum play.	
			Equipment tags attached.	

2. Electrical:

Yes	No	N/A	Task	Comment
			All electrical connections complete and tight.	
			Power disconnects installed, operational, and properly labeled.	
			Electric heater powered and operational.	
			VFD startup complete.	

3. Condensing Section:

Yes	No	N/A	Task	Comment
			System is charged per manufacturer's recommendations.	

4. Ductwork:

Yes	No	N/A	Task	Comment
			Ductwork complete and clean.	
			Duct joint sealant properly applied.	

5. Controls:

Yes	No	N/A	Task	Comment
			Thermostat installed, programming complete.	
			CO2 sensors installed and reporting accurately.	
			Smoke detector and miscellaneous safety circuits tested and operational.	
			Dampers stroked fully open and fully closed.	
			Energy wheel start/stop functioning as intended.	
			EF and SF VFD speeds accurately scaled.	
			BAS control panels wired, energized, and programmed.	
			Sequence of operations has been tested and field verified to operate per the approved controls submittal.	
			Graphics and monitoring via the Building Automation System 100-percent complete.	

O. Condensing Units:

1. Mounting:

Yes	No	N/A	Task	Comment
			Vibration isolation devices installed.	
			Seismic restraints installed.	
			Housekeeping pad or wood sleeper is anchored to roof structure.	
			Clearance at air intake and around unit is per manufacturer recommendation.	

			Clearance between two condensing units is adequate and per manufacturer recommendation.	

2. Piping:

Yes	No	N/A	Task	Comment
			Refrigerant connection is brazed.	
			Suction refrigerant line is insulated.	
			For heat pumps – both liquid and suction lines are installed.	

3. Electrical:

Yes	No	N/A	Task	Comment
			Power available to unit disconnect.	
			Power available to unit control panel.	
			Power disconnect is located within sight of the unit it controls.	
			Maintenance power outlet provided.	

P. Chiller/Heat Pump:

1. Installation:

Yes	No	N/A	Task	Comment
			Vibration isolation devices installed per detail.	
			Seismic restraints installed.	
			Insulation of evaporator and internal refrigeration piping undamaged.	
			Evaporator/condenser barrel clearance. Manufacturer required maintenance space, provided.	
			Refrigerant rupture disk relief piping provided at/for indoor chillers, and extended to outdoors.	
			Proper refrigerant level is provided.	
			Refrigerant detection system operational, if required.	

2. Water Piping:

Yes	No	N/A	Task	Comment
			Piping connected and valves installed	
			Chemical treatment and system flushing is complete and strainers, cleaned.	
			Flexible connector provided.	

			Isolation valve provided.	
			Flow direction of strainers, verified.	
			Pressure and test ports, installed.	
			Flow switch, installed.	
			Piping insulation is complete.	
			Piping type and flow direction labeled on piping.	

3. Unit Identification:

Yes	No	N/A	Task	Comment
			Chiller plate ID provided.	
			Chiller tag installed.	

4. Condenser (if air-cooled):

Yes	No	N/A	Task	Comment
			No obstructions to fan discharge.	
			Air short circuiting, not present or approved by manufacturer.	
			Condenser coils clean, combed, and in good condition.	

5. Electrical:

Yes	No	N/A	Task	Comment
			Power available to unit disconnect.	
			Power available to unit control panel.	
			Power disconnect is located within sight of the unit it controls.	
			Maintenance power outlet provided.	

6. Controls:

Yes	No	N/A	Task	Comment
			Flow switches and safety interlocks, operational.	
			Control system interlocks, interfaced and operational.	
			Control panel location acceptable.	
			Control panel front and side clearance.	
			Controls system, operational.	
			Mapping of BACNet points to the BMS, completed.	
			Graphics and monitoring via the BAS is complete.	

Q. Energy Recovery Unit:

1. Energy Wheel Type:

Yes	No	N/A	Task	Comment
			Duct connections have flexible connections.	
			Access door panels are sealed and air-tight.	
			Energy wheel is clean.	
			Direction of wheel rotation is correct.	
			Wheel motion and drain assembly are installed tight.	
			Unit is provided with disconnect switch.	
			Unit supply air stream is provided with (duct) smoke detector.	
			Unit is mounted per detail.	
			Unit is connected to BMS.	
			Filters cleans and tight fitting; filter bank has differential pressure gauge.	
			Equipment ID and tag are provided.	

2. Supply and Exhaust Side:

Yes	No	N/A	Task	Comment
			Fan assembly and motor are spring isolated.	
			Fan has disconnect switch.	
			Air filters are clean and secure.	
			Supply and exhaust air stream inside unit is sealed and air tight.	

3. Electrical:

Yes	No	N/A	Task	Comment
			Power available to unit disconnect.	
			Power available to unit control panel.	
			Proper motor rotation verified.	

R. Air Handling Units:

1. Installation:

Yes	No	N/A	Task	Comment
			Vibration isolation devices installed.	
			Seismic restraints installed.	
			Inspection and access doors are operable and sealed.	
			Casing undamaged.	

			Insulation undamaged.	
			Air filters clean and tight fitting.	
			Condensate drainage is unobstructed. (visually verify pan drains completely by pouring a cup of water into drain pan.)	
			Fan belt adjusted.	
			Manufacturer's required maintenance clearance provided.	
			Equipment Tags attached.	

2. Electrical:

Yes	No	N/A	Task	Comment
			Power available to unit disconnect.	
			Power available to unit control panel.	
			Proper motor rotation verified.	
			Power disconnect is located within sight of the unit it controls.	
			VFD installed.	
			Maintenance power outlet provided.	

3. Coils:

Yes	No	N/A	Task	Comment
			Piping properly connected.	
			Piping pressure tested.	
			Air vents installed on water coils (with shut off valves) as specified.	
			Damage to coil fins has been repaired.	

4. Controls:

Yes	No	N/A	Task	Comment
			Control valves/actuators properly installed.	
			Dampers/actuators properly installed.	
			Proper location and installation of all temperature, pressure and humidity inputs verified.	
			Fan air volume controller operable.	
			Air handler controls system, operational.	
			Outside air ventilation rates (CFM) reliability maintained.	

			Combination Fire & Smoke Dampers in distribution ductwork close when unit is off and open before unit starts.	

5. Testing, Adjusting, and Balancing:

Yes	No	N/A	Task	Comment
			Construction filters removed and replaced.	
			TAB report submitted.	
			TAB results within specified tolerances shown on drawings.	

S. Make-Up Air Unit:

1. Unit:

Yes	No	N/A	Task	Comment
			Shipping restrains removed.	
			Vibration isolation devices installed and released from shipping restraints.	
			Seismic restraints installed.	
			Access doors close tightly, gaskets installed.	
			Filters clean and tight fitting.	
			Dampers move freely/close tightly. Linkages have minimum play.	
			Freezestat sensing element is installed per the manufacturer's instructions.	
			Equipment tags attached.	

2. Electrical:

Yes	No	N/A	Task	Comment
			Electrical connections complete and tight.	
			Power disconnects installed, operational, and properly labeled.	

3. Piping:

Yes	No	N/A	Task	Comment
			Piping flushed, tested, and filled with all valves open.	
			Cooling and heating coil piping insulation complete.	
			Coil strainers have been cleaned.	
			Piping correctly labeled.	

			Adequate space provided for coil removal.	
			Heat transfer fins clean and in good condition.	
			Control valves installed correctly and wired.	
			Vent and drains installed.	
			Automatic air vents installed.	
			Condensate drain pan and piping complete and clear.	
			Piping components, valves, strainers, gauges, Pete's Plugs have been installed per design drawings.	
			No leaks observed around fittings.	

4. Compressor and Condenser:

Yes	No	N/A	Task	Comment
			Refrigerant sight glass clear of bubbles.	
			Moisture indicator shows no moisture.	
			Correct oil level.	
			Compressors and piping leak tested.	
			Crankcase heater on when unit is off.	
			Condenser coils clean and in good condition.	
			Adequate clearance for airflow around condenser.	

5. Controls:

Yes	No	N/A	Task	Comment
			Thermostat installed, programming complete.	
			Freeze, smoke and miscellaneous safety circuits tested and operational.	
			Interlock with kitchen exhaust fans verified.	
			Control valves operational.	
			BAS control panels wired, energized, and programmed.	
			Graphics and monitoring via the Building Automation System	

			complete.	

T. Mini-Split Air Conditioning Unit:

1. Unit:

Yes	No	N/A	Task	Comment
			Air filters clean and tight fitting.	
			Coil clean and in good condition.	
			Equipment tags attached.	

2. Electrical:

Yes	No	N/A	Task	Comment
			Electrical connections complete and tight.	

3. Piping:

Yes	No	N/A	Task	Comment
			Condensate drain pan complete and clear.	
			Condensate pump and piping is complete and pump is operational.	
			Piping insulation complete.	
			No leaking around refrigerant fittings.	

4. Compressor and Condenser:

Yes	No	N/A	Task	Comment
			Refrigerant sight glass clear of bubbles.	
			Moisture indicator shows no moisture.	
			Correct oil level.	
			Compressors and piping leak tested.	
			Crankcase heater on when unit is off.	
			Condenser coils clean and in good condition.	
			Adequate clearance for airflow around condenser.	

5. Controls:

Yes	No	N/A	Task	Comment
			Thermostat installed and programming is complete.	
			Zone temperature sensor installed and reading accurately.	

			Temperature monitoring provided on floor plan graphic.	
			High temperature alarm programmed and enunciates at the BAS.	
			BACnet interface connected and communicating to BAS, and mapping of points to BAS, complete.	

U. Fan Coil Units:

1. Installation:

Yes	No	N/A	Task	Comment
			FCU provided with adequate support.	
			FCU provided with seismic restraint.	
			FCU provided with approved spring isolation.	
			Coil clean and in good condition.	
			Equipment ID and tag are provided.	

2. Piping:

Yes	No	N/A	Task	Comment
			Piping installed per detail.	
			Air is already vented from coil.	
			Control valve actuator provided with power.	
			Pipe and fittings are accessible.	
			Control panel is accessible.	

3. Drain:

Yes	No	N/A	Task	Comment
			Condensate drain pan complete and clear.	
			Condensate drain is piped correctly.	
			Trap and vent provided at condensate drain piping.	
			If provided with secondary drain pan, drain terminates at a visible location.	

4. Smoke Detector (SD) if cumulative supply air into a room is over 2000CFM:

Yes	No	N/A	Task	Comment
			SD is provided.	

			SD is wired to fire life safety.	
			SD is wired to shut down FCU upon detection of smoke.	

5. Electrical:

Yes	No	N/A	Task	Comment
			Power available to unit disconnect.	
			Code clearance maintained.	
			Proper motor rotation verified.	
			Power disconnect is located within sight of the unit it controls.	
			Maintenance power outlet provided.	

END OF SECTION 23 00 05

SECTION 23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Starters
2. Shaft Grounding
3. Motors

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NEMA Premium Efficiency
2. Energy Policy Act (EPACT), latest applicable version(s) for minimum motor efficiencies.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Field Installed Motors: Installed motors to be of single type, from one source and from a single manufacturer.
2. Electrical components and materials to be UL and ETL listed/labeled as suitable for location and use.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. For motors 50 HP and larger, provide 5-year manufacturer's limited warranty from date of substantial completion.

PART 2 - PRODUCTS

2.1 STARTERS

A. Manufacturers

1. Cerus
2. Eaton Electrical
3. General Electric
4. Siemens
5. Schneider Electric/Square D

B. Single Phase Motors:

1. Manual across-the-line starting switch having toggle-operated switch pilot running light and built-in thermal overload device with heating element rated not more than 115 percent motor full load current indicated on name plate of motor to be protected. Surface mount starters. Provide NEMA-1 enclosure.
2. Overload relays to be melting alloy type with a replaceable control circuit module. Thermal units to be interchangeable. Starter to be non operative if thermal unit is removed.
3. Single-phase motors with automatic controls. Provide motor-rated relay with coils rated for control voltage.

C. Starters up to Size 8 to be suitable for the addition of a minimum of three external auxiliary contacts (normally open or normally closed). Contactor, coils, and relays to perform the control functions of the associated equipment and control sequence.

D. Three Phase Motors up to and Including 15 HP:

1. Provide enclosed type magnetic across-the-line starter with thermal overload and undervoltage protection.
2. Operator: "Start-Stop" pushbutton, except where automatic control is indicated on Drawings or specified. Then provide "Hand-Off-Auto" selector switch.
3. Starters for 3-phase motors to have overload protection in each of the three legs, with external manual reset.
4. Unless indicated on Drawings or in Specifications, furnish motor starters with a neon pilot light. Neon lights are required for exhaust fan switches.
5. Equip starters with integral transformer and coil for control circuit. Coordinate coil voltage with control voltage.

E. For Three Phase Motors Greater than 15 HP:

1. Provide combination starter and fused safety disconnect integral in the same enclosure. Utilize Type 'RK' or 'L' fuses. Provide fuse block with rejection type fuse holders. Size fuses per motor manufacturer's recommendations.
2. Provide a solid-state reduced voltage starter, consisting of power section, one-piece removable printed circuit logic board and field wiring interface terminals. Logic board uses quick disconnect plug-in connectors for current transformers inputs, line-and-load voltage inputs, SCR gate firing output circuits and status panel. 3-phase current sensing via current transformers. Class 10 electronic overload protection.
3. Motor starters to include the following protections:
   a. Inverse time running overcurrent protection.

b. 250 percent to 500 percent current limit adjustment.
c. Minimum and maximum voltage adjustments.
d. Voltage stability adjustment.
e. Single-phase protection with built-in short-time delay.
f. Undervoltage protection with built-in short time delay.
g. MOV surge suppression protection of SCRs rated 10 percent above the rated voltage.
h. Phase sequence protection.

4. Display: Door-mounted status LCD alphanumeric or LED display indicating run, undervoltage, phase loss, phase current unbalance, overcurrent trip, overtemperature, current limit, end of ramp, and incorrect phase rotation.
5. Enclosure: NEMA 12. Operator: "Start-Stop" pushbutton, except where automatic control is indicated on Drawings or specified, then provide "Hand-Off-Auto" selector switch
6. Input/Output Relays: Provide relays as required to provide the control sequence.
7. UL 508 listed.

2.2 SHAFT GROUNDING

A. Manufacturers

1. Shaft Grounding Inc.
2. Aegis SGR Bearing Protection Ring
3. Or approved equivalent.

B. Variable Speed Motor Shaft Grounding: Shaft grounding ring; solid ring type.

C. Provide shaft grounding assembly on motors controlled by variable frequency drive. Shaft grounding device to be in the form of brush that resides on the motor shaft. Brush assembly shall be capable of tolerating misalignment and maintaining rotating contact throughout the motors life.

D. Material: Material used in the grounding assembly shall be stable material commonly used within industry that is not believed to constitute a hazardous material under Occupational Safety & Health Administration (OSHA) regulations.

E. Brushes: Specifically developed carbon compounds of sustained performance with wear life expectancy of 3 years minimum.

F. Seals: Sealed type to keep contaminants from entering the shaft grounding system in wet or severe environment applications.

G. Shaft Grounding Assembly: For clean room air handling systems, use the type that contains the wear products within a special enclosure within the shaft grounding system.

2.3 MOTORS

A. Manufacturers:

1. Lincoln Motor
2. Century Electric Motors (formerly A.O. Smith Electrical Products)
3. Baldor Electric
4. General Electric
5. Toshiba

6. Exception: Motors integral to equipment efficiency listing (EER, COP, etc.) per listing agency.

B. Construction:

1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 40 degrees C environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
4. Built-in thermal overload protection or externally protected with separate over-load with low-voltage release or lock-out. Quick trip device on hermetically sealed motors.
5. Service Factor: 1.15 for poly-phase motors except 1.25 for motors associated with shaft pressurization system fans and 1.35 for single phase motors.
6. Efficiency: Provide NEMA Premium Efficiency motors.
7. Motors used in conjunction with variable speed drives: Variable torque type matched for the full operating range of the variable frequency drive. As a minimum, motors to have Class F insulation, winding insulation rated for 1000 Volts and insulated bearings to prevent high frequency ground path. Loads not-to-exceed 80 percent of nameplate rating

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Coordinate conductor sizes with Division 26, Electrical. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

E. Single Phase Power, Split Phase Motors:

1. Starting Torque: Less than 150 percent of full load torque.
2. Starting Current: Up to seven times full load current.
3. Breakdown Torque: Approximately 200 percent of full load torque.
4. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
5. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

F. Single Phase Power, Permanent-Split Capacitor Motors:

1. Starting Torque: Exceeding one fourth of full load torque.
2. Starting Current: Up to six times full load current.
3. Multiple Speed: Through tapped windings.
4. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

G. Single Phase Power, Capacitor Start Motors:

1. Starting Torque: Three times full load torque.

2. Starting Current: Less than five times full load current.
3. Pull-up Torque: Up to 350 percent of full load torque.
4. Breakdown Torque: Approximately 250 percent of full load torque.
5. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
6. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.
7. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

H. Three Phase Power, Squirrel Cage Motors:

1. Starting Torque: Between 1 and 1-1/2 times full load torque.
2. Starting Current: Six times full load current.
3. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
4. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.
5. Insulation System: NEMA Class B or better. Use class F insulation when motors are controlled by a VFD.
6. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
7. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
8. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter.
9. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
10. Sound Power Levels: To NEMA MG 1.
11. Weatherproof Epoxy Treated Motors: Epoxy coat windings with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
12. Nominal Efficiency: Meet or exceed NEMA Premium Efficiency rating when tested in accordance with IEEE 112.
13. Nominal Power Factor: Minimum at full load and rated voltage when tested in accordance with IEEE 112.

I. Electronically Commutated Motors:

1. Brushless DC type motor specifically designed for intended application.
2. Permanently lubricated motor with heavy duty ball bearing type to match intended application load.
3. Operation Range: 20 percent to 100 percent of full speed (80 percent turndown).
4. Motor Efficiency: Minimum 85 percent efficient at all speeds.
5. Pre-wired to specific voltage and phase. Internal motor circuitry to convert AC power supplied to the fan to DC power.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Coordinate location of disconnect and starter or motor controller. Combination starter/disconnects may be used in lieu of separate items.

B. Explosion-Proof Motors: UL approved and labeled for hazard classification, with over temperature protection.

C. Provide inverter ready motors per NEMA MG1-30 for variable speed drive or soft-start starter use. Provide shaft grounding for motors over 2 HP serving variable speed drives. Provide shaft grounding and insulated bearings on motors 25 HP and larger serving variable speed drives. Shielded cable required for power wiring from variable speed drive to motor connection.

D. Unless otherwise indicated, motors 1-HP and larger to meet/exceed NEMA Premium Efficiency and latest EPACT.

E. Vertical in-line pump motors per NEMA MG1 vertical motor requirements.

F. Exception: Motors less than 250 watts, for intermittent service, motors furnished with equipment manufacturer's standard package equipment need not conform to these specifications.

G. Single phase motors for air compressors and pumps: Capacitor start type.

H. Motors located in exterior locations or wet air streams are to be of totally enclosed type.

I. Motors located in outdoor, wet/wash-down locations: Totally enclosed weatherproof epoxy-sealed type. Provide protective covering for electronically commutated motors located in outdoor or wet/wash-down locations.

J. Disconnects: Provided by Division 26, Electrical unless specified otherwise.

K. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

3.2 STARTER INSTALLATION

A. Install starters in accordance with manufacturer's instructions.

B. Coordinate disconnect requirements and location with Division 26, Electrical if not integral to starter. If starter is installed out of line of sight of motor, provide additional disconnect at motor per code.

C. Provide NEMA housing appropriate to installation location.

D. Provide supports and install securely, in neat and workmanlike manner, as specified in NECA 1.

E. Meet mounting height and accessible location requirements per local code.

F. Provide fuses for fusible switches.

G. Select and install overload heater elements in motor starters to match installed motor characteristics.

H. Single Phase 120 Volt Starter: If not furnished as single packaged controller/disconnect, provide contactors, relays, wiring and devices necessary to match sequence of operation for equipment.

3.3 SHAFT GROUNDING INSTALLATION

A. Shaft grounding assembly installation not to affect the motor manufacturer warranty. Where the severe environment conditions require application of the shaft grounding types that are screwed into the motor shaft, the installation of the shaft grounding system performed either by the motor manufacturer or by the motor manufacturer authorized facility.

B. Bond the brush to the closest ground point using code sized green insulated stranded copper conductor per manufacturer instructions.

C. Test and verify the performance of the assembly to ensure that under no conditions the shaft exceeds 3 volts.

D. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

E. Check line voltage and phase and ensure agreement with nameplate.

F. Verify motor rotation.

3.4 MOTOR INSTALLATION

A. Electrical Service: Power wiring from source to motor termination under Division 26, Electrical.

B. Install in accordance with manufacturer's instructions. Coordinate with starter or variable speed controller with control sequence to provide necessary starter accessories.

C. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

D. Check line voltage and phase and ensure agreement with nameplate.

E. Verify motor rotation.

F. Field Quality Control:

1. Prepare for acceptance tests as follows:
    a. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
    b. Test interlocks and control features for proper operation.
    c. Verify that current in each phase is within nameplate rating.
2. Testing: Perform the following field quality-control testing:
    a. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.
    b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

a. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.
b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
c. Verify bearing lubrication.
d. Verify proper motor rotation.
e. Test Reports: Prepare a written report to record the following test procedures used:
    1) Test results that comply with requirements.
    2) Test results that do not comply with requirements and corrective action taken to achieve compliance.

G. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

H. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 23 05 13

SECTION 23 05 19 - METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Pressure Gauges
2. Thermometers
3. Dial Thermometers
4. Separable Sockets
5. Thermometer Wells
6. Differential and Filter Pressure Gauges
7. Pressure-Gauge Fittings
8. Test Plugs

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Maintenance Materials:
   a. Extra gauge Oil for Inclined Manometers: One bottle.
   b. Extra Pressure Gauges: One.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

A. Manufacturers:

1. Trerice Model 600CB.
2. Dwyer Instruments, Inc.
3. Moeller Instrument Co., Inc.
4. Omega Engineering, Inc.

B. ASME B40.100, phosphor-bronze bourdon type, dry type.

1. Case: Cast aluminum, stem-mounted, flangeless.
2. Size: 4-1/2 inch diameter.
3. Window: Clear glass.
4. Connector: Brass.
5. Scale: White aluminum with black graduation and markings.
6. Pointer: Black, adjustable.
7. Mid-Scale Accuracy: One percent.
8. Scale: psi.

2.2 THERMOMETERS

A. Manufacturers:

1. Trerice Model BX9.
2. Ashcroft
3. Weiss
4. Marshaltown
5. Weksler

B. Adjustable Angle: Red-or blue-appearing organic liquid in glass: ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9-inch scale.
2. Window: Acrylic.
3. Scale: Aluminum, white background, black graduations and markings.
4. Stem: 3/4-inch NPT brass (aluminum for installation in air ducts).
5. Accuracy: 2 percent, per ASTM E 77.
6. Calibration: 0-160 with 2 degrees F graduations.

2.3 DIAL THERMOMETERS

A. Manufacturers:

1. Trerice Model 80742.
2. Ashcroft
3. Weiss
4. Marshaltown
5. Weksler

B. ASTM E 1, cast aluminum case, vapor or liquid actuated with brass or copper bulb, copper or bronze braided capillary, white with black markings and black pointer, glass lens, adjustable 360 degrees in horizontal plane. 180 degrees in vertical plane.

1. Size: 4-1/2-inch diameter dial.
2. Lens: Clear glass.
3. Length of Capillary: Minimum 6-feet (for remote reading if required).

4. Accuracy: 2 percent.
5. Calibration: 2 degrees F graduations.

2.4 SEPARABLE SOCKETS

A. Manufacturers:

1. Kimray
2. Weiss
3. Trerice

B. Description: Fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem.

1. Material: Brass, for use in copper piping.
2. Material: Stainless steel, for use in steel piping.
3. Extension-Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation. Omit extension neck for sockets for piping not insulated.
4. Insertion Length: To extend to center of pipe.
5. Cap: Threaded, with chain permanently fastened to socket.
6. Heat Transfer Fluid: Oil or graphite.

2.5 THERMOMETER WELLS

A. Manufacturers:

1. Ashcroft
2. Omega
3. Weiss

B. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.

1. Material: Brass for use in copper piping.
2. Material: Stainless steel, for use in steel piping.
3. Extension Neck Length: Nominal thickness of 2-inches, but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
4. Insertion Length: To extend to center of pipe.
5. Cap: Threaded, with chain permanently fastened to socket.
6. Heat Transfer Fluid: Oil or graphite.

2.6 DIFFERENTIAL AND FILTER PRESSURE GAUGES

A. Manufacturers:

1. Orange Gauges
2. Midwest
3. Or approved equivalent.

B. Service: Air and non-combustible, compatible gases (Natural Gas option available.)

C. Wetted Materials: Consult factory.

D. Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.

E. Accuracy: Plus or minus 2 percent of full scale throughout range at 70 degrees F.

F. Pressure Limits: Minus 20 Hg to 15 PSIG.

G. Overpressure: Relief plug opens at approximately 25 PSIG standard gauges only.

H. Temperature Limits: 20 to 140 degrees F.

I. Size: 4-inch diameter dial face.

J. Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientation.

K. Process Connections: 1/8-inch female NPT duplicate high and low pressure taps, one pair side and one pair back.

L. Standard Accessories: Two 1/8-inch NPT plugs for duplicate pressure taps, two 1/8-inch pipe thread to rubber tubing adapter and three flush mounting adapters with screws.

2.7 PRESSURE-GAUGE FITTINGS

A. Manufacturers:

1. Omega
2. Weiss
3. Trerice

B. Valves: NPS 1/4 (DN8) brass or stainless-steel needle type.

C. Syphons: NPS 1/4 (DN8) coil of brass turbine with threaded ends.

D. Snubbers: ASME B40.5, NPS 1/4 (DN8) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.

2.8 TEST PLUGS

A. Manufacturers:

1. Pete's Plug
2. Or approved equivalent.

B. Description: Nickel-plated, brass-body test plug in NPS 1/2 (DN15) fitting.

C. Body: Length as required to extend beyond insulation.

D. Pressure Rating: 500 PSIG (3450 kPa) minimum.

E. Core Inserts: One or two self-sealing valves, suitable for inserting 1/8-inch OD probe from dial-type thermometer or pressure gauge.

F. Core Material for Air, Water, Oil and Gas: 20 to 200 degrees F (minus 7 to plus 93 degrees Celsius), chlorosulfonated polyethylene synthetic rubber.

G. Test Plug Cap: Gasketed and threaded cap, with retention chain or strap.

H. Test Kit: Pressure gauge and adapter with probe, two bimetal dial thermometers, and carrying case.

1. Pressure Gauge and Thermometer Ranges: Approximately two times the system's operating conditions.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Provide instruments with scale ranges selected according to service with largest appropriate scale.

3.2 PRESSURE GAUGES

A. Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position, visible from floor.

B. Locations: Install in the following locations as a minimum, and elsewhere as indicated.

1. At each pump inlet and outlet.
2. At inlet and discharge of each pressure reducing valve.
3. At makeup water service outlets.
4. At inlet and discharge of each chiller and boiler.

C. Install in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust to final angle, clean windows and lenses, and calibrate to zero.

E. Pressure Gauge Range/Graduations:

System	Pressure (PSI)	Graduations (PSI)
Heating Water	0-100	1

3.3 THERMOMETERS

A. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2-inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

B. Install in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

C. Adjust to final angle, clean windows and lenses, and calibrate to zero.

D. Thermometer Range/Graduations:

System	Temperature (degree F)	Graduations (degrees F)
Heating Water	30-240	2

3.4 DIAL THERMOMETERS

A. Install in vertical upright position, tilted so as to be easily read at floor.

3.5 SEPARABLE SOCKETS

A. Inspect the openings in the vessel for foreign material and clean the connection ports to remove scale, chips and debris.

B. Install thermostats with separable sockets. Install the separable socket using good piping practice. Be sure to use TFE tape or pipe thread sealant on external pipe threads.

C. Never stand directly over or in front of a valve or controller when the system is pressurized.

D. Assure the separable socket is completely submerged in liquid or flow stream. Partial submersion will give erratic temperature transfer to thermostat.

E. Pack separable socket full with high temp bearing grease. This helps in heat transfer and prevents air space.

3.6 THERMOMETER WELLS

A. Install in piping in vertical upright position. Fill well with oil or graphite, secure cup.

3.7 DIFFERENTIAL AND FILTER PRESSURE GAUGES

A. Install pressure gauge where exposure to heat and vibration are minimal and where the dial cc an be easily read. It is also important to install the gauge in a location with undisturbed and continuous flow of the pressure medium.

B. Provide a needle valve or gauge cock, installed between the process and the pressure gauges.

C. General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position, visible from floor.

D. Locations: Install in the following locations, and elsewhere as indicated.

1. At each pump inlet and outlet.
2. At inlet and discharge of each pressure reducing valve.
3. At make-up water service outlets.

E. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

3.8 PRESSURE-GAUGE FITTINGS

A. Install per manufacturer's instructions and recommendations.

B. Reference "Pressure Gauges" Article above.

3.9 TEST PLUGS

A. Locate test plugs adjacent to thermometers and thermometer sockets, adjacent to pressure gauges and pressure gauge taps, adjacent to control device sockets, or where indicated.

END OF SECTION 23 05 19

SECTION 23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Globe Valves
2. Balancing Valves
3. Ball Valves
4. Butterfly Valves
5. Swing Check Valves
6. Wafer Check Valves

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Valves: Obtain each type of valve from a single source and from a single manufacturer.

B. Valves, General:

1. Apollo
2. Armstrong
3. ASCO
4. Cla-Val
5. Conbraco

6. Crane
7. Clow
8. Griswold
9. Hammond
10. Hays
11. Jenkins
12. Josam
13. Kennedy
14. Milwaukee
15. Mueller
16. Nibco
17. Red-White Valve
18. Smith
19. Stockham
20. Tour & Andersson
21. Wade
22. Watts
23. Wilkins
24. Zurn

C. Globe Valves:

1. See Valves General above.

D. Balancing Valves:

1. Griswold
2. Hays
3. Armstrong CBV
4. Tour & Andersson
5. Victaulic (T&A Valves only)

E. Ball Valves:

1. See Valves General above.
2. NSF Valves:
   a. Clow
   b. Kennedy
   c. Nibco

F. Butterfly Valves:

1. See Valves General above.

G. Swing Check Valves:

1. See Valves General above.

H. Wafer Check Valves:

1. See Valves General above.

2.2 VALVES - GENERAL

A. General:

1. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
2. Operators: Provide handwheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves 6 inches and smaller. Provide gear operators for quarter-turn valves 8 inches and larger and plug valves 5 inches and larger. Provide chain-operated sheaves and chains for overhead valves installed over 5 feet above finished floor.
3. Valve Identification: Manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

B. Valves in Insulated Piping: With 2-inch stem extension and following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied.
   a. Basis of Design Product: Subject to compliance with requirements. Provide NIBCO NIB-SEAL handle extension or comparable product by one of the following.
      1) Conbraco Industries, Inc.: Apollo Div.

C. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves, ASME B16.5 for steel valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With thread according to ASME B1.20.1.

D. Valve Bypass and Drain Connections: MSS SP-45.

E. Building Service:

1. Shutoff and Isolation Valves:
   a. Pipe Sizes 3 Inches and Smaller: Ball valve.
2. Drain Service: Ball valves.
3. Strainer Blow-Off: Ball valve.
4. Check Valves: Swing or Wafer.

2.3 GLOBE VALVES

A. 3 Inches and Smaller: Class 200, 200 lb. SWP, MSS SP-80, ASTM B61, cast bronze body, bronze bonnet, bronze disc, bronze packing gland, non-asbestos packing and aluminum or malleable iron hand-wheel.

2.4 BALANCING VALVES

A. Maximum 125 PSIG System Working Water Pressure.

B. Manual Set Balancing Valves:

1. Valves are to be of the "Y" pattern, equal percentage globe-style and provide three functions:
   a. Precise flow measurement.

b. Precision flow balancing.
c. Positive drip-tight shutoff.

2. Valve to provide multi-turn, 360 degree adjustment with micrometer type indicators located on the valve handwheel. Valves have a minimum of four full 360 degree handwheel turns. 90 degree style ball valves are not acceptable. Valve handle to have hidden memory feature, which will provide a means for locking the valve position after the system is balanced. Valves to be furnished with precision machined venturi built into the valve body to provide highly accurate flow measurement and flow balancing. The venturi to have two 1/4-inch threaded brass metering ports with check valves and gasketed caps located on the inlet side of the valve. The valve body, stem and plug to be brass. The handwheel to be high-strength resin.
3. 2-1/2 Inches and Larger: Valve body to be either cast iron with integrated cast iron flanges (2-1/2-inch to 12-inch) or ductile iron with industrial standard grooved ends (2-1/2-inch to 12-inch). Valve stem and plug disc to be bronze with handwheel that permits multi-turn adjustments. Sizes 2-1/2-inch and 3-inch: five turns; sizes 4-inch to 6-inch: 6 turns; sizes 8-inch to 10-inch: 12 turns; and size 12-inch: 14 turns. Provide flange adapters to prevent rotation.

2.5 BALL VALVES

A. Ball valves on brazed piping are to be three-piece.

B. 2-1/2 Inches and Smaller: MSS SP-110, 400-600 PSI, two-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 77CLF 100 Series two-piece.

C. 3 Inches and Larger: MSS SP-110, 400-600 PSI, three-piece full port ball configuration, bronze body, extended soldered ends for copper pipe and threaded ends for iron pipe, lead-free brass or stainless steel ball, lead-free brass stem, Teflon seat, extended steel handle. Apollo 82-100/82A 140 Series three-piece.

D. Full Port Ball Valve: 2- to 4-inch ductile iron, ASTM A536, micro finish steel chrome plated or stainless steel ball and stem. TFE seats, 600 PSI.

2.6 BUTTERFLY VALVES

A. Select lug type valves.

B. 6 Inches and Smaller: 200 PSI, ductile iron body, extended neck, stainless steel stem with stainless steel disc, reinforced resilient EPDM seat, memory stop control, lever handle through 5 inches, size and worm gear operator for 6 inches and larger. Mount stem in horizontal position. Manual lever and lock Nibco LD2000, for mechanical coupling fittings. MSS SP-67, Type 1.

C. 8 Inches and Larger: 200 PSI, ductile iron body, extended neck, stainless steel disc and stem reinforced resilient EPDM seat, memory stop control, lever handle through 5 inches, size and worm gear operator for 6 inches and larger. Mount stem in horizontal position. Manual lever for mechanical coupling fittings. MSS SP-67, Type 1.

2.7 SWING CHECK VALVES

A. 2 Inches and Smaller: Class 125, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc. Nibco 413. MSS SP-80, Type 4.

B. 2-1/2 Inches and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends. Nibco F918. MSS SP-71, Type 1.

C. Check Valve: Horizontal installation. Working pressure to 300 PSI. Ductile body, ASTM A536, and stainless clapper, EPDM, nitrile or optional viton bumper and bonnet seals. Stainless wetted parts.

2.8 WAFER CHECK VALVES

A. Twin disc, Class 125 spring actuated designed to be installed with gaskets between two standard Class 125 flanges. 200 PSI, cast iron body, aluminum bronze disc. Nibco W-920-W.

B. Check Valve: PPS coated ductile iron body, ASTM A536, aluminum bronze nonslamming disc, stainless steel spring and shaft. Rubber seat for intended service.

PART 3 - EXECUTION

3.1 GENERAL VALVE INSTALLATION REQUIREMENTS

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set angle and globe valves closed to prevent rattling.
4. Set ball open to minimize exposure of functional surfaces.
5. Block check valves in either closed or open position.

B. Inspect the shipping container before unpacking to look for damage that could have occurred during transport, and report it to the transportation company immediately. After visual inspection, remove the valve from the shipping container. Make sure the faces are free of any scratches and that there is not any obvious damage to the actuator assembly or valve body.

C. Make sure to note the valve's model number during the unpacking process. The model number will need to be provided when purchasing replacement parts.

D. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

E. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

F. Do not attempt to repair defective valves; replace with new valves.

G. Install valves per manufacturer's recommendations.

H. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.

I. Purge and clean piping to be connected to valve.

J. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose end adapter and cap on chain for each valve that must be installed with stem below horizontal plane. Ensure installation provides full stem movement.

K. Determine that the valve and its piping is adequately supported when installed. If a valve is not adequately supported, this could prevent the valve from operating and sealing correctly. Be sure that mating flanges are in line and parallel to minimize straining on joints and valve body.

L. Insulation: Where insulation is indicated, install extended stem valves, arranged in proper manner to receive insulation.

M. Mechanical Actuators: Install with chain operators where indicated. Extend chains to 5-feet above floor and hook to clips to clear aisle passage.

N. Stem Selection: Outside screw and yoke stems, except provide inside screw, nonrising stem where space prevents full opening of OS&Y valves.

O. Seats: Renewable seats, except where otherwise indicated.

P. When soldering, use paste flux that is approved by the manufacturer for use with lead-free alloys.

Q. Boiler isolation valves with adjustable packing gland per CSD-1 requirements.

R. Valve Adjusting and Cleaning:

1. Inspect valves for leaks. Adjust or replace packing to stop leaks. Replace valve if leak persists.
2. Valve Identification: Tag valves per Section 23 05 53, Identification for HVAC Piping, Ductwork and Equipment.

S. General Requirements for Valve Applications:

1. If valve applications are not indicated, use the following:
    a. Shutoff Service: Ball valves.
    b. Throttling Service: Balancing valves.
    c. Pump-Discharge Check Valves:
        1) 2 Inches and Smaller: Swing or spring-loaded lift check valves with bronze disc.
        2) 2-1/2 Inches and Larger: Swing check valves with lever and weight or with spring or wafer - seat check valves.
    d. Provide isolation valve, check valve, and balancing valve on discharge side of pumps where indicated. Combination triple duty valves not allowed. Provide isolation valve and strainer on suction side of pump.
2. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
3. Valves, except wafer types, with the following end connections.
    a. For Copper Tubing 2-Inches and Smaller: Threaded ends.
    b. For Copper Tubing 2-1/2-Inches to NPS 4-Inches: Flanged ends.
    c. For Copper Tubing 5-Inches and Larger: Flanged ends.
    d. For Steel Piping 2-Inches and Smaller: Threaded ends.
    e. For Steel Piping 2-1/2-Inches to NPS 4-Inches: Flanged ends.
    f. For Steel Piping 5-Inches and Larger: Flanged ends.

3.2 GLOBE VALVE INSTALLATION

A. See General Installation Requirements above.

B. If valve applications are not indicated on Drawings, use the following:

1. Throttling Service: Globe valves or Pressure reducing valves.

3.3 BALANCING VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install with flow in the direction of the arrow on the valve body and install at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump. Two pipe diameters downstream from the balancing valve should be free of any fittings. When installed, easy and unobstructed access to the valve handwheel and metering ports for adjustment and measurement are to be provided. Install devices in accordance with manufacturer's recommendations to automatically balance flow in piping loops as indicated.

C. For venturi valves less than 1-1/2-inch pipe size, provide valve sized for flow to coil. Provide transitions on both inlet and outlet of valve if valve is less than line size.

3.4 BALL VALVE INSTALLATION

A. See General Installation Requirements above.

3.5 BUTTERFLY VALVE INSTALLATION

A. See General Installation Requirements above.

3.6 SWING CHECK VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install in the horizontal or vertical position with upward flow. Install for proper direction of flow. Install with minimum three pipe diameters of straight pipe upstream of valve.

3.7 WAFER CHECK VALVE INSTALLATION

A. See General Installation Requirements above.

B. Install between two flanges in horizontal or vertical position, position for proper direction of flow.

END OF SECTION 23 05 23

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Hangers and Supports for HVAC Piping, Ductwork and Equipment
2. Wall and Floor Sleeves
3. Building Attachments
4. Flashing
5. Miscellaneous Metal and Materials

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. ASCE 7-16, Minimum Design Loads for Buildings and Other Structures.
2. Terminology: As defined in MSS SP-90 "Guidelines on Terminology for Pipe Hangers and Supports".
3. Install ductwork and piping per SMACNA's requirements.
4. Hanger spacing installation and attachment to meet all manufacturer's requirements and MSS SP-58.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Welding:
   a. Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Welding for Hangers:
   a. Qualify procedures and personnel according to AWS D9.1, Sheet Metal Welding Code for duct joint and seam welding.
3. Engineering Responsibility:

a. Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, duct support, equipment hangers/supports, support from floor structure, roof structure or from structure above, and seismic restraint by a qualified Structural Professional Engineer.
   1) Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

4. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
5. Support systems to be supplied by a single manufacturer.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

A. Provide pipe, ductwork and equipment hangers and supports in accordance with the following:

1. When supports, anchorages, and seismic restraints for equipment, and supports, anchorages, and seismic restraints for conduit, piping, and ductwork are not shown on the Drawings, the contractor is responsible for their design.
2. Connections to structural framing not to introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems:

1. Support frames such as pipe racks or stanchions for piping, ductwork, and equipment which provide support from below.
2. Equipment, ductwork and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

D. Provide heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

E. Provide seismic restraint hangers and supports for piping, ductwork and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment. See Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Hangers and Supports for HVAC Piping, Ductwork and Equipment:

1. Anvil International
2. B-Line Systems, Inc.
3. Erico Company, Inc.
4. Nelson-Olsen Inc.
5. Rilco Manufacturing Company, Inc.
6. Snappitz Thermal Pipe Shield Manufacturing
7. Unistrut Corporation

B. Wall and Floor Sleeves:

1. Thunderline Corporation “Link Seal”
2. Or approved equivalent.

C. Building Attachments:

1. Anchor-It
2. Gunnebo Fastening Corporation
3. Hilti Corporation
4. ITW Ramset/Red Head
5. Masterset Fastening Systems, Inc.

2.2 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

A. Hanger Rods: Hanger rods continuously threaded or threaded ends only in concealed spaces and threaded ends only in exposed spaces; finish electro-galvanized or cadmium-plated in concealed spaces and prime painted in exposed spaces; sizes per MSS.

B. Hanger Rod Couplings: Anvil Figure 136, B-Line Figure B3220, or approved equivalent; malleable iron rod coupling with elongated center sight gap for visual inspection; to have same finish as hanger rods.

C. Channel Hanging System:

1. Framing members No. 12 gauge formed steel channels, 1-5/8-inch square, conforming to ASTM A1011 Grade 33, one side of channel to have a continuous slot within turned lips; framing nut with grooves and spring 1/2-inch size, conforming to ASTM 675 GR60; screws conforming to ASTM A307; fittings conforming to ASTM A575; parts enamel painted or electro-galvanized.
2. Concrete Inserts: Malleable iron body, hot dipped galvanized finish. Lateral adjustment. MSS Type 18.

D. Continuous Concrete Insert: Steel construction, minimum 12 gauge. Electrogalvanized finish. Pipe clamps and insert nuts to match.

E. Pipe Hangers:

1. Pipe Rings for Hanger Rods:

a. Pipe Sizes 2-inches and Smaller: Adjustable swivel ring hanger, UL listed. Erico 100 or 101, Anvil Figures 69 or 104, or approved equivalent.
b. Pipe Sizes 2-1/2-inches and Larger: Clevis type hangers with adjustable nuts on rod, UL listed. Anvil figure 260, Erico 400, or approved equivalent.
c. Pipe hangers to have same finish as hanger rods.

F. Pipe Saddles and Shields:

1. Factory fabricated saddles or shields under piping hangers and supports for insulated piping.
2. Size saddles and shields for exact fit to mate with pipe insulation. 1/2 round, 18 gauge, minimum 12-inches in length (4-inch pipe and larger to be three times longer than pipe diameter).

G. Riser Clamps: Steel, UL listed. MSS Type 8. Erico 510 or 511. Copper coated; Erico 368.

H. Pipe Slides: Anvil, reinforced Teflon slide material (3/32-inch minimum thickness) bonded to steel; highly finished steel or stainless steel contact surfaces to resists corrosion; 60-80 PSI maximum active contact surface loading; steel parts 3/16-inch minimum thickness; attachment to pipe and framing by welding.

I. Pipe Guides:

1. Furnish and install pipe guides on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides securely to pipe and structure. Contact with chilled water pipe not to permit heat to be transferred in sufficient quantity to cause condensation on any surface.
2. Furnish and install guides approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Guides are not to be used as supports and are in addition to other pipe hangers and supports.

J. Pipe Roller Hangers: Adjustable roller hanger. Black steel yoke, cast iron roller. MSS Type 41.

K. Thermal Hanger Shield Inserts:

1. 100-PSI (690-kPa) minimum compressive strength calcium silicate insulation, encased in sheet metal shield or polyisocyanurate rigid foam exceeding the load bearing weight of the pipe at the hanger point with a PVC vapor barrier.
2. Material for Cold Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier or polyisocyanurate rigid foam with a PVC vapor barrier.
3. Material for Hot Piping: Water-repellent-treated ASTM C533, Type 1 calcium silicate or polyisocyanurate rigid foam with a PVC vapor barrier.
4. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
5. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
6. Insert Length: Extend 2-inches beyond sheet metal shield for piping operating below ambient air temperature.
7. Thermal Hanger Shield Insulation Operating Temperature: Meet or exceed fluid temperature in pipe.

L. Freestanding Roof Supports: Polyethylene high-density UV resistant quick "pipe" block with foam pad.

2.3 WALL AND FLOOR SLEEVES

A. Pre-Engineered Firestop Pipe Penetration Systems: UL listed assemblies for maintaining fire rating of piping penetrations through fire-rated assemblies. Comply with ASTM E814.

B. Fabricated Accessories:

1. Steel Pipe Sleeves: Fabricate from Schedule 40 black or galvanized steel pipe. Remove end burrs by grinding.
2. Sheet Metal Pipe Sleeves: Fabricate from G-90 galvanized sheets closed with lock-seam joints. Provide the following minimum gauges for the sizes indicated:
    a. Sleeve Size 4-inches in Diameter and Smaller: 18 gauge.
    b. Sleeve Sizes 5-6-inches: 16 gauge.
    c. Sleeve Sizes 7-inches and Larger: 14 gauge.
    d. Fire-Rated Safing Material.
        1) Rockwool Insulation: Complying with FS-HH-I-558, Form A, Class IV, 6 pounds per cubic foot density with melting point of 1985 degrees F and K value of 0.24 at 75 degrees F.
        2) Calcium Silicate Insulation: Noncombustible, complying with FS-HH-I-523, Type II, suitable for 100 degrees F to 1200 degrees F service with K value of 0.40 at 150 degrees F.

2.4 BUILDING ATTACHMENTS

A. Beam Clamps:

1. MSS Type 19 and 23, wide throat, with retaining clip.
2. Universal Side Beam Clamp: MSS Type 20.

B. Powder-Actuated Drive Pin Fasteners: Powder actuated type, drive pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Anchor Bolts:

1. Anchor supports to existing masonry, block and tile walls per anchoring system manufacturer's recommendations or as modified by project structural engineer. Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
2. Anchor Bolts (Cast-In-Place): Steel bolts, ASTM A307. Nuts to conform to ASTM A194. Design values for shear and tension not more than 80 percent of the allowable listed loads.
3. Anchor (Expansion) Bolts: Carbon steel to ASTM A307; nut to conform to ASTM A194; drilled-in type. Design values for shear and tension not more than 80 percent of the allowable listed loads.
4. Anchor (Adhesive) Bolts: Consisting of two-part adhesive cartridge and zinc-plated Type A307 steel anchor bolt rod assembly with ASTM A194 nut.

2.5 FLASHING

A. Steel Flashing: 26 gauge galvanized steel.

B. Safes: 8 mil thick neoprene.

C. Caps: Steel, 22 gauge minimum, 16 gauge at fire-resistant structures.

2.6 MISCELLANEOUS METAL AND MATERIALS

A. General:

1. Provide miscellaneous supports and metal items, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on drawings or otherwise not shown on drawings that are necessary for completion of the project. Contractor is responsible for their design.
2. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

B. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.

C. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

G. Provide hot dipped galvanized components for items exposed to weather. Cold galvanize field-welded joints and components. Use materials compatible with system being supported (i.e. aluminum for aluminum ductwork, stainless steel for stainless steel ductwork).

H. Use straps, threshold rods and wire with sizes required by SMACNA to support ductwork.

I. Grout:

1. ASTM C1107, Grade B, factory mixed and packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
2. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
3. Properties: Nonstaining, noncorrosive, and non gaseous.
4. Design Mix: 5000-PSI (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Verify building materials to have hangers and attachments affixed in accordance with hangers to be used. Provide supporting calculations.

B. Examine Drawings and coordinate for verification of exact locations of fire and smoke rated walls, partitions, floors and other assemblies. Indicate, by shading and labeling on Record Drawings such locations and label as "1-Hour Wall," "2-Hour Fire/Smoke Barrier," and the like. Determine proper locations for piping penetrations. Set sleeves in place in new floors, walls or roofs prior to concrete pour or grouting.

C. Install hangers, supports, anchors and sleeves after required building structural work has been completed in areas where the work is to be installed. Coordinate proper placement of inserts, anchors and other building structural attachments.

D. Equipment Clearances: Do not route ductwork, equipment, or piping through electrical rooms, transformer vaults, IT rooms, MPOE rooms, or other electrical or electronic equipment spaces and enclosures and the like. Within equipment rooms, provide minimum 3-feet lateral clearance from all sides of electric switchgear panels. Do not route ductwork, equipment, or piping above any electric power or lighting panel, switchgear, or similar electric device. Coordinate with Electrical and coordinate exact ductwork, equipment or pipe routing to provide proper clearance with such items.

3.2 HANGERS AND SUPPORTS FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

A. Hang rectangular sheet-metal ducts with a cross sectional area of less than 7 SF with galvanized strips of No. 16 USS gauge steel 1-inch wide, and larger ducts with steel angles and adjustable hanger rods similar to piping hangers. Support at a maximum of 8-feet on center.

B. Support horizontal ducts within 24-inches of each elbow and within 48-inches of each branch intersection.

C. Design hangers and supports to allow for expansion and contraction.

D. Provide aluminum supports for aluminum ductwork.

E. Provide stainless steel supports for stainless steel ductwork.

F. Support vertical ducts at maximum intervals of 16-feet and at each floor.

G. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

H. Install flexible ductwork per the more stringent of SMACNA HVAC Duct Construction Standards or the following:

1. Support horizontal duct runs at not more than 4 feet intervals.
2. Support vertical risers at not more than 6 feet intervals.
3. Limit sag between support hangers to 1/2-inch per foot of spacing support.
4. Supports shall be rigid and shall be not less than 1.5-inches wide at point of contact with the duct surface.

5. Duct bends shall be not less than 1.5 duct diameter bend radius.

I. Use double nuts and lock washers on threaded rod supports.

J. Floor supports in mechanical rooms to be elevated 1-inch above finish floor and void space filled with masonry grout.

K. Anchor ducts securely to building in such a manner as to prevent transmission of vibration to structure. Do not connect duct hanger straps directly to roof deck. Do not support ducts from other ducts, piping or equipment.

L. Attach strap hangers installed flush with end of sheet-metal duct run to duct with sheet-metal screws.

M. Construct exterior ductwork or ductwork which is otherwise exposed to weather watertight and slope 1/4-inch per foot to avoid standing water.

N. Exposed ductwork hung in clean areas such as sanitary areas, pharmaceutical areas, wash down areas or food process areas to be installed using double end, food grade trapeze hanger rods suitable for use with food grade strut.

O. Channel Support System Installation:

1. Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
2. Field assemble and install according to manufacturer's written instructions.

P. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

Q. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

R. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

S. Adjust hangers so as to distribute loads equally on attachments. Provide grout under supports to bring piping, ductwork and equipment to proper level and elevations.

T. Prime paint ferrous nongalvanized hangers, accessories, and supplementary steel which are not factory painted.

U. Horizontal Piping Hangers and Supports; Horizontal and Vertical Piping, and Hanger Rod Attachments:

1. Factory fabricated horizontal piping hangers and supports complying with MSS SP-58, to suit piping systems and in accordance with manufacturer's published product information.
2. Use only one type by one manufacturer for each piping service.
3. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping.
4. Pipe support spacing (pipe supported in ceiling or floor-supported) to meet latest applicable Code and manufacturer's requirements.

5. Provide copper-plated hangers and supports for uninsulated copper piping systems.

V. Plumber's Tape not permitted as pipe hangers or pipe straps.

W. Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. For horizontally hung grooved-end piping, provide a minimum of 2 hangers per pipe section.

X. Pipe Ring Diameters:

1. Uninsulated and Insulated Pipe, Except Where Oversized Pipe Rings are Specified: Ring inner diameter to suit pipe outer diameter.
2. Insulated Piping Where Oversized Pipe Rings are Specified and Vibration Isolating Sleeves: Ring inner diameter to suit outer diameter of insulation or sleeve.

Y. Oversize Pipe Rings: Provide oversize pipe rings of 2-inch and larger size.

Z. Pipe Support Brackets: Support pipe with pipe slides.

AA. Steel Backing in Walls: Provide steel backing in walls to support fixtures and piping hung from steel stud walls.

BB. Pipe Guides:

1. Install on continuous runs where pipe alignment must be maintained. Minimum two on each side of expansion joints, spaced per manufacturer's recommendations for pipe size. Fasten guides to pipe structure. Contact with chilled water pipe does not permit heat to be transferred in sufficient quantity to cause condensation on any surface.
2. Install approximately four pipe diameters (first guide) and 14 diameters (second guide) away from each end of expansion joints. Do not use as supports. Provide in addition to other required pipe hangers and supports.

CC. Heavy-Duty Steel Trapeze Installation:

1. Arrange for grouping of parallel runs of horizontal piping and support together on field fabricated, heavy-duty trapezes.
2. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
3. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

DD. Group parallel runs of horizontal piping to be supported together on trapeze-type hangers. Maximum spacings: MSS SP-58.

EE. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe.

FF. Do not support piping from other piping.

GG. Fire protection piping will be supported independently of other piping.

HH. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated.

II. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping" is not exceeded.

JJ. Insulated Piping:

1. Attach clamps and spacers to piping.
    a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating Below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
2. Do not exceed pipe stress limits according to ASME B31.9.
3. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
4. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields to span arc of 180 degrees.
5. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
6. Shield Dimensions for Pipe, not less than the following:
    a. NPS 1/4 to NPS 3-1/2 (DN8 to DN 90): 12-inches long and 0.048-inch thick.
    b. NPS 4 (DN100): 12-inches long and 0.06-inch thick.
    c. NPS 5 and NPS 6 (DN125 and DN150): 18-inches long and 0.06-inch thick.
    d. NPS 8 to NPS 14 (DN200 to DN350): 24-inches long and 0.075-inch thick.
    e. NPS 16 to NPS 24 (DN400 to DN600): 24-inches long and 0.105-inch thick.
7. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
    a. Insert Material: Length at least as long as protective shield.
8. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

KK. Pipe Anchors: Provide anchors to fasten piping which is subject to expansion and contraction, and adjacent to equipment to prevent loading high forces onto the equipment.

LL. Pipe Curb Assemblies:

1. Provide prefabricated units for roof membrane and insulation penetrations related to equipment. Coordinate with roofing system. Set supports on the structural deck. Do not set supports on insulation or roofing. Provide level supports by prefabricated pitch built into the curb.
2. Provide for piping and electrical conduit which penetrates the structural roof deck to service equipment above the roof level (i.e., piping, electrical power and control wiring). Meet requirements of roof warranty.

MM. Escutcheon Plates: Install around horizontal and vertical piping at visible penetrations through walls, partitions, floors, or ceilings, including penetrations through closets, through below ceiling corridor walls, and through equipment room walls and floors.

NN. Vertical Piping:

1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
2. Riser clamps to be directly under fitting or welded to pipe.
    a. Riser to be supported at each floor of penetration.

b. Provide structural steel supports at the base of pipe risers. Size supports to carry forces exerted by piping system when in operation.

OO. Piping Above Roof:

1. Provide engineered roof piping supports appropriate for installation and attachment to the roof structure or structure below roof (see Architectural and Structural Drawings for roof construction, building structural systems, and sloping requirements for insulation).
2. Design a complete system unless specific details have been shown on Drawings.
3. Provide calculations signed and stamped by a Structural Engineer, registered in the State where the project is located at, as part of submittals and coordinated shop drawings.
4. Do not use freestanding supports unless approved by the Structural Engineer of Record.
5. Provide miscellaneous metal and materials as specified in Miscellaneous Metal and Materials article, above.

3.3 WALL AND FLOOR SLEEVES

A. "Link-Seal" Pipe Sleeves: Install at floor/below grade piping penetrations. Provide manufacturer's sleeve appropriate to seal type for pre-cast penetrations.

B. Fabricated Pipe Sleeves:

1. Provide either steel or sheet metal pipe sleeves accurately centered around pipe routes. Size such that piping and insulation, if any, will have free movement within the sleeve, including allowance for thermal expansion. Sleeve diameter to be determined by local seismic clearance requirements, and by waterproofing requirements.
2. Length: Equal to thickness of construction penetrated, except extend floor sleeves 1-inch above floor finish.
3. Provide temporary support of sleeves during placement in concrete and other work around sleeves. Provide temporary end closures to prevent concrete and other materials from entering pipe sleeves.
4. Seal each end airtight with a resilient nonhardening sealer, UL listed, fire rated ASTM 814.

C. Installation of metallic or plastic piping penetrations through non fire-rated walls and partitions and through smoke-rated walls and partitions:

1. Install fabricated pipe sleeve.
2. After installation of sleeve and piping, tightly pack entire annular void between piping or piping insulation and sleeve identification with specified material.
3. Seal each end airtight with a resilient nonhardening UL listed fire resistant ASTM 814.

D. Piping Penetrations Through Fire-Rated (One to Three Hour) Assemblies:

1. Select and install pre-engineered pipe penetration system in accordance with the UL listing and manufacturer's recommendation.
2. Provide proper sizing when providing sleeves or core-drilled holes to accommodate the penetration. Firestop voids between sleeve or core-drilled hole and pipe passing through to meet the requirements of ASTM E814.

3.4 BUILDING ATTACHMENTS

A. Factory fabricated attachments complying with MSS SP-58, selected to suit building substructure conditions and in accordance manufacturer's published product information.

B. Select size of building attachments to suit hanger rods.

C. Space attachments within maximum piping span length indicated in MSS SP-58.

D. Install building attachments within concrete slabs or attach to structural steel or wood. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.

E. Attachment to Wood Structure: Anvil side beam bracket Figure 202 for attachment to wooden beam or approved attachment for a wood structure.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install concrete inserts before concrete is placed; fasten inserts to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top in inserts.

H. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Test powder-actuated insert attachments with a minimum load of 100 pounds.

I. Do not use powder-actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4-inches thick.

J. Bolting: Provide bored, drilled or reamed holes for bolting to miscellaneous structural metals, frames or for mounts or supports. Flame cut, punched or hand sawn holes will not be accepted.

K. Anchor Bolts:

1. Install anchor bolts for mechanical equipment, piping and ductwork as required. Tightly fit and clamp base-supported equipment anchor bolts at equipment support points. Provide locknuts where equipment, piping and ductwork are hung.
2. Anchor Bolts (Cast-In-Place): Embed anchor bolts in new cast-in-place concrete to anchor equipment. Install a pipe sleeve around the anchor bolt for adjustment of the top 1/3 of the bolt embedment; sizes and patterns to suit the installation conditions of the equipment to be anchored.

3.5 FLASHING

A. Flash and counterflash where piping, ductwork and equipment passes through weather or waterproofed walls, floors, and roofs.

B. Provide 12-inch minimum height curbs for roof-mounted mechanical equipment. Flash and counter flash with galvanized steel, soldered and waterproofed.

3.6 MISCELLANEOUS METAL AND MATERIALS

A. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.

B. Finishes:

1. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with 1 coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
2. Metal in Contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
3. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

C. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required. Avoid cutting concrete reinforcing when drilling for inserts. Reference structural drawings and reinforcing shop drawings and determine locations of stirrups prior to drilling into concrete.

E. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items, which are to be built into concrete masonry or similar construction.

F. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

G. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

H. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with edge of the bearing plate before packing with grout. Use metallic non-shrink grout in concealed locations where not exposed to moisture; use non-metallic non-shrink grout in exposed locations, unless otherwise indicated.

I. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

J. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.

K. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.

L. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

M. Provide galvanized components for items exposed to weather.

3.7 FIRE RATED SUPPORTS

A. Provide fire rated support as required by Codes.

END OF SECTION 23 05 29

SECTION 23 05 33 - HEAT TRACING FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Heat Trace Cable (Freeze Protection)

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 23 07 00, HVAC Insulation

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 718K, Pipe Heating Cable.
2. CSA 3A, 3B, and 3C.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Project Record Documents: Record physical locations of thermostats.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Minimum heat tape capacities per linear foot as scheduled on Drawings.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Heat Trace Cable (Freeze Protection):

1. Thermon/FLX
2. Chromalox/SRF
3. Raychem/XL-Trace
4. Nelson/CLT

2.2 HEAT TRACE CABLE (FREEZE PROTECTION)

A. General: Provide complete UL listed system of heating cables and components listed specifically for maintaining pipe temperature over entire piping system exposed to freezing temperatures.

B. Materials

1. Cable: Self-regulating flat, flexible, low-heat density, parallel electric heater strip consisting of two stranded circuit conductors enclosed in semi-conductive, polymer core insulated with plastic jacket protected with tinned-copper braid. Ability to overlapped without creating hot spots and suitable for application on plastic, copper or steel pipe.
2. Voltage: See Electrical Drawings. Provide power connections, end seals, splices tap-offs and tees for a complete system.
3. Controls: Thermostat with fixed setpoint of 40 degrees F, remote bulb and capillary sensor enclosed in a NEMA 4 enclosure.

C. Minimum Exposure Temperature: 150 degrees F continuous.

PART 3 - EXECUTION

3.1 HEAT TRACE CABLE INSTALLATION

A. Heat Trace (Freeze Protection):

1. Location: Provide heat trace on piping exposed to freezing conditions.
2. Install cable parallel to pipe or spiral wrap to achieve power density per linear foot of pipe to prevent freezing.
3. Attach heat trace cable to pipe with polyester tape; increments not exceeding 1-foot, 0-inches.
4. Install thermostat capillary and bulb to pipe with polyester tape assuring a firm bulb contact with pipe. Install bulb without contact to heat cable. Maximum 12-inch spacing between tape.
5. Install thermostat at accessible location adjacent to pipe with minimum of exposed capillary.
6. Labeling: Provide “Electric Traced” label to outside of the pipes thermal insulation on alternating sides. Locate labels at intervals of 5- to 15-feet over entire length of heat tracing.
7. Coordinate installation with work under Division 26, Electrical for electrical service to each thermostat.
8. Coordinate application of heat tape with pipe insulation and weather jacketing.

END OF SECTION 23 05 33

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Vibration Isolation
2. Seismic Restrained Spring Vibration Isolation Roof-Curb
3. Seismic Restraint Devices
4. Factory Finishes
5. Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork

B. General:

1. Vibration isolation for mechanical ductwork, piping and equipment.
2. Seismic restraint for mechanical ductwork, piping and equipment.
3. Seismic Certification for equipment, hangers and systems.
4. Special inspections for systems.

C. Scope of Work:

1. Vibration isolation and seismic restraint of new equipment and systems within project boundary defined in architectural drawings.
2. Provide supplementary structural steel for seismic restraint systems. No hanging from roof deck is permitted on this project, unless specifically allowed by Structural Engineer of Record in writing prior to bid.

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Vibration Isolation:
   a. Product Data: Provide catalog data indicating size, type, load and deflection of each isolator; and percent of vibration transmitted based on lowest disturbing frequency of equipment.
   b. Shop Drawings: Showing complete details of construction for steel and concrete bases including:

1) Fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment and cantilever loads.
2) Equipment mounting holes.
3) Dimensions.
4) Size and location of concrete and steel bases and curbs.
5) Isolation selected for each support point.
6) Details of mounting brackets for isolator.
7) Weight distribution for each isolator.
8) Details of seismic snubbers.
9) Code number assigned to each isolator.

c. Design calculations: Provide calculations for selecting vibration isolators and for designing vibration isolation bases.

2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Seismic Restraint:
   a. Shop Drawings: Show compliance with requirements of Quality Assurance article of this Section. Shop drawings to be stamped by a professional Structural Engineer licensed in State of Washington.
   b. Calculations: Submit seismic calculations indicating restraint loadings resulting from design seismic forces. Include anchorage details and indicate quantity, diameter and depth of penetration of anchors. Calculations certified by professional Structural Engineer licensed in State of Washington.
4. Seismic Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter and depth of penetration of anchors.
5. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y and z planes.
6. Welding certificates.
7. Equipment Certification: Provide seismic certification for equipment as noted in Seismic Design Summary or schedules on Drawings.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Vibration Isolation:
   a. Except for packaged equipment with integral isolators, single manufacturer selects and furnishes isolation required.
   b. Deflections indicated on drawings are minimum actual static deflections for specific equipment supported.
   c. Isolator Stability:
      1) Size springs of sufficient diameter to maintain stability of equipment being supported. Spring diameters not less than 0.8 of compressed height at rated load.
      2) Springs have minimum additional travel to solid equal to 50 percent of rated defection.

3) Springs support 200 percent of rated load, fully compressed, without deformation or failure.

d. Maximum Allowable Vibration Levels: Peak vibration velocities not exceed 0.08 in/sec. Correct equipment operating at vibration velocities that exceed this criteria.

2. Seismic Restraint:

a. Code and Standard Requirements:

1) Seismic restraint of equipment, piping and ductwork to be in accordance with latest enacted version of ASCE 7-16 and IBC Chapter 16.

b. Confirm Seismic Control requirements in Division 01, General Requirements and Structural documents.

c. Certification: See Seismic Design Table or schedules on Drawings for equipment, systems and seismic-restraint devices designated to have seismic certification/qualification. Horizontal and vertical load testing and analysis performed according to ASCE 7-16. Anchorage systems to bear anchorage preapproval number from an agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing or calculations, if preapproved ratings are not available. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be sealed by qualified licensed professional engineer in State of Washington. Testing and calculations must include both shear and tensile loads and one test or analysis at 45 degrees to weakest mode.

d. Seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure be designed to resist total design seismic force prescribed in local building code:

1) Floor- or roof-mounted equipment weighing 400 pounds or greater.
2) Suspended, wall-mounted or vibration isolated equipment weighing 20 pounds or greater.
3) In-line duct devices connected to ductwork weighing 75 pounds or greater.
4) Housekeeping slabs: provide reinforcement and anchorage to building structure.

e. Where required, seismic sway bracing of suspended duct and piping meet following:

1) Pipe and duct runs requiring seismic bracing have minimum of two traverse braces and one longitudinal brace. Longitudinal (or traverse) brace at 90 degree change in direction may act as traverse (or longitudinal) brace if located within 2-feet of change in direction.
2) Seismic bracing may not pass through seismic separation joint. Pipe or duct runs that pass through seismic separation joint must be restrained within 5-feet of both sides of separation.
3) Seismic brace assembly spacing not to exceed 40-feet transverse and 80-feet longitudinal.

f. Seismic restraints may be omitted from suspended piping and duct if following conditions are satisfied:

1) For piping or ducts supported by rod hangers 12-inches or less in length from top of duct to bottom of structural support. Top connections to structure have swivel joints, eye bolts, or vibration isolation hangers for entire length of system run.
2) Lateral motion of system will not cause damaging impact with surrounding systems or cause loss of system vertical support.
3) System must be welded steel pipe, brazed copper pipe, sheet metal duct or similar ductile material with ductile connections.

C. Seismic restraints, including anchors to building structure, be designed by registered professional Structural Engineer licensed in State of Washington. Design includes:

1. Number, size, capacity and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both unit to curb and curb to structure.
2. Number, size, capacity and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations and test data verifying horizontal and vertical ratings of seismic restraint devices.
3. Number, size, capacity and location of braces and anchors for suspended piping and ductwork on as-built plan drawings.
4. Maximum seismic loads to be indicated on drawings at each brace location. Drawings bear stamp and signature of registered professional Structural Engineer who designed layout of braces.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Seismic Snubber Units: Furnish replacement neoprene inserts for snubbers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vibration Isolation:

1. The VMC Group
2. B-Line Systems, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.
5. M.W. Saussé - Vibrex
6. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

B. Seismic Restrained Spring Vibration Isolation Roof-Curb:

1. The VMC Group
2. B-Line Systems, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.
5. M.W. Saussé - Vibrex
6. Thybar Corporation
7. Vibration Eliminator Co., Inc.
8. California Dynamics Corporation
9. Vibro-Acoustics
10. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

C. Seismic Restraint Devices:

1. The VMC Group
2. B-Line Systems, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.
5. M.W. Saussé - Vibrex
6. California Dynamics Corporation
7. Cooper B-Line Tolco
8. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
9. Hilti, Inc.

D. Factory Finishes:

1. Kynar 500 Fluoropolymer Coating
2. Or approved equivalent.

E. Seismic-Bracing/Restraint Devices/Systems for Equipment, Piping and Ductwork:

1. The VMC Group
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. Hilti, Inc.
5. Cooper B-Line, Inc.
6. California Dynamics Corporation
7. Unistrut
8. ISAT, Inc.
9. Where Mason numbers are specified, equivalent products by listed manufacturers are acceptable.

2.2 VIBRATION ISOLATION

A. Type 1 - Neoprene Pad: Natural rubber waffle pads, arranged in single or multiple layers, 3/4-inch thick per layer with pattern repeating on 1/2-inch centers; 50 durometer hardness; maximum loading 60 PSI. Minimum 1/4-inch thick steel load distribution plate and 1/16-inch shim plates between layers, factory cut to sizes matching requirements of supported equipment. Molded bridge with neoprene anchor bolt bushing and flat washer face to prevent metal to metal contact. Number of layers required for equipment scheduled. Mason Type: Super WMH.

B. Type 2 - Neoprene Mount: Double-deflection type, with ductile-iron housing containing two separate and opposing, oil-resistant natural rubber or bridge bearing neoprene elements, factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Neoprene elements to prevent metal to metal contact during normal operation. Minimum static deflection of 0.30-inches. Mason Type: BR.

C. Type 3 - Spring: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
2. Minimum Additional Travel: 50 percent of required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, natural rubber or bridge bearing neoprene isolator pad attached to baseplate underside. Baseplates limit floor load to 100 PSIG (690 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
7. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
8. Mason Type: SLFH or SLF.

D. Type 4A - Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops (out of contact during normal operation) to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch thick, natural rubber or bridge bearing neoprene isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation. Restraining bolts have large rubber grommets to provide cushioning in vertical and horizontal directions. A minimum clearance of 3/8-inch maintained around restraining bolts so as not to interfere with spring action.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
7. Mason Type: SLR.

E. Type 4B - Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint with neoprene acoustical cup, spring inspection ports and rebound adjustment ports.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel before contacting a resilient collar.
4. Brackets: Manufacturer's standard bracket, utilize height saving brackets to accommodate height restrictions.
5. Mason Type: SSLFH.

F. Type 5A - Restrained Elastomeric Hangers: Double-deflection type, with molded, oil-resistant natural rubber or bridge bearing neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range. Seismic rebound steel and bonded LDS rubber washer to limit upward seismic movement. Mason Type: RWHD.

G. Type 5B - Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 15 degrees of angular hanger-rod misalignment from vertical without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Mason Type: 30N.

H. Type 6 - Horizontal Thrust Restraints: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of compressed height of spring at rated load.
3. Minimum Additional Travel: 50 percent of required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.
8. Mason Type: WBI or WBD.

I. Type 7 - Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on isolation material of 500 PSIG (3.45 MPa) and for equal resistance in all directions. Mason Type: ADA.

J. Type 8 - Resilient Pipe Vertical Sliding Guide: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin be removable and reinsertable to allow for selection of pipe movement. Guides be capable of motion to meet location requirements. Mason Type: VSG. Provide pipe expansion hangers to control load shifts as the riser expands or contracts, Mason HES.

K. Type FC-1, Flexible Duct Connectors. See Specification Section 23 33 00, Air Duct Accessories.

L. Type FC-2A, Flexible Pipe Connector, Steel:

1. 321 stainless steel, close pitch, annular corrugated hose.
2. Exterior Sleeve: 304 stainless steel, braided.
3. Pressure Rating: 125 PSI at 70 degrees F for 12-inch and smaller pipe.
4. Joint: ANSI Class 150 carbon steel flanges.
5. Size: Use pipe sized units.
6. Minimum Allowable Offset: 3/4-inch on each side of installed center line.
7. Basis of Design: Metraflex Model MLP.

M. Type FC-2B, Flexible Pipe Connector, Copper:

1. Inner Hose: Bronze, close pitch, annular corrugated hose.
2. Exterior Sleeve: Braided bronze (for piping over 2-inches, to be 3 pound braided stainless steel).
3. Minimum Allowable Pressure Rating: 125 PSI at 70 degrees F.
4. Joint: Sweat ends.
5. Size: Use pipe sized units.
6. Minimum Allowable Offset: 3/8-inch on each side of installed center line.
7. Basis of Design: Metraflex Model BBS.

N. Type FC-2C, Flexible Pipe Connector, Gas:

1. Inner Hose: 304 stainless steel.
2. Exterior Sleeve: Braided, 304 stainless steel.
3. Minimum Allowable Pressure Rating: 150 PSI at 70 degrees F up to 4-inch pipe.
4. Joint: Threaded carbon steel.
5. Minimum Allowable Offset: 3/4-inch on each side of installed center line.
6. Basis of Design: Metraflex GASCT.

O. Type FC-3, Flexible Compensator, Double Sphere:

1. Body: Molded twin spherical type. Neoprene with internal cord or wire.
2. Minimum Pressure Rating, Sizes 2-inch to 12-inch: 225 PSI at 170 degrees F.
3. Minimum Pressure Rating, Sizes 14-inch to 20-inch: 125 PSI at 170 degrees F.
4. Minimum Allowable Compression: 1-1/2 inches.
5. Minimum Allowable Elongation: 1-1/8 inches.
6. Minimum Allowable Offset: 1-1/8 inches.
7. Minimum Allowable Angular Movement: 20 degrees.
8. Joint: Steel flanges.
9. Accessories: Galvanized aircraft-type cable or control rods to prevent over extension.
10. Basis of Design: Metraflex Doublesphere.

2.3 SEISMIC RESTRAINED SPRING VIBRATION ISOLATION ROOF-CURB

A. Type RC-1, Spring Roof Curb: Continuous steel frames above and below isolators. Isolators adjustable, freestanding and laterally stable and include 1/4-inch acoustical neoprene cup and leveling bolts. Continuous sheet metal flashing attached to upper frame and separated from lower frame by neoprene weather seal with removable cover plates for adjustment and inspection of isolators. Seismic snubbers with all directional neoprene bushing and 1/4-inch air gap incorporated into each corner. Fasten unit to top steel frame and lower sheet metal curb must be attached to roof structure. Mason Type: ISC.

B. Type RC-2, Spring Roof Curb: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces. Mason Type: RSC.

1. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame provides continuous support for equipment and be captive to resiliently resist seismic and wind forces. Lower support assembly have means for attaching to building structure and wood nailer for attaching roof materials and be insulated with a minimum of 2-inches of rigid, glass-fiber insulation on inside of assembly.

2. Spring Isolators: Adjustable, restrained spring isolators be mounted on 1/4-inch-thick, elastomeric vibration isolation pads and have access ports, for level adjustment, with removable waterproof covers, accessible for adjustment.
3. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4-inch thick.
4. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly and counterflashed over roof materials.
5. Acoustic Option: Upper floating frame of curb have steel framework that supports 2 layers of 5/8-inch thick waterproof gypsum board. Gypsum board must surround ducts to provide a continuous sound break. This acoustical barrier be caulked to minimize sound transmission. 4-inch thick layer of 1.5-density fiberglass covers entire solid roof surface under unit. Gypsum board and insulation provided in field by contractor.

2.4 SEISMIC RESTRAINT DEVICES

A. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5, with a flat washer face.

B. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts and replaceable resilient isolation washers and bushings. Snubber load rating to match equipment size. Mason Type: Z-1011 or Z-1225.

1. Anchor bolts for attaching to concrete be seismic-rated, drill-in and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 50, plus or minus 5.

C. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement. Mason Type: SCB.

D. Anchor Bolts: Seismic-rated, drill-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.5 FACTORY FINISHES

A. Provide manufacturer's standard prime-coat finish ready for field painting. Units mounted outdoors exposed to weather: Epoxy powder coated, with 1000 hour salt spray rating per ASTM B-117. For high levels of corrosion protection utilize:

1. Conform to AAMA 605.2.
2. Apply coating following cleaning and pretreatment.
3. Cleaning: AA-C12C42R1X.
4. Dry system before final finish application.
5. Total Dry Film Thickness: Approximately 1.2 mils, when baked at 450 degrees F for 10 minutes.

B. Finish:

1. Manufacturer's standard paint applied to factory-assembled and factory-tested equipment before shipping.
2. Powder coating on springs and housings.
3. Hardware be electrogalvanized. Hot-dip galvanize metal components for exterior use.

4. Baked enamel for metal components on isolators for interior use.
5. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

2.6 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

A. General Requirements for Restraint Components: Rated strengths, features and applications to be as defined in reports by agency acceptable to authorities having jurisdiction.

B. Structural Safety Factor: Allowable strength in tension, shear and pullout force of components be at least four times maximum seismic forces to which they will be subjected.

C. Anchor bolts for attaching to concrete to be seismic-rated, drill-in and stud-wedge or female-wedge type.

D. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

E. Maximum 1/4-inch air gap and minimum 1/4-inch thick resilient cushion.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Set floor-mounted equipment with steel base rails on minimum 4-inch-high concrete housekeeping pads. Extend pad minimum 6-inches beyond footprint of equipment in each direction, but not less than twice the embedment depth of concrete anchors.

B. Provide mounts for equipment installed outdoors for wind loads of 30 lbs. psf applied to any exposed surface of isolated equipment.

C. Do not install equipment or pipe which makes rigid contact with building slabs, beams, studs, walls, etc.

D. Anchor baseplate to floor or structure. Provide rubber grommets and washers to isolate bolt from base plate. Under no circumstances is isolation efficiency to be destroyed when bolting isolators to floor.

E. Building Penetrations: Isolate water piping and ductwork penetrating wall, ceilings, floors or shafts from structure by piping isolator or by 3/8-inch thick foamed rubber insulation. Install units flush with finished structure face, using one for each side as required. Cut units to length if longer than structure thickness. Caulk around pipe or duct at equipment room wall.

F. Provide roof curbs, equipment supports and roof penetrations. Work to maintain roof warranty. Coordinate location, size, structural connections/requirements and flashing prior to installation.

G. Install Type 6 horizontal thrust restraints at centerline of thrust, symmetrical on either side of equipment.

H. Vibration isolators must not cause change of position of equipment or piping which would stress piping connections or misalignment shafts or bearings. Isolated equipment is to be level and in proper alignment with connecting ducts and pipes.

I. Pipe Hangers in Equipment Rooms: Support water and gas piping connected to rotating equipment within equipment rooms on spring and neoprene hangers. The first three hangers from a piece of vibrating equipment are to have a minimum of 1/2 static deflection of equipment isolators. Other isolators should have a minimum of 1/4 static deflection of equipment isolators.

J. Examination:

1. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements, installation tolerances and other conditions affecting performance.
2. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

K. Testing: Perform following field quality-control testing:

1. Isolator seismic-restraint clearance.
2. Isolator deflection.
3. Snubber minimum clearances.

L. Adjusting:

1. Adjust snubbers according to manufacturer's written recommendations.
2. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

M. Cleaning: After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt and debris.

N. Demonstration: Engage factory-authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain air-mounting systems. Reference Division 01, General Requirements.

3.2 VIBRATION ISOLATION

A. Reference General Installation Requirements above.

B. Install per manufacturer's instructions and recommendations.

C. Vibration isolators must be installed in strict accordance with manufacturer's written instructions and certified submittal data.

D. Install isolation as indicated on Drawings by type and location and where indicated below.

E. Equipment Vibration Isolation Schedule:

Equipment	Size	Vibration Isolator Type	Minimum Deflection (in)
Chillers/Heat Pumps: Reciprocating, Water or Air-Cooled	All	Type 4A or 4B, FC-3	2.5

Chillers/Heat Pumps: Centrifugal, Screw or Scroll, Water or Air-Cooled	All	Type 4A or 4B, FC-3	1.5
Boilers	All	Type 1 or 2, FC-2	0.3
Base-Mounted Pumps (Close-Coupled Only)	0 to 7.5 HP	FC-3	0.75
Base-Mounted Pumps	7.5+ HP	FC-3	1.5
Inline Pumps	All	Type 4A, 4B, 5B, FC-2	1.5
Fan-Coils, Unit Heaters, Fan-Powered Terminal Units	All	Type 5B, FC-1,2	0.75
Condensing Units	0 to 4.5 tons	Type 1 or 2	0.3
Condensing Units	5+ tons	Type 4A	2.5
Rooftop Air Handlers, AC, Heat Pump Units	0 to 19.5 tons	RC-1, FC-1,2	0.75
Rooftop Air Handlers, AC, Heat Pump Units	20+ tons	RC-2, FC-1,2	1.5
Axial, Cabinet, Centrifugal Inline Fans	0 to 23.5-inch diameter	Type 3, 4A, 4B, 5B, FC-1	0.75
Axial, Cabinet, Centrifugal Inline Fans	24-inch+ diameter	Type 3, 4A, 4B, 5B, FC-1	1.5
Propeller Fans	All	Type 2 or 5A, FC-1	0.25

F. Isolation Mounts:

1. Install minimum of four seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts.
3. Provide flexible piping connection and flexible ductwork connection to equipment with isolation mounts or bases.

G. Isolating Hangers:

1. Support piping and ductwork connected to isolated equipment within equipment rooms on isolating hangers as scheduled on drawings. Unless otherwise noted, first three hangers from isolated equipment to have a minimum of 1/2 static deflection of equipment isolators. Other isolating hangers to have a minimum of 1/4 static deflection of equipment isolators.
2. Position isolating hanger elements as high as possible in hanger rod assembly, but not in contact with building structure. Install hangers so that hanger housing may rotate full 360 degrees about rod axis without contacting any object.
3. Unless otherwise noted, air supply units with internally isolated fans do not require isolating hangers for connecting pipes and ductwork.
4. Where parallel running pipes are hung together on an isolated trapeze, provide isolator deflections for largest determined by provisions for pipe isolation. Do not mix isolated and non-isolated pipes in same trapeze.
5. Install limit stops so they are out of contact during normal operation.

H. Adjusting:

1. Adjust isolators after piping systems have been filled and equipment is at operating weight.
2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
3. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.

3.3 SEISMIC RESTRAINED SPRING VIBRATION ISOLATION ROOF-CURB

A. Reference General Installation Requirements above.

B. Install per manufacturer's instructions and recommendations.

C. Adjusting:

1. Adjust isolators after piping systems have been filled and equipment is at operating weight.
2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
3. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.
4. Adjust active height of spring isolators.

3.4 SEISMIC RESTRAINT DEVICES

A. Reference General Installation Requirements above.

B. Install in strict accordance with manufacturer's written instructions and certified submittal data.

C. Install and adjust seismic restraints so equipment, piping and ductwork supports are not degraded by restraints.

D. Restraints must not short circuit vibration isolation systems or transmit objectionable vibration or noise.

E. Install restraining cables at each trapeze, individual pipe hanger and hanging vibration isolated equipment. Provide restraining cables in each of the four directions of movement. Install restraining cables no less than 45 degrees from vertical. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

F. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

3.5 FACTORY FINISHES

A. Reference General Installation Requirements above.

B. Install per manufacturer's instructions and recommendations.

C. Finishes to be factory-applied. No field patching or holidays allowed.

3.6 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING AND DUCTWORK

A. Reference General Installation Requirements above.

B. Install per manufacturer's instructions and recommendations.

C. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 23 05 48

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Plastic Nameplates
2. Tags
3. Plastic Pipe Markers
4. Ceiling Tags
5. Plastic Duct Markers

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Schedules:
   a. Submit valve schedule for each piping system, in tabular format using Microsoft Word or Excel software. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shutoff and similar special uses by special "flags" in margin of schedule. In addition to mounted copies, furnish extra copies for maintenance manuals.
2. Submit schedule of identification type, including material, for each class of tagged item.
3. Submit locations at which Valve Schedules will be installed.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 PLASTIC NAMEPLATES

A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark
5. Seton

B. Description: Engraving stock melamine plastic laminate in the size and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color), punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Provide 1/8-inch thick material.

1. Letter Color: White.
2. Letter Height: 1/2-inch.
3. Background Color: Black.
4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.

2.2 TAGS

A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark
5. Seton

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 2-inch diameter.

C. Metal Tags: Polished Brass with stamped letters; tag size minimum 2-inch diameter with smooth edges.

D. Valve designations to be coordinated with existing valve identifications to ensure no repetitive designations are utilized.

E. Chart/Schedules: Valve Schedule Frames. For each page of a valve schedule, provide glazed display frame with removable mounting as appropriate for wall construction upon which frame is to be mounted. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

F. Valve Tag Fasteners: Solid brass chain (wire link or beaded type), or solid brass S-hooks.

G. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7-inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. Color: Yellow background with black lettering.

2.3 PLASTIC PIPE MARKERS

A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark
5. Seton

B. Color: Conform to ASME A13.1 and ANSI Z535.1.

C. Plastic Pipe Markers (for external diameters of 6-inches and larger including insulation): Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers (for external diameters less than 6-inches including insulation): Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. Minimum information indicating flow direction arrow and identification of fluid being conveyed.

E. Lettering:

1. 3/4-inch to 1-1/4-inch Outside Diameter of Insulation or Pipe: 8-inch long color field, 1/2-inch high letters.
2. 1-1/2-inch to 2-inch Outside Diameter of Insulation or Pipe: 8-inch long color field, 3/4-inch high letters.
3. 2-1/2-inch to 6-inch Outside Diameter of Insulation or Pipe: 12-inch long color field, 1-1/4-inch high letters.
4. 8-inch to 10-inch Outside Diameter of Insulation or Pipe: 24-inch long color field, 2-1/2-inch high letters.
5. Over 10-inch Outside Diameter of Insulation or Pipe: 32-inch long color field, 3-1/2-inch high letters.

2.4 CEILING TAGS

A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark
5. Seton

B. Description: Steel with 3/4-inch diameter color coded head.

C. Color code as follows:

1. Yellow - HVAC equipment.
2. Red - Fire dampers/smoke dampers.
3. Blue - Heating/cooling valves.
4. Ceiling tile labels, machine generated, adhesive backed tape labels with black letters, clear tape.

2.5 PLASTIC DUCT MARKERS

A. Manufacturers:

1. Brady Corporation
2. Brimar
3. Champion America
4. Craftmark
5. Seton

B. General: Manufacturer's standard laminated plastic, color-coded duct markers. Supply separate color codes for supply, exhaust, outside, return air and hazardous exhaust lab, chemical, fume hood, isolation room systems.

C. Include the Following Nomenclature:

1. Direction of air flow.
2. Duct service (supply, return, general exhaust, outdoor air), kitchen exhaust, dishwasher exhaust, fume hood exhaust, isolation room exhaust, etc.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates riveted to equipment body.

B. Identify ductwork with plastic ductmarkers.

C. Identify piping, concealed or exposed, with plastic pipe markers.

D. Coordinate names, abbreviations and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

E. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples: Chiller No. 3, Air Handling Unit No. 42, Standpipe F12, and the like).

F. Degrease and clean surfaces to receive adhesive for identification materials.

G. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

H. Install all products in accordance with manufacturer's instructions.

I. Manual Balancing Dampers: Provide 12-inch long orange marker ribbon to end of balancing damper handle.

3.2 PLASTIC NAMEPLATES

A. Install plastic nameplates with corrosive-resistant mechanical fasteners.

B. Identify control panels and major control components outside panels with plastic nameplates riveted to equipment body.

C. Identify thermostats with nameplates.

3.3 TAGS

A. Use metal tags on piping 3/4-inch diameter and smaller.

B. Tag balancing valves and major dampers with balanced GPM or CFM indicated after balancing is completed and accepted.

C. Install tags with corrosion resistant chain.

D. Small devices, such as in-line pumps, may be identified with tags.

E. Identify valves with metal tags. Indicate valve function and the normally open or closed positions on the valve tag.

F. Identify air terminal units and radiator valves with numbered plastic tags.

G. Tag automatic controls, instruments, and relays. Key to control schematic.

H. Install valve schedule at each mechanical room.

3.4 PLASTIC PIPE MARKERS

A. Install plastic pipe markers complete around pipe in accordance with manufacturer's instructions.

B. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20-feet (reduced to 10-feet in congested areas and mechanical equipment rooms) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction. Locate near branches, valves, control devices, equipment connections, access doors, floor/wall penetrations.

3.5 CEILING TAGS

A. Provide ceiling tags to locate valves, dampers, and equipment above accessible ceilings. Locate in corner of ceiling tee grid closest to equipment.

3.6 PLASTIC DUCT MARKERS

A. Identify air supply, return, exhaust, isolation room exhaust, and outside air intake ductwork with duct markers, showing ductwork service and direction of flow, in black or white (whichever provides most contrast with ductwork identification color). Identify with air handling unit identification number and area served. Locate identification at air handling unit, in mechanical rooms, at each side of penetration of structure or enclosure, at each obstruction, and within view of access doors/panels. In each space where ductwork is exposed, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment) and at 50 foot spacing along exposed runs. Where noted on Drawings, identify ductwork in exposed/public locations.

B. Access Doors: Provide duct markers on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions.

C. Isolation Rooms and Anteroom: Identify exhaust ducts by labeling with the words "Caution Airborne Infection Isolation Rooms Exhaust." Provide labeling in a manner which is not readily removable and appears on the exhaust duct at intervals of not more than 20-feet and at least once near each room and each story traversed by the exhaust system.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. General Requirements and Procedures
2. Fundamental Air Systems Balancing Procedures
3. Temperature Control Verification
4. Constant Volume Air Systems Balancing Procedures
5. Fundamental Procedures for Hydronic Systems
6. Pump Balancing Procedures
7. Variable Flow Hydronic Systems Additional Procedures
8. Primary-Secondary Flow Hydronic Systems Additional Procedures
9. Heat Exchangers
10. Pre-Balance Reporting
11. Final Reports:
    a. Report Requirements
    b. General Report Data
    c. System Diagrams
    d. Air Handling Units
    e. Hydronic Coils
    f. Fans
    g. Duct Traverses
    h. Diffusers/Registers/Grilles
    i. Heat Exchangers
    j. Pumps
    k. Boilers
    l. Instrument Calibration
12. Additional Tests

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Quality-Assurance Submittals: Submit two copies of evidence that the Testing, Adjusting, and Balancing (TAB) Agent and Project's TAB team members meet the qualifications specified in the "Quality Assurance" Article below.
2. Pre-Construction Phase Report:

a. Provide a pre-construction phase TAB Plan at least two weeks prior to the commencement of TAB work. This report is to include:
   1) A complete set of report forms intended for use on the Project, with data filled in except for the field readings. Forms to be Project-specific.
   2) Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
   3) Identification of the type, manufacturer, and model of the actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications to be included.
   4) A narrative of Project-specific and/or non-standard TAB procedures to be used, and the equipment or systems to which they apply.

3. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit two copies of the Contract Documents review report as specified in Part 3 of this Section.
4. Strategies and Procedures Plan: Submit two copies of the TAB strategies and step-by-step procedures as specified in Part 3 of this Section. Include a complete set of report forms intended for use on this Project.
5. Specify reports required because of editing procedures in Part 3 of this Section.
6. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by the TAB Agent.
7. Sample Report Forms: Submit two sets of sample TAB report forms.
8. Test Instrument Calibration: Submit proof of calibration within the last 6 months.
9. Final Report.
10. Provide additional submittals to commissioning authority as dictated in Commissioning Specifications.

1.5 QUALITY ASSURANCE

A. Quality Assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Acceptable TAB Agencies:
   a. Washington:
      1) Neudorfer
      2) Hardin & Sons
      3) Northwest Engineering Services
      4) Testcomm
      5) Precision Test & Balance, Inc.
2. Balance Firm Qualifications:
   a. General:
      1) Procure services of independent TAB agency to balance, adjust and test water circulating and air moving equipment and air distribution or exhaust systems. Minimum experience: 5 years.
      2) Provide proof of testing agency having successfully completed at least five projects of similar size and scope.
   b. Testing and Balancing firm is certified by NEBB or AABC and has a NEBB Certified Professional (CP) or a AABC Test and Balancer Engineer (TBE) on staff.
   c. Industry Standards: Testing and Balancing will conform to NEBB or AABC, and American National Standards Institute (ANSI) as follows:
      1) NEBB: Comply with Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
      2) AABC: Comply with National Standards for Total System Balance.

3) ANSI:
a) S1.4 Specifications for sound level meters.
b) S1.11 Specifications for Octave-Band and Fractional-Octave-Band analog and digital filters.
c) ANSI S1.13 Methods for the Measurement of Sound Pressure Levels.

d. Test Observation: If requested, conduct tests in the presence of the Commissioning Authority, AHJ, Architect or the Architect's representative.

3. Code Compliance: Perform tests in the presence of the Authority Having Jurisdiction (AHJ) where required by the Authority Having Jurisdiction (AHJ).
4. Owner Witness: Perform tests in the presence of the Commissioning Authority, Architect, Architect's Representative, or Owner's representative.
5. Engineer Witness: The engineer or engineer's representative reserves the right to observe tests or selected tests to assure compliance with the specifications.
6. Simultaneous Testing: Test observations by the AHJ, the Owner's Authorized Representative and the engineer's representative need not occur simultaneously.
7. Do not perform TAB work until heating, ventilating, and air conditioning equipment has been completely installed and is operating continuously as required.
8. Conduct air testing and balancing with clean filters in place. Clean strainers prior to performing hydronic testing and balancing.
9. TAB Conference: Meet with the Commissioning Authority, Owner's and the Architect's representatives on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days advance notice of scheduled meeting time and location.
a. Agenda Items: Include at least the following:
1) Submittal distribution requirements.
2) Contract Documents examination report.
3) TAB plan.
4) Work schedule and Project site access requirements.
5) Coordination and cooperation of trades and subcontractors.
6) Coordination of documentation and communication flow.
10. Certification of TAB Reports: This certification includes the following:
a. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
b. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
11. TAB Reports: Use standard forms from NEBB or AABC.
12. Instrumentation Type, Quantity, and Accuracy: As described in NEBB or AABC.
13. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. TAB Agency provides warranty for a period of 90 days following submission of completed report, during which time, Owner may request a recheck of up to 10 percent of total number of terminals, or resetting of outlet, coil, or device listed in the final TAB report.
2. Guarantee: Meet the requirements of the following programs:

a. Provide a guarantee on NEBB or AABC forms stating that the agency will assist in completing the requirements of the Contract Documents if the TAB Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
   1) The certified Agent has tested, adjusted, and balanced systems according to the Contract Documents.
   2) Systems are balanced to optimum performance capabilities within design and installation limits.

1.7 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. TAB: Testing, Adjusting, and Balancing.

K. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

L. Test: A procedure to determine quantitative performance of a system or equipment.

M. Testing, Adjusting, and Balancing (TAB) Agent: The entity responsible for performing and reporting the TAB procedures.

N. AABC: Associated Air Balance Council.

O. NEBB: National Environmental Balancing Bureau.

P. AMCA: Air Movement and Control Association.

Q. CTI: Cooling Tower Institute.

R. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.8 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.

C. Witness leakage and pressure tests carried out by Section 23 31 00, HVAC Ducts and Casings.

D. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS AND PROCEDURES

A. Project Conditions:

1. Non-Owner Occupancy: Complete balancing of building systems prior to Substantial Completion and owner occupancy.

B. General Requirements:

1. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and controls, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.
2. Perform TAB work with doors, closed windows, and ceilings installed etc., to obtain simulated or project operating conditions. Do not proceed until systems scheduled for TAB are clean and free from debris, dirt and discarded building materials.
3. Where Owner occupies building during the testing period, cooperate with Owner to minimize conflicts with Owner's operations.

C. Examination:

1. Examine Contract Documents to become familiar with project requirements and existing building record documents (if available) to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
    a. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
    b. Verify that balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
2. Examine approved submittal data of HVAC systems and equipment.
3. Examine Project record documents described in Division 01, General Requirements.

4. Examine Architect's and Engineer's design data, including Basis of Design, HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
5. Examine equipment performance data, including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
6. Coordinate requirements in system and equipment with this Section.
7. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
8. Examine system and equipment test reports.
9. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
10. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
11. Examine equipment for installation and for properly operating safety interlocks and controls.
12. Report deficiencies discovered before and during performance of TAB procedures.

D. Preparation:

1. Prepare a TAB plan that includes strategies and step-by-step procedures.
2. Complete system readiness checks and prepare system readiness reports. Verify the following:
    a. Permanent electrical power wiring is complete.
    b. Hydronic systems are filled, clean, and free of air.
    c. Automatic temperature-control systems are operational.
    d. Equipment and duct access doors are securely closed.
    e. Balance, smoke, and fire dampers are open.
    f. Isolating and balancing valves are open and control valves are operational.
    g. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
    h. Windows, doors and other portions of the building envelope can be closed so design conditions for system operations can be met.
3. Hold a pre-balancing meeting at least one week prior to starting TAB work.
    a. Attendance is required by installers whose work will be tested, adjusted, or balanced.
4. Provide instruments required for TAB operations. Make instruments available to Architect to facilitate spot checks during testing.

E. General TAB Procedures:

1. Perform TAB procedures on each system according to the procedures contained in NEBB or AABC and this Section.

2. Coordinate location of test probes prior to start of TAB procedures and make test probes available for Owner's tests after start of occupancy. Where required, cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
3. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

F. Adjustment Tolerances:

1. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
2. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
3. Hydronic Systems: Adjust to within plus or minus 10 percent of design at coils and plus or minus 5 percent at system pumps and equipment.
4. Adjust supply, return, and exhaust air quantities to maintain pressurization in spaces indicated on Drawings. Note and document room-to-room pressurization and maintain these relationships. Adjust pressure controlled spaces to within plus or minus 0.01 in WC.

G. Recording and Adjusting:

1. Field Logs: Maintain written logs including:
   a. Running log of events and issues.
   b. Discrepancies, deficient or uncompleted work by others.
   c. Contract interpretation requests.
   d. Lists of completed tests.
2. Ensure recorded data represents actual measured or observed conditions.
3. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
4. Mark on drawings locations where traverse and other critical measurements were taken and cross reference location in final report.
5. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
6. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
7. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner's Authorized Representative, or Commissioning Agent.

3.2 FUNDAMENTAL AIR SYSTEMS BALANCING PROCEDURES

A. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

B. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.

C. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

D. Prepare test reports for both fans and inlets and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross check the summation of required outlet volumes with required fan volumes.

E. Prepare schematic diagrams of systems' "as-built" duct layouts.

F. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

G. Check the airflow patterns from the outside-air louvers and dampers and the return-air and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

H. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

I. Verify that motor starters are equipped with thermal protection, sized for the connected load.

J. Check dampers for proper position to achieve desired airflow path.

K. Check for airflow blockages.

L. Check that condensate drains are installed, trapped and primed and routed to drain.

M. Check for readily observable leaks in air-handling unit components and ductwork.

N. Use sheaves and pulleys to adjust the speed of belt drive fans to achieve design flow with motors running at 60 Hertz unless noted otherwise.

3.3 TEMPERATURE CONTROL VERIFICATION

A. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices operate by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including 2-way valves and 3-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, equipment, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to design values.

B. Verify that controllers are calibrated and commissioned.

C. Check transmitter and controller locations and note conditions that would adversely affect control functions.

D. Record controller settings and note variances between set points and actual measurements.

E. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

F. Verify free travel and proper operation of control devices such as damper and valve operators.

G. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.

H. Confirm interaction of electrically operated switch transducers.

I. Confirm interaction of interlock and lockout systems.

J. Verify main control supply-air pressure and observe compressor and dryer operations.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.4 CONSTANT VOLUME AIR SYSTEMS BALANCING PROCEDURES

A. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer. Adjust fans to deliver design airflow at the lowest possible speed.

1. Measure fan static pressures to determine actual static pressure as follows:
    a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
2. Measure static pressure across each air-handling unit component under final balanced condition.
3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Recommend corrective action to align design and actual conditions.
4. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
5. Do not make fan-speed adjustments that result in motor loading greater than full load amps. Do not increase fan speed beyond fan class rating. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
6. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
7. Calibrate airflow measuring stations.

3.5 FUNDAMENTAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Examine strainers for clean screens and proper perforations.

B. Examine 3-way valves for proper installation for their intended function of diverting or mixing fluid flows.

C. Examine open-piping-system pumps to ensure absence of entrained air in the suction piping.

D. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

E. Prepare schematic diagrams of systems' "as-built" piping layouts.

F. Prepare hydronic systems for TAB according to the following, in addition to the general preparation procedures specified above:

1. Open manual valves for maximum flow.
2. Check expansion tank liquid level, or air charge if bladder type.
3. Check makeup-water-station pressure gauge for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at design flow.
5. Set differential-pressure control valves at the specified differential pressure.
6. Set system controls so automatic valves are wide open to heat exchangers and coils.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

G. Calibrate waterflow measuring stations.

3.6 PUMP BALANCING PROCEDURES

A. Determine water flow at pumps. Use the following procedures:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gauge heights. Note the point on the manufacturer's pump curve at zero flow and confirm that the pump has the intended impeller size.
2. Check system resistance. With valves open, read pressure differential across the pump and mark the pump manufacturer's head-capacity curve. Adjust pump discharge valve until design water flow is achieved. Report flow rates that are not within plus or minus 5 percent of design.
3. Verify pump-motor amperage. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Set calibrated balancing valves, if installed, at calculated presettings.
5. Measure flow at stations and adjust, where necessary, to obtain first balance. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
6. Measure flow at main balancing station and set main balancing device or adjust pump speed to achieve flow that is 5 percent greater than design flow.
7. Adjust balancing stations to within specified tolerances of design flow rate as follows:
    a. Determine the balancing station with the highest percentage over design flow.
    b. Adjust each station in turn, beginning with the station with the highest percentage over design flow and proceeding to the station with the lowest percentage over design flow.
    c. Record settings and mark balancing devices.
8. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures, including outdoor-air temperature.
9. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.7 VARIABLE FLOW HYDRONIC SYSTEMS ADDITIONAL PROCEDURES

A. Balance systems with automatic 2- and 3-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

B. Balance system to achieve the lowest required differential pressure for the system to minimize pump brake horsepower.

3.8 PRIMARY-SECONDARY-FLOW HYDRONIC SYSTEMS' ADDITIONAL PROCEDURES

A. Balance the primary system crossover flow first, then balance the secondary system.

3.9 HEAT EXCHANGERS

A. Adjust water flow to within specified tolerances.

B. Measure inlet and outlet water temperatures.

C. Measure inlet steam pressure. Check the setting and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves.

D. Measure hot and cold side pressure drops.

E. Record safety valve settings.

F. Verify operation of steam traps.

3.10 PRE-BALANCE REPORTING

A. Pre-Construction Phase Report:

1. Provide a pre-construction phase TAB Plan at least 2 weeks prior to the commencement of TAB work. This report is to include:
    a. A complete set of report forms intended for use on the Project, with all data filled in except for the field readings. Forms to be Project-specific.
    b. Marked up shop drawings identifying all HVAC equipment to be balanced, and associated outlets and terminal devices.
    c. Identification of the type, manufacturer, and model of actual instruments to be used, and clear indication of which instrument will be used to take each type of reading. Calibration certifications are to be included.
    d. A narrative of Project-specific and/or non-standard TAB procedures to be used, and the equipment or systems they apply to.

B. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

C. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced.

3.11 FINAL REPORTS

A. Report Requirements:

1. General:
   a. Computer generated in PDF format and tabulated, divided, and bookmarked into sections by tested and balanced systems.
   b. Include a certification sheet in front of binder signed and sealed by the certified TAB engineer.
      1) Include a list of the instruments used for procedures, along with proof of calibration.
   c. Final Report Contents: In addition to the certified field report data, include the following:
      1) Pump curves
      2) Fan Curves
      3) Manufacturers Test Data
      4) Field test reports prepared by system and equipment installers
      5) Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data

B. General Report Data:

1. In addition to the form titles and entries, include the following data in the final report, as applicable:
   a. Title Page
   b. Name and Address of TAB Agent
   c. Project Name
   d. Project Location
   e. Architect's Name and Address
   f. Engineer's Name and Address
   g. Contractor's Name and Address
   h. Report Date
   i. Signature of TAB Agent who Certifies the Report
   j. Summary of Contents, Including the Following:
      1) Design versus Final Performance
      2) Notable Characteristics of Systems
      3) Description of System Operation Sequence if it varies from the Contract Documents
   k. Nomenclature Sheets for Each Item of Equipment
   l. Data for Terminal Units, including Manufacturer, Type Size, and Fittings
   m. Notes to explain why certain final data in the body of reports vary from design values.
   n. Test Conditions for Fans and Pump Performance Forms, Including the Following:
      1) Settings for Outside-, Return-, and Exhaust-Air Dampers
      2) Conditions of Filters
      3) Cooling Coil, Wet- and Dry-bulb Conditions
      4) Face and Bypass Damper Settings at Coils
      5) Fan Drive Settings, including Settings and Percentage of Maximum Pitch Diameter
      6) Inlet Vane Settings for Variable-Air-Volume Systems
      7) Settings for Supply-air, Static-pressure Controller
      8) Other System Operating Conditions that affect Performance

C. System Diagrams:

1. Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
   a. Quantities of Outside, Supply, Return, and Exhaust Airflows
   b. Water and Steam Flow Rates
   c. Duct, Outlet, and Inlet Sizes
   d. Pipe and Valve Sizes and Locations
   e. Terminal Units
   f. Balancing Stations

D. Air Handling Units:

1. For air-handling units, split systems, fan coils, pumps, and evaporator units with coils, include the following:
   a. Unit Data: Include the following:
      1) Unit Identification
      2) Location
      3) Make and Type
      4) Model Number and Unit Size
      5) Manufacturer's Serial Number
      6) Unit Arrangement and Class
      7) Discharge Arrangement
      8) Sheave Make, Size in inches, and Bore
      9) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
      10) Number of Belts, Make, and Size
      11) Number of Filters, Type, and Size
   b. Motor Data: Include the following:
      1) Make and Frame Type and Size
      2) Horsepower and rpm
      3) Volts, Phase, and Hertz
      4) Full-load Amperage and Service Factor
      5) Sheave Make, Size in Inches, and Bore
      6) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
   c. Test Data: Include design and actual values for the following:
      1) Total Airflow Rate in cfm (L/s)
      2) Total System Static Pressure in Inches wg (Pa)
      3) Fan rpm
      4) Discharge Static Pressure in Inches wg (Pa)
      5) Filter Static-pressure Differential in Inches wg (Pa)
      6) Preheat Coil Static-pressure Differential in Inches wg (Pa)
      7) Cooling Coil Static-pressure Differential in Inches wg (Pa)
      8) Heating Coil Static-pressure Differential in Inches wg (Pa)
      9) Outside Airflow in cfm (L/s)
      10) Return Airflow in cfm (L/s)
      11) Outside-air Damper Position
      12) Return-air Damper Position
      13) Vortex Damper Position

E. Hydronic Coils:

1. For hydronic coils in all equipment with coils, include the following:
   a. Coil Data: Include the following:
      1) System Identification
      2) Location and Zone
      3) Room or Riser Served

4) Coil Type
5) Number of Rows
6) Fin Spacing in Fins per Inch o.c.
7) Make and Model Number
8) Face Area in SF
9) Tube Size in NPS (DN)
10) Tube and fin Materials
11) Circuiting Arrangement

b. Test Data: Include design and actual values for the following:
1) Airflow Rate in cfm
2) Average Face Velocity in fpm
3) Air Pressure Drop in Inches wg
4) Outside-air, Wet- and Dry-bulb Temperatures in Degrees F
5) Return-air, Wet- and Dry-bulb Temperatures in Degrees F
6) Entering-air, Wet- and Dry-bulb Temperatures in Degrees F
7) Leaving-air, Wet- and Dry-bulb Temperatures in Degrees F
8) Water Flow Rate in gpm
9) Water Pressure Differential in Feet of Head or PSIG
10) Entering-water Temperature in Degrees F
11) Leaving-water Temperature in Degrees F

F. Fans:

1. Fan Test Reports: For supply, return, and exhaust fans, include the following:
a. Fan Data: Include the following:
1) System Identification
2) Location
3) Make and Type
4) Model Number and Size
5) Manufacturer's Serial Number
6) Arrangement and Class
7) Sheave Make, Size in Inches, and Bore
8) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
b. Motor Data: Include the following:
1) Make and Frame Type and Size
2) Horsepower and rpm
3) Volts, Phase, and Hertz
4) Full-load Amperage and Service Factor
5) Sheave Make, Size in Inches, and Bore
6) Sheave Dimensions, Center-to-center and Amount of Adjustments in Inches
7) Number of Belts, Make, and Size
c. Test Data: Include design and actual values for the following:
1) Total Airflow Rate in cfm
2) Total System Static Pressure in Inches wg
3) Fan rpm
4) Discharge Static Pressure in Inches wg
5) Suction Static Pressure in Inches wg

G. Duct Traverses:

1. Include a diagram with a grid representing the duct cross-section and record the following:
a. Report Data: Include the following:
1) System and Air-handling Unit Number

2) Location and Zone
3) Duct Static Pressure in Inches wg
4) Duct Size in Inches
5) Duct Area in SF
6) Design Airflow Rate in cfm
7) Design Velocity in fpm
8) Actual Airflow Rate in cfm
9) Actual Average Velocity in fpm

H. Diffusers/Registers/Grilles:

1. For diffusers, registers and grilles, include the following:
   a. Unit Data: Include the following:
      1) System and Air-handling Unit Identification
      2) Location and Zone
      3) Test Apparatus Used
      4) Area Served
      5) Air-terminal-device Make
      6) Air-terminal-device Number from System Diagram
      7) Air-terminal-device Type and Model Number
      8) Air-terminal-device Size
      9) Air-terminal-device Effective Area in SF
   b. Test Data: Include design and actual values for the following:
      1) Airflow Rate in cfm
      2) Air Velocity in fpm
      3) Final Airflow Rate in cfm
      4) Final Velocity in fpm
      5) Space Temperature in Degrees F

I. Heat Exchangers:

1. For heat exchangers, include the following:
   a. Unit Data: Include the following:
      1) Unit Identification
      2) Location
      3) Service
      4) Make and Type
      5) Model and Serial Numbers
      6) Ratings
   b. Primary Water Test Data: Include design and actual values for the following:
      1) Entering-water Temperature in Degrees F
      2) Leaving-water Temperature in Degrees F
      3) Entering-water Pressure in Feet of Head or PSIG
      4) Water Pressure Differential in Feet of Head or PSIG
      5) Water Flow Rate in gpm
   c. Secondary Water Test Data: Include design and actual values for the following:
      1) Entering-water Temperature in Degrees F
      2) Leaving-water Temperature in Degrees F
      3) Entering-water Pressure in Feet of Head or PSIG
      4) Water Pressure Differential in Feet of Head or PSIG
      5) Water Flow Rate in gpm

J. Pumps:

1. For pumps, include the following data. Calculate impeller size by plotting the shutoff head on pump curves.
   a. Unit Data: Include the following:
      1) Unit Identification
      2) Location
      3) Service
      4) Make and Size
      5) Model and Serial Numbers
      6) Water Flow Rate in gpm
      7) Water Pressure Differential in Feet of Head or PSIG
      8) Required Net Positive Suction Head in Feet of Head or PSIG
      9) Pump rpm
      10) Impeller Diameter in Inches
      11) Motor Make and Frame Size
      12) Motor Horsepower and rpm
      13) Voltage at Each Connection
      14) Amperage for Each Phase
      15) Full-load Amperage and Service Factor
      16) Seal Type
   b. Test Data: Include design and actual values for the following:
      1) Static Head in Feet of Head or PSIG
      2) Pump Shutoff Pressure in Feet of Head or PSIG
      3) Actual Iimpeller Size in Inches
      4) Full-open Flow Rate in gpm
      5) Full-open Pressure in Feet of Head or PSIG
      6) Final Discharge Pressure in Feet of Head or PSIG
      7) Final Suction Pressure in Feet of Head or PSIG
      8) Final Total Pressure in Feet of Head or PSIG
      9) Final Water Flow Rate in gpm
      10) Voltage at Each Connection
      11) Amperage for Each Phase

K. Boilers:

1. For boilers, include the following:
   a. Unit Data: Include the following:
      1) Unit Identification
      2) Location
      3) Service
      4) Make and Type
      5) Model and Serial Numbers
      6) Fuel Type and Input in Btuh
      7) Number of Passes
      8) Ignition Type
      9) Burner-control Types
      10) Voltage at Each Connection
      11) Amperage for Each Phase
   b. Test Data: Include design and actual values for the following:
      1) Operating Pressure in PSIG
      2) Operating Temperature in Degrees F
      3) Entering-water Temperature in Degrees F
      4) Leaving-water Temperature in Degrees F
      5) Number of Safety Valves and Sizes in NPS (DN)
      6) Safety Valve Settings in PSIG

7) High-limit Setting in PSIG
8) Operating-control Setting
9) High-fire Set Point
10) Low-fire Set Point
11) Voltage at Each Connection
12) Amperage for Each Phase
13) Draft Fan Voltage at Each Connection
14) Draft Fan Amperage for Each Phase
15) Manifold Pressure in PSIG

L. Instrument Calibration:

1. For instrument calibration, include the following:
   a. Report Data: Include the following:
      1) Instrument Type and Make
      2) Serial Number
      3) Application
      4) Dates of Use
   b. Dates of Calibration

3.12 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 00 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Type A, Flexible Glass Wool Blanket
2. Type B, Duct Liner
3. Type F, Closed-Cell Polyisocyanurate Rigid Foam Board
4. Type 1, Glass Wool Pipe Insulation
5. Type 2, Flexible Elastomeric Pipe Insulation
6. Jacketing
7. Accessories
8. Duct Insulation Accessories
9. Duct Insulation Compounds
10. Outdoor Ducting Cover

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Piping and duct insulation products to contain less than 0.1 percent by weight PBDE in all insulating materials.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Installer qualifications.
2. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any) for each type of product indicated.
   a. Where indicated R-values/ratings cannot be achieved by a single layer of insulation, describe how performance requirements will be achieved.
3. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
4. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
5. Submit manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Formaldehyde Free: Should be third-party certified with UL Environment Validation.
2. Recycled Content: A minimum of 40 percent post-consumer recycled glass content certified and UL validated.
3. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
4. Installer to have minimum 5 years' experience in the business of installing insulation.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 FIRE HAZARD CLASSIFICATION

A. Maximum fire hazard classification of the composite insulation construction as installed to be not more than a Flame Spread Index (FSI) of 25 and Smoke Developed Index (SDI) of 50 as tested by current edition of ASTM E84 (NFPA 255) method.

B. Test pipe insulation in accordance with the requirements of current edition of UL "Pipe and Equipment Coverings R5583 400 8.15."

C. Test duct insulation in accordance with current edition of ASTM E84, UL 723, NFPA 255, NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

2.1 TYPE A, FLEXIBLE GLASS WOOL BLANKET

A. Acceptable Manufacturers:

1. Certainteed
2. Johns Manville
3. Knauf
4. Owens-Corning

B. ASTM C553, Type 1, Class B-2; flexible blanket.

C. 'K' Value: 0.27 BTU*in/(hr*sf*F) at 75 degrees F installed, maximum service temperature: 250 degrees F.

D. Density: 0.75 pounds per cubic foot.

E. DBDE-free. UL/E validated to be formaldehyde-free.

F. Vapor Barrier Jacket: FSK aluminum foil reinforced with glass wool yarn and laminated to fire resistant Kraft, secured with UL listed pressure sensitive tape or outward clinched expanded staples and vapor barrier mastic as needed.

2.2 TYPE B, DUCT LINER

A. Acceptable Manufacturers:

1. Certainteed
2. Johns Manville
3. Knauf
4. Owens-Corning

B. ASTM C1071; flexible blanket.

C. 'K' Value: ASTM C518, 0.25 BTU*in/(hr*sf*F) at 75 degrees F, maximum service temperature: 250 degrees F.

D. Noise Reduction Coefficient: 0.65 or higher based on ASTM C 423 "Type A mounting."

E. Maximum Velocity on Mat or Coated Air Side: 5,000 FPM.

F. Adhesive: UL listed waterproof type.

G. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.

H. Erosion-Resistant Surfaces: UL 181.

I. ASTM G21 and ASTM G22 Microbial Growth Resistance.

J. UL GREENGUARD Certified does not support the growth of mold, fungi, or bacteria per ASTM C 1338 and meets UL Environment GREENGUARD Microbial Resistance Listing per UL 2824 - “GREENGUARD Certification Program Method for Measuring Microbial Resistance.” DBDE-free. UL/E validated to be formaldehyde-free.

2.3 TYPE F, CLOSED-CELL POLYISOCYANURATE RIGID FOAM BOARD

A. Acceptable Manufacturers:

1. Johns Manville
2. Certainteed
3. Knauf
4. RMax

B. ASTM C1289, Type 1, Class 1.

C. Thermal Conductivity: 0.16 BTU*in/(hr*sf*F).

D. Service Temperature: -100 degrees F to 250 degrees F.

E. Jacketing: 0.016-inch thick multi-layered laminate with minimum tensile strength of 149-lb/inch, minimum puncture resistance of 49 pounds per ASTM D1000, maximum emittance of 0.03 per ASTM C1371, maximum WVTR of 0.00 perm per ASTM E96, and min/max service temperature of -40 degrees F to 300 degrees F, as manufactured by 3M, VentureClad1579GCW-E.

2.4 TYPE 1, GLASS WOOL PIPE INSULATION

A. Acceptable Manufacturers:

1. Certainteed
2. Johns Manville
3. Knauf
4. Owens-Corning

B. Glass Wool: ASTM C547 Type I and IV; rigid molded, noncombustible.

1. Thermal Conductivity Value: As indicated in the insulation tables below.
2. Maximum Service Temperature: 850 degrees F to 1000 degrees F.

C. Vapor Retarder Jacket: White Kraft paper reinforced with glass wool and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips or vapor barrier mastic.

2.5 TYPE 2, FLEXIBLE ELASTOMERIC PIPE INSULATION

A. Acceptable Manufacturers:

1. Insulation:
   a. Armacell LLC Armaflex
   b. K-Flex
   c. Or approved equivalent.
2. Glue:
   a. Armacell LLC Armaflex Low VOC Adhesive
   b. K-Flex
   c. Or approved equivalent.
3. Paint:
   a. Armacell LLC Armaflex
   b. K-Flex
   c. Or approved equivalent.

B. Elastomeric Foam: ASTM C534; flexible, cellular elastomeric, molded or sheet.

1. Thermal Conductivity Value: As indicated in the insulation tables below.
2. Maximum Service Temperature of 220 degrees F.
3. Maximum Flame Spread: 25.
4. Maximum Smoke Developed: 50 (1-inch thick and below).
5. Vapor Retarder Jacket, for over 1-inch insulation thickness: White Kraft paper reinforced with glass wool and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips or vapor barrier mastic.
6. Connection: Waterproof vapor retarder adhesive as needed.
7. UV Protection: UV outdoor protective coating per manufacturer's requirements.

C. Glue: Contact adhesive specifically manufactured for cementing flexible elastomeric foam.

D. Paint (for exterior insulation only): Nonhardening high elasticity type, specifically manufactured as protective covering of flexible elastomeric foam insulation for prevention of degradation due to exposure to sunlight and weather.

2.6 JACKETING

A. Acceptable Manufacturers:

1. ITW Insulation Systems
2. General Insulation Company
3. Johns Manville
4. 3M
5. Or approved equivalent.

B. Insulation Jacketing Tape: 0.016-inch thick multi-layered laminate with minimum tensile strength of 149-lb/inch, minimum puncture resistance of 49 pounds per ASTM D1000, maximum emittance of 0.03 per ASTM C1371, maximum WVTR of 0.00 perm per ASTM E96, and min/max service temperature of -40 degrees F to 300 degrees F, as manufactured by 3M, VentureClad1579GCW-E.

C. PVC preformed molded insulation covers, for piping. Zeston or approved equivalent.

D. Aluminum Jacket: 0.016-inch-thick sheet, (smooth/embossed) finish, with longitudinal slip joints and 2-inch laps, die-shaped fitting covers with factory attached protective liner.

E. Stainless Steel Jacket: Type 304 stainless steel, 0.010-inch, smooth or corrugated finish.

F. Canvas Jacket: UL listed fabric, 6 ounce/sq.yd., plain weave cotton treated with dilute fire retardant lagging adhesive.

2.7 ACCESSORIES

A. Acceptable Manufacturers:

1. ITW Insulation Systems
2. Or approved equivalent.

B. Equipment Insulation Jacketing: Presized glass cloth, not less than 7.8 ounces/sq.yd., except as otherwise indicated. Coat with gypsum based cement.

C. Equipment Insulation Compounds: Provide adhesives, cement, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

D. General: Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins and metal covers as recommended by insulation manufacturer for applications indicated. Accessories, i.e., adhesives, mastics, cements and tape to have the same flame and smoke component ratings as the insulation materials with which they are used. Shipping cartons to bear a label indicating that flame and smoke ratings do not exceed those listed above. Provide permanent treatment of jackets or facings to impart flame and smoke safety. Provide non-water-soluble treatments. Provide UV protection recommended by manufacturer for outdoor installation.

2.8 DUCT INSULATION ACCESSORIES

A. Acceptable Manufacturers:

1. Certainteed
2. Johns Manville

3. Owens-Corning

B. Staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

2.9 DUCT INSULATION COMPOUNDS

A. Acceptable Manufacturers:

1. Certainteed
2. Johns Manville
3. Owens-Corning

B. Cements, adhesives, coatings, sealers, protective finishes and similar accessories as recommended by insulation manufacturer for applications indicated. Comply with South Coast Air Quality Management District (SCAQMD) Rule #1168 in accordance with LLE EQ 4.1.

2.10 OUTDOOR DUCTING COVER

A. Acceptable Manufacturers:

1. 3M
2. Certainteed
3. Johns Manville
4. Owens-Corning

B. Aluminum Jacket: 0.016-inch-thick sheet, (smooth/embossed) finish, with longitudinal slip joints and 2-inch laps, die-shaped fitting covers with factory attached protective liner.

C. Insulation Jacketing Tape: 0.016-inch thick multi-layered laminate with minimum tensile strength of 149-lb/inch, minimum puncture resistance of 49 pounds per ASTM D1000, maximum emittance of 0.03 per ASTM C1371, maximum WVTR of 0.00 perm per ASTM E96, and min/max service temperature of -40 degrees F to 300 degrees F, as manufactured by 3M, VentureClad1579GCW-E.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Verification of Conditions:

1. Do not apply insulation until pressure testing and inspection of ducts and piping has been completed. Do not apply insulation over heat tracing temperature maintenance until system has been tested.
2. Examine areas and conditions under which duct and pipe insulation will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Preparation: Clean and dry surfaces to be insulated.

C. Installation:

1. Insulation: Continuous through walls, floors and partitions except where noted otherwise.
2. Piping and Equipment:

a. Install insulation over clean, dry surfaces with adjoining sections firmly butted together and covering surfaces. Fill voids and holes. Seal raw edges. Install insulation in a manner such that insulation may be split, removed, and reinstalled with vapor barrier tape on strainer caps and unions. Do not install insulation until piping has been leak tested and has passed such tests. Do not insulate manholes, equipment manufacturer's nameplates, handholes, and ASME stamps. Provide beveled edge at such insulation interruptions. Repair voids or tears.

D. Cover insulation on exposed refrigerant piping above ground, outside of building with heavy duty multi-layered laminated jacketing tape. Position seams on bottom of pipe. Use 3M VentureClad Plus 1579GCW-E or approved equal.

E. Provide accessories as required. See Part 2 Article "Accessories" above.

F. Protection and Replacement: Installed insulation during construction. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

G. Labeling and Marking: Provide labels, arrows and color on piping and ductwork. Attach labels and flow direction arrows to the jacketing per Section 23 05 53, Identification for HVAC Piping, Ductwork and Equipment.

H. Ductwork:

1. Install insulation in conformance with manufacturer's recommendations to completely cover duct.
2. Butt insulation joints firmly together and install jackets and tapes smoothly and securely.
3. Apply duct insulation continuously through sleeves and prepared openings, except as otherwise specified. Apply vapor barrier materials to form complete unbroken vapor seal over insulation.
4. Coat staples and seals with vapor barrier coating.
5. Cover breaks in jacket materials with patches of same material as vapor barrier. Extend patches not less than 3-inches beyond break or penetration on all directions and secure with adhesive and staples. Seal staples and joints with vapor barrier coating.
6. Fill jacket penetrations, i.e., hangers, thermometers and damper operating rods, and other voids in insulation, with vapor barrier coating. Seal penetration with vapor barrier coating. Insulate hangers and supports for cold duct in un-conditioned spaces to extent to prevent condensation on surfaces.
7. Seal and flash insulation terminations and pin punctures with reinforced vapor barrier coating.
8. Continue insulation at fire dampers and fire/smoke dampers up to and including those portions of damper frame visible at outside of the rated fire barrier. Insulating terminations at fire dampers in accordance with this Section.
9. Do not conceal duct access doors with insulation. Install insulation terminations at access door in accordance with this Section.

I. Insulated Pipe Exposed to Weather: Where piping is exposed to weather, cover insulation with aluminum jacketing or stainless steel jacketing. Seal jacketing watertight per manufacturer's recommendations. Install metal jacketing with 2-inch overlap at longitudinal and butt joints with exposed lap pointing down. Secure jacketing with stainless-steel draw bands 12-inches on center and at butt joints. Provide heat tracing on piping subject to freezing. See Section 23 05 33, Heat Tracing for HVAC Piping.

J. Insulation Shields: Provide hangers and shields (18 gauge minimum) outside of insulation for cold piping (<60 degrees F). Hot water piping hangers may penetrate insulation to contact pipe directly. Provide 18-inch long, noncompressible insulation section at insulation shields for lines 2-inches and larger (hot and cold) piping.

K. Ductwork Surfaces to be Insulated: Washington Climate Zone 4

Item to be Insulated	System Insulation Type	Duct Size	Minimum Installed R-Value
Supply ductwork inside building thermal envelope, where duct is not specified to be lined.	A	All	R-4
Return ductwork inside building thermal envelope, where duct is not specified to be lined.	--	All	None
Supply ductwork routed exposed within conditioned space where duct conveys air between 55°F and 105°F.	--	All	None
Supply and return ductwork located outside building thermal envelope (exposed to weather, above insulated ceilings, in crawl spaces, in parking garages).	A (for round ductwork) F (for rectangular ductwork)	All	R-8
Supply and return ductwork routed through unconditioned space outside building thermal envelope or buried below grade.	A (for round ductwork) F (for rectangular ductwork)	All	R-6
Outside air ducts inside building thermal envelope	A, F	Airflow greater than or equal to	R-16

and upstream of automatic shutoff damper.		2800 cfm	
Outside air ducts inside building thermal envelope and downstream of automatic shutoff damper.	A	Airflow greater than or equal to 2800 cfm	R-8
Outside air ducts inside building thermal envelope and upstream of automatic shutoff damper.	A	Airflow less than 2800 cfm	R-8
Combustion air ducts inside building thermal envelope.	A	All	R-8
Built up HVAC equipment plenums and unit housings not preinsulated.	B	All	R-6
Exhaust ducts within building thermal envelope, between energy recovery media, and automatic shutoff damper.	A	All	R-8
Exhaust ducts within building thermal envelope between exterior and automatic shutoff damper.	A	All	R-16

1. Note: Insulation R-value shown is a minimum. If state codes require higher R-value, then provide insulation per code requirements.

L. Piping Surfaces to be Insulated:

Item to be Insulated	System Insulation Type	Conductivity Range (Btu-inch per hour per SF per degrees	Pipe Size (Inches)	Insulation Thickness (Inches)

		F)		
Heating, Steam, and Steam Condensate (above 350F)	1	0.32-0.34 at a mean rating temperature of 250 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	4.5 5.0 5.0 5.0 5.0
Heating, Steam, and Steam Condensate (251F to 350F)	1	0.29-0.32 at a mean rating temperature of 200 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	3.0 4.0 4.5 4.5 4.5
Heating, Steam, and Condensate (201F to 250F)	1	0.27-0.30 at a mean rating temperature of 150 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	2.5 2.5 2.5 3.0 3.0
Heating, Steam, and Steam Condensate (141F to 200F)	1	0.25-0.29 at a mean rating temperature of 125 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	1.5 1.5 2.0 2.0 2.0
Heating, Steam, and Steam Condensate (105F to 140F)	1	0.21-0.28 at a mean rating temperature of 100 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	1.0 1.0 1.5 1.5 1.5

Chilled Water (40F to 60F)	1	0.21-0.27 at a mean rating temperature of 75 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	0.5 0.5 1.0 1.0 1.0
Chilled Water (<40F)	1	0.20-0.26 at a mean rating temperature of 75 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	0.5 0.5 1.0 1.0 1.0
Refrigerant Suction and Liquid Piping (40F to 60F)	2	0.21-0.27 at a mean rating temperature of 75 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	0.5 0.5 1.0 1.0 1.0
Refrigerant Suction and Liquid Piping (<=40F)	2	0.20-0.26 at a mean rating temperature of 75 degrees F	<1 1 to <1.5 1.5 to <4 4 to <8 >= 8	0.5 1.0 1.0 1.0 1.5
Heating Water Storage and Air Separation Tanks	2	0.24-0.28 at a mean rating temperature of 75 degrees F	N/A	2.0
Heat Exchangers (Hydronic)	2	0.24-0.28 at a mean rating temperature of 75	N/A	2.0

		degrees F		
Condenser Water (Exterior)	1, 2	0.21-0.27 at a mean rating temperature of 75 degrees F	1 to 6 >=8	1.0 1.5

1. Note: Insulation thickness shown is a minimum. If state code requires additional thickness, then provide insulation thickness per code requirements.

3.2 TYPE A, FLEXIBLE GLASS WOOL BLANKET

A. Install insulation in conformance with manufacturer's recommendations and requirements.

B. Duct Wrap: Cover air ducts per insulation table except ducts internally lined where internal duct lining is adequate to achieve adequate insulating values to meet local Energy Codes (indicate on shop drawings, locations where duct wrap is planned to be omitted and indicate internal duct lining insulating values to confirm they will meet the Energy Code). Wrap tightly with circumferential joints butted and longitudinal joints overlapped minimum of 2-inches. On ducts over 24-inches wide, additionally secure insulation with suitable mechanical fasteners at 18-inches on center. Circumferential and longitudinal joints stapled with flare staples 6-inches on center and covered with 3-inch wide, foil reinforced tape.

3.3 TYPE B, DUCT LINER

A. Install insulation in conformance with manufacturer's recommendations and requirements.

B. Duct Liners: Mat finish surface on air stream side. Secure insulation to cleaned sheet metal duct with continuous (minimum 90) percent coat of adhesive. Secure liner with mechanical fasteners 15-inches on center or per manufacturer requirements. Accurately cut liner and thoroughly coat ends with adhesive. Butt joints tightly. Top and bottom sections of insulation overlap sides. Factory/field coat exposed edges. Metal nosing for exposed leading or transverse edges and when velocity exceeds 3500 FPM or manufacturer rating on exposed edges. Keep duct liner clean and free from dust. At completion of Project, vacuum duct liner if it is dirty or dusty. Do not use small pieces. If insulation is installed without horizontal, longitudinal, and end joints butted together, installation will be rejected and work removed and replaced with work that conforms to this Specification.

3.4 TYPE F, CLOSED-CELL POLYISOCYANURATE RIGID FOAM BOARD

A. Install insulation in conformance with manufacturer's recommendations and requirements.

3.5 TYPE 1, GLASS WOOL PIPE INSULATION

A. See General Installation Requirements above.

B. Install insulation in conformance with manufacturer's recommendations and requirements.

C. Lap seal insulation with waterproof adhesive. Do not use staples or other methods of attachment which would penetrate vapor barrier. Apply fitting covers with seated tacks and vapor barrier tape.

D. Apply insulation to pipe and seal with self-sealing lap. Use self-sealing butt strips to seal butt joints. Insulate fittings, valves and unions with single or multiple layers of insulation and cover to match pipe or use preformed PVC molded insulation covers.

3.6 TYPE 2, FLEXIBLE ELASTOMERIC PIPE INSULATION

A. Flexible Elastomeric Insulation:

1. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and below grade with two coats of finish as recommended by manufacturer.

B. Flexible Elastomeric Tubing:

1. Flexible Elastomeric Tubing: Slip insulation over piping or, if piping is already installed, slit insulation and snap over piping. Joints and butt ends must be adhered with 520 adhesive.

C. See General Installation Requirements above.

D. Install insulation in conformance with manufacturer's recommendations and requirements.

E. Slip insulation on pipe prior to connection. Butt joints sealed with manufacturer's adhesive. Insulate fitting with miter-cut pieces. Cover insulation exposed to weather and undergrade with two coats of finish as recommended by manufacturer.

F. Install in accordance with manufacturer's instructions for below grade installation.

3.7 JACKETING

A. See General Installation Requirements above.

B. Install in accordance with manufacturer's instructions.

3.8 ACCESSORIES

A. Install insulation in conformance with manufacturer's instructions, recommendations and requirements.

B. See General Installation Requirements above.

C. Furnish and install accessories for all insulation types listed in this Section.

3.9 DUCT INSULATION ACCESSORIES

A. Install insulation in conformance with manufacturer's recommendations and requirements.

3.10 DUCT INSULATION COMPOUNDS

A. Install insulation in conformance with manufacturer's recommendations and requirements.

3.11 OUTDOOR DUCTING COVER

A. Install insulation in conformance with manufacturer's recommendations and requirements.

B. Outdoor Duct Exposed to Weather:

1. Install jacket with brakes/slope to prevent standing water on duct. Use weatherable components.
2. Weatherproof seal at joints and seams. Minimum 3-inch overlap.
3. Label jacket every 6-feet and within 2-feet of building penetrations and equipment connections: "Do not stand or place equipment on duct."

END OF SECTION 23 07 00

SECTION 23 08 00 - COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Definitions, warranties, test equipment requirements, and mechanical commissioning requirements.

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 01 91 13, General Commissioning Requirements.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Current edition of ASHRAE Guideline 0, The Commissioning Process.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Certificates of readiness.
2. Certificates of completion of installation, prestart, and startup activities.
3. Operation and Maintenance Manuals.
4. Test reports.
5. Control Drawings Submittal
    a. Provide a key to abbreviations.
    b. Provide graphic schematic depictions of the systems and each component.
    c. Include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
    d. Provide a full points list with at least the following included for each point:
        1) Controlled system
        2) Point abbreviation
        3) Point description
        4) Display unit
        5) Control point or set point (Yes / No)
        6) Monitoring point (Yes / No)
        7) Intermediate point (Yes / No)

8) Calculated point (Yes / No)

6. Architect forwards one set of submittals for systems to be commissioned to Commissioning Agent at same time as design team.
7. Commissioning Agent forwards comments to design team for consideration in their submittal response.
8. Design team sends consolidated response to submittals and copies to Commissioning Agent.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to Commissioning Authority upon request.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Commissioning, inspecting, and testing will not modify terms or time periods of mechanical equipment, systems, and controls warranties including related equipment and systems, and adjacent work.
2. Control system warranty period starts from date of Commissioning Agent acceptance.

1.7 COORDINATION

A. Reference Section 01 91 13, General Commissioning Requirements, for requirements pertaining to coordination during the commissioning process.

1.8 PURPOSE

A. Purpose of commissioning process is to provide Owner assurance that systems have been installed in prescribed manner and will operate within performance guidelines. Commissioning is intended to enhance quality of system startup and aid in orderly transfer of systems to beneficial use by Owner.

B. Commissioning procedures and results will be observed by Commissioning Authority or Owner's staff. Contractor is expected to verify functional readiness of systems to be tested prior to performing the tests in presence of Owner's witness. A high rate of test failure will indicate that Contractor has not adequately verified readiness of systems.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Provide standard testing equipment required to perform startup, initial checkout and functional performance testing for the equipment being tested. For example, the mechanical contractor of Division 23, HVAC will ultimately be responsible for standard testing equipment for the HVAC&R system and controls system in Division 23, HVAC, except for the equipment specific to and used by TAB in their commissioning responsibilities. Provide a sufficient quantity of two-way radios by each subcontractor.

B. Include special equipment, tools and instruments (specific to a piece of equipment and only available from vendor) required for testing in the base bid price to the Owner and leave on site, except for stand-alone data logging equipment that may be used by the Commissioning Authority.

C. Manufacturer of equipment to provide proprietary test equipment and software required for programming and/or start-up, whether specified or not. Manufacturer provides the test equipment, demonstrates its use, and assists in the commissioning process as needed. Proprietary test equipment (and software)become the property of the Owner upon completion of the commissioning process.

D. Data logging equipment and software required to test equipment will be provided by the Commissioning Authority, and will not become the property of the Owner.

E. Use only testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers have a certified calibration within the past year to an accuracy of 0.5 degree F and a resolution of plus or minus 0.1 degree F. Pressure sensors have an accuracy of plus or minus 2.0 percent of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

A. With assistance from the installing contractors, the Commissioning Authority will prepare prefunctional checklists for commissioned components, equipment, and systems

B. Red-Lined Drawings:

1. Verify equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings.
2. Preliminary red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing.
3. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings.
4. The contracted party, as defined in the Contract Documents will create the as-built drawings.

C. Operation and Maintenance (O&M) Data:

1. Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for commissioned equipment and systems.
2. The Commissioning Authority will review the O&M literature once for conformance to project requirements.
3. The Commissioning Authority will receive a copy of the final approved O&M literature once corrections have been made by the Contractor.

D. Demonstration and Training:

1. Contractor will provide demonstration and training as required by the specifications.
2. A complete training plan and schedule must be submitted by the contractor to the Commissioning Authority four weeks prior to any training.
3. A training agenda for each training session must be submitted to the Commissioning Authority one week prior the training session.
4. Notify the Commissioning Authority at least 72 hours in advance of scheduled tests so that testing may be observed by the Commissioning Authority and Owner's Authorized Representative. Provide a copy of the test record to the Commissioning Authority, Owner, and Architect.
5. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specific equipment.
6. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, trouble shooting, servicing, and maintaining equipment.
7. Review data in O&M Manuals.

E. Systems Manual Requirements:

1. The Systems Manual is intended to be a usable information resource containing the information related to the systems, assemblies, and Commissioning Process in one place with indexes and cross references.
2. Include final approved versions of the following information for the Systems Manual:
   a. Facility Description.
   b. Basis of Design (A/E).
   c. A list of contractors, subcontractors, suppliers, architects, and engineers involved in the project along with their contact information.
   d. Overview of each commissioned system including operational schedules and sequence of operations.
   e. General maintenance recommendations and procedures.
   f. Recommendations for recalibration frequency of sensors and actuators
   g. Recommended best practices for keeping the system running efficiently.
   h. Blank Functional Performance Tests so the Owner can recommission the facility at a later date.
3. Organize and arrange information by building system, such as fire alarm, chilled water, heating hot water, etc.
4. Provide Information in an electronic version to the extent possible. Legible, scanned images are acceptable for non-electronic documentation to facilitate this deliverable.

3.2 CONTRACTOR'S RESPONSIBILITIES

A. Mechanical, Controls and TAB Contractors. The commissioning responsibilities applicable to each of the mechanical, controls and TAB contractors of Division 23, HVAC are as follows (references apply to commissioned equipment only):

1. Perform commissioning tests at the direction of the Commissioning Authority.

2. Attend construction phase controls coordination meetings.
3. Attend testing, adjusting, and balancing review and coordination meetings.
4. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the Commissioning Authority.
5. Provide information requested by the Commissioning Authority for final commissioning documentation.
6. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or subcontract written.
7. Prepare preliminary schedule for mechanical system orientations and inspections, operation and maintenance manual submissions, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, testing and balancing and task completion for owner. Distribute preliminary schedule to commissioning team members.
8. Update schedule as required throughout the construction period.
9. During the startup and initial checkout process, execute the related portions of the prefunctional checklists for commissioned equipment.
10. Contractor to participate and complete checklists using the Commissioning Authority's web based commissioning software Facility Grid. A desktop, laptop, tablet, or iPad will be required.
11. Assist the Commissioning Authority in verification and functional performance tests.
12. Gather operation and maintenance literature on equipment, and assemble in binders as required by the specifications. Submit to Commissioning Authority 45 days after submittal acceptance.

B. Coordinate with the Commissioning Authority to provide 48 hour advance notice so that the witnessing of equipment and system start-up and testing can begin.

C. Notify the Commissioning Authority a minimum of two weeks in advance of the time for start of the testing and balancing work. Attend the initial testing and balancing meeting for review of the official testing and balancing procedures.

D. Participate in, and schedule vendors and contractors to participate in the training sessions.

E. Provide written notification to the Construction Manager/General Contractor (CM/GC) and Commissioning Authority that the following work has been completed in accordance with the Contract Documents, and that the equipment, systems, and sub-system are operating as required.

1. HVAC&R equipment including fans, air handling units, ductwork, dampers, terminals, and other equipment furnished under this Division.
2. Fire stopping in the fire rated construction, including fire and smoke damper installation, caulking, gasketing and sealing of smoke barriers.
3. Fire detection and smoke detection devices furnished under other divisions of the specification.

F. Equipment supplier to document the performance of his equipment.

G. Test, Adjust and Balance Contractor:

1. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
2. Participate in verification of the testing and balancing report, which will consist of repeating measurements contained in the testing and balancing reports. Assist in diagnostic purposes when directed.

H. Provide training of the Owner's operating staff using expert qualified personnel, as specified.

I. Equipment Suppliers:

1. Provide requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.
2. Assist in equipment testing per agreements with contractors.
3. Provide information requested by Commissioning Authority regarding equipment sequence of operation and testing procedures.

J. Reference Section 01 91 13, General Commissioning Requirements for additional contractor responsibilities.

3.3 OWNER'S RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for Owner's Responsibilities.

3.4 DESIGN PROFESSIONAL'S RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for Design Professional's Responsibilities.

3.5 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

A. Reference Section 01 91 13, General Commissioning Requirements for Commissioning Authority's Responsibilities.

3.6 TESTING PREPARATION

A. Certify in writing to the Commissioning Authority that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify in writing to the Commissioning Authority that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify in writing that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the Commissioning Authority.

3.7 TESTING, ADJUSTING AND BALANCING VERIFICATION

A. Prior to performance of Testing, Adjusting and Balancing work, provide copies of reports, sample forms, checklists, and certificates to the Commissioning Authority.

B. Notify the Commissioning Authority at least 10 days in advance of testing and balancing Work, and provide access for the Commissioning Authority to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the Commissioning Authority.

1. The Commissioning Authority will notify testing and balancing subcontractor 10 days in advance of the date of field verification. Notice will not include data points to be verified.
2. Testing and balancing subcontractor to use the same instruments (by model and serial number) that were used when original data were collected.
3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items to result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB to result in rejection of final testing. Variations in background noise must be considered.
4. Remedy the deficiency and notify the Commissioning Authority so verification of failed portions can be performed.

3.8 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the Commissioning Authority.

B. Scope of HVAC&R testing to include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing to include measuring capacities and effectiveness of operational and control functions.

C. Test operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The Commissioning Authority along with the HVAC&R contractor, testing and balancing Subcontractor, and HVAC&R Instrumentation and Control Subcontractor to prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the Commissioning Authority and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The Commissioning Authority may direct that set points be altered when simulating conditions is not practical.

H. The Commissioning Authority may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.9 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 23, HVAC Sections. Provide submittals, test data, inspector record, and certifications to the Commissioning Authority.

B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23, HVAC Sections "Instrumentation and Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the Commissioning Authority with preparation of testing plans.

C. Pipe System Cleaning, Flushing, Hydrostatic Tests, and Chemical Treatment: Test requirements are specified in Division 23, HVAC Piping Sections. HVAC&R Contractor to prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the Commissioning Authority. Plan to include the following:

1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Provide drawings keyed to pipe zones or sectors formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
2. Description of equipment for flushing operations.
3. Minimum flushing water velocity.
4. Tracking checklist for managing and ensuring that pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

D. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of components, systems and sub-systems. Evaluate the following equipment and systems:

1. HVAC Equipment and Systems (all)
2. Boiler
3. Building Automation System
4. Chilled Water System
5. Computer Room AC
6. Domestic Hot Water Systems
7. Renewable Energy Systems
8. Pumps
9. VFDs

3.10 DEFICIENCIES/NONCONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

A. Reference Division 01, General Requirements for requirements pertaining to deficiencies/nonconformance, cost of retesting, or failure due to manufacturer defect.

3.11 OPERATION AND MAINTENANCE MANUALS

A. The Operation and Maintenance Manuals to conform to Contract Documents requirements as stated in Division 23, HVAC.

B. Provide an updated as-built version of the control drawings and sequences of operation in the final controls O&M manual submittal.

3.12 TRAINING OF OWNER PERSONNEL

A. Mechanical Contractor's Training Responsibilities:

1. Provide the Commissioning Authority with a training plan two weeks before the planned training.
2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of HVAC equipment including, but not limited to, HVAC equipment (i.e., pumps, heat exchangers, chillers, heat rejection equipment, air conditioning units, air handling units, fans, terminal units, controls and water treatment systems, etc.).
3. Training starts with classroom sessions followed by hands-on training on each piece of equipment to illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
5. The appropriate trade or manufacturer's representative provides the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise as well as in-depth knowledge of modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. Controls contractor to attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
8. Training Includes:
    a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
    b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. Training to include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
    c. Discussion of relevant health and safety issues and concerns.
    d. Discussion of warranties and guarantees.
    e. Common troubleshooting problems and solutions.
    f. Explanatory information included in the O&M manuals and the location of plans and manuals in the facility.
    g. Discussion of any peculiarities of equipment installation or operation.
9. Schedule training after functional testing is complete, unless approved otherwise by the Owner.

B. Controls Contractor's Training Responsibilities:

1. Provide the Commissioning Authority and A/E with a training plan four weeks before the planned training.
2. Provide designated Owner personnel training on the control system in this facility. The intent is to clearly and completely instruct the Owner on the capabilities of the control system.
3. Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals include detailed description of the subject matter for each session. Manuals to cover control sequences and have a definitions section that fully describes relevant words used in the manuals and in software displays. Manuals will be approved by the Commissioning Authority and A/E. Deliver copies of audiovisuals to the Owner.
4. The trainings will be tailored to the needs and skill-level of the trainees.
5. The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) will be used. Owner to approve the instructor prior to scheduling the training.
6. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
7. Attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
8. Three Training Sessions, as Follows:
    a. Training I - Control System. The first training consists of eight hours of actual training. This training may be held on-site or in the supplier's facility. If held off-site, the training may occur prior to final completion of the system installation. Upon completion, each student, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
    b. Training II - Building Systems. The second session held on-site for a period of eight hours of actual hands-on training after the completion of system commissioning. The session includes instruction on:
        1) Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.
        2) Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing set points and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
        3) Trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.
        4) Completely discuss every screen, allowing time for questions.
        5) Use of keypad or plug-in laptop computer at the zone level.
        6) Use of remote access to the system via phone lines or networks.
        7) Setting up and changing an air terminal unit controller.
        8) Graphics generation.
        9) Point database entry and modifications.
        10) Understanding DDC field panel operating programming (when applicable).

c. Training III - The third training will be conducted on-site six months after occupancy and consist of eight hours of training. The session will be structured to address specific topics that trainees need to discuss and to answer questions concerning operation of the system.

END OF SECTION 23 08 00

SECTION 23 09 00 - INSTRUMENTATION AND CONTROL PERFORMANCE SPECIFICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Communications
2. Operator Interface
3. Controller Software
4. Web Based Access
5. BAS Graphics
6. Building Controllers
7. Application Specific Controllers
8. Advanced Application Controllers
9. Input/Output Interface
10. Power Supplies and Line Filtering
11. Control Panels
12. Auxiliary Control Devices
13. Wiring and Raceways
14. Smoke Detection for Projects with a Building Fire Alarm System

B. This is a performance specification and Contractor is responsible for design tasks and engineering.

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Current edition of ANSI/ASHRAE Standard 135 and addendum, BACnet.
2. Current edition of UL 916 Underwriters Laboratories Standard for Energy Management Equipment, Canada and the US.
3. Current edition of FCC Part 15, Subpart J, Class A.
4. Current edition of BACnet Testing Laboratories (BTL).

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Prepare and submit a detailed schedule of work. Schedule to identify milestones such as equipment submittals, control panel diagrams, color graphic panel displays, Interlock.

2. Wiring diagrams, control program sequence software flow chart diagrams, conduit layout diagrams, device location diagrams, equipment and component deliveries, installation sequencing, controller startup, point to point startup, control programming, sequence testing, commissioning/acceptance testing and training.
3. Submit design drawings, sequences of operation, program listings, software flow charts and details for each typical piece of equipment and system being controlled. No work to be initiated or fabrication of any equipment started prior to the Owner's Authorized Representatives return of REVIEWED submittals.
    a. Sequence of Operation: The sequence of operation included in the design documents is intended only to communicate the Engineers' general control intent and is not to be used as a direct reference for programming of the EMS system. Verbatim duplication of the Engineer's Sequence of Operation on the submittals is discouraged and may result in non-approval of the submittal. Sequence of operation on submittals to accurately detail the system's intended programming, and include details of enhancements, adjustments, or deviations from the Engineer's sequence of operation. Submitted sequence of operation to be written with a logical and organized format and flow. Provide detailed, clear and unambiguous sequence of operation language. Point descriptors and point nomenclature referenced in the submitted sequence of operation to match those (to be) actually programmed. As-built submittal Sequence of Operation to include modifications to the programming made as a result of any addendum, bulletins, RFI's, change orders, and commissioning.
4. Format: Make each submittal in one complete and contiguous package. Partial or unmarked submittals will be rejected without review.
5. Submit Manufacturers Data as Follows:
    a. Complete materials list of items proposed to be furnished and installed. A complete Bill of Materials, listing materials, components, devices, wire and equipment are required for this work. The Bill of Materials to be separate for each controller on its own page(s) and to contain the following information for each item listed:
        1) Manufacturer's Name and Model number with furnished options highlighted.
        2) Quantity of each by controller location.
        3) Description of product (generic).
        4) Specified item.
        5) Operating range or span.
        6) Operating point or setpoint.
    b. Manufacturer's specifications and other data required demonstrating compliance with the specified requirements, including but not limited to: Catalog cuts, technical data and descriptive literature on hardware, software, and system components to be furnished.
    c. The data to be clearly marked and noted to identify specific ranges, model numbers, sizes, and other pertinent data. Submit printed manufacturer's technical product data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials and including printed installation instructions and start-up instructions.
    d. Unless specifically called for otherwise, provide bound copies of catalog cuts for standard products, not requiring specifically prepared Shop Drawings, for the following:
        1) Wire and Cable, Class II
        2) Face Plates for Devices
        3) Disconnect Switches for Power Control
    e. Where more than one item, size, rating or other variations appear on a catalog cut sheet, clearly identify items to be provided. These items to be properly indexed and referenced to identification numbers, designations and/or details on the Drawings.

6. Shop Drawings: Submit shop drawings for each controlled system, depicting the following information:
    a. Schematic flow diagram of system showing fans, pumps, coils, dampers, valves and other control/monitoring devices.
    b. Label each control device with initial setting or adjustable range of control. Label points in schematic diagrams with termination at corresponding controller.
    c. Electrical Wiring: Clearly differentiate between portions of wiring that are factory installed and portions of be field-installed.
    d. Details of control panel faces, including controls, instruments, and labeling.
    e. Interfaces to equipment furnished under other Specification Sections identifying numbers of wires, termination location, voltages and pertinent details. Responsibility for each end of the interfaces to be noted on these drawings whether or not they are a part of this Section.
    f. System architecture diagram showing the global connectivity of new controllers and any existing systems that will be connected to.
7. Equipment locations, wiring and piping schematics, details, panel configurations, sizes, damper motor mounting details, valve schedules, and a points list keyed to specific hardware submittals. Control wiring depicted as fully annotated ladder diagrams with terminations identified, completely configured as to the exact panel, wiring, relay, switch, and component configuration.
8. Tag Number Lists: Develop instruments tag number system and submit list for approval. Coordinate methods and number block with the Owner's Authorized Representative.
9. Format the Shop and Field Drawings to Include:
    a. A Title Sheet containing a drawing list, abbreviations list, symbols list, site and vicinity maps for project location and schedules.
    b. Floor Plans showing proposed device locations and device nomenclatures.
    c. A Riser Diagram illustrating conduit relationships between devices shown on the Floor Plans. Show device nomenclatures.
    d. A Single-Line Diagram for each system showing signal relationships of devices within the system. Show device nomenclatures.
    e. A Wiring Diagram for each assembly, enclosure or free standing device, showing:
        1) The Devices Within
        2) Wiring Connections
        3) Wire Identification
        4) Voltage Levels
        5) Fuse Ratings
    f. Operations and Maintenance Manuals:
        1) Following approval of Shop Drawings of control equipment and prior to acceptance of control work, prepare Operating and Maintenance manuals describing operating, servicing, and maintenance requirements of control systems and equipment installed under this Section, in accordance with the General and Special Conditions of these Specifications.
        2) Information contained in the manual for the above equipment to include the following:
            a) Manufacturer's catalog cuts and printed descriptive bulletins.
            b) Manufacturer's installation, operating, and maintenance instruction booklets. Complete instructions regarding the operation and maintenance of equipment involved.
            c) Instrument calibration certificates.
            d) Parts list and costs.
            e) Complete nomenclature of replaceable parts, list of recommended spare parts for 12 months operation, their part numbers, current cost and name and address of the nearest vendor of replacement parts.

f) Name, address and telephone number for closest source of spare parts.
g) Wiring and schematic diagrams.
h) Include final record copies of shop drawings.
i) Copy of guarantees and warranties issued for the various items of equipment, showing dates of expiration.
j) Reduced plans, diagrams, and control schematics.
k) Copies of test results.
l) Control System Operating Manual including: point of summary and point data base; complete printout of program listings; magnetic tape CD or DVD backup of Field Control Cabinet programs; cabinet layout; hard copy of graphic screens; hard copy of specified reports.

g. A final Bill of Quantities including a separate schedule for portable equipment, if delivered as part of this work.
h. Performance, Test and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified in these specifications.
i. Record Drawings: Comply with Division 01, General Requirements and Section 23 00 00, HVAC Basic Requirements. Provide complete as-built submittals including "as-programmed" sequence of operation as well as final occupancy schedules.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Installer Qualifications: Company specializing in performing work of the type specified in this Section with minimum five years' experience in the local area. Installers required to have successfully completed manufacturer's control system factory training.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

A. Control system referenced throughout specifications and drawings as Building Automation System (BAS), Building Management System (BMS), or Energy Management System (EMS) interchangeably consists of high-speed, peer-to-peer network of DDC controllers, control system server, and operator workstation.

B. System software based on server/thin-client architecture, designed around open standards of web technology. Control system server accessed using a web browser over control system network, Owner's local area network, and remotely over Internet (through Owner's LAN). Intent of thin-client architecture is to provide operators complete access to control system via web browser. No special software other than web browser required to access graphics, point displays, and trends.

C. Local Area Network (LAN) either 10 or 100 Mpbs Ethernet network.

D. System will consist of open architecture that is capable of:

1. High speed Ethernet communication using TCP/IP protocol.
2. Native BACnet communications according to ANSI / ASHRAE Standard 135, latest edition. Provide necessary BACnet-compliant hardware and software to meet the system's functional specifications. Controller devices must be BTL tested and listed by an official BACnet Testing Laboratory and have the BTL mark issued.

E. Complete temperature control system to be DDC with electronic sensors and electronic/electric actuation valves and dampers.

F. Prepare individual hardware layouts, interconnection drawings, building riser/architecture diagram and sequence of control from the project design data. Any architecture diagrams on design drawings have been included as schematics only and are not meant to portray quantity of devices or power/data requirements.

G. Design, furnish, and install equipment cabinets, panels, data communication network infrastructure (including cables, conduits, outlets, connections, etc.) needed, and associated hardware.

H. Provide complete manufacturer's specifications for items that are supplied. Include vendor name and model number of every item supplied.

I. Provide a comprehensive operator and technician training program as described in these Specifications.

J. Provide as-built documentation, operator's terminal software, diagrams, and other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

K. Provide 120V power, low voltage power, transformers, etc. for control panels, transformer panels, and BAS devices. Install per Division 26, Electrical Specifications. Power for devices within this Specification Section is solely the responsibility of the BAS Contractor.

L. Conduit and raceway systems. Provide per Division 26, Electrical Specifications.

M. Devices, components, controllers, and software to be manufacturer's most current version at the time of installation.

1.8 SYSTEM PERFORMANCE

A. Performance Standards - System conforms to following minimum standards over network connections:

1. Graphic Display: Graphic with 20 dynamic points display with current data within 10 seconds.
2. Graphic Refresh: Graphic with 20 dynamic points update with current data within 8 seconds.
3. Object Command: Devices react to command of binary object within 2 seconds. Devices begin reacting to command of analog object within 2 seconds.
4. Object Scan: Data used or displayed at controller or workstation have been current within previous 6 seconds.
5. Alarm Response Time: Object that goes into alarm is annunciated at workstation within 45 seconds.

6. Program Execution Frequency: Custom and standard applications are capable of running as often as once every 5 seconds. Select execution times consistent with mechanical process under control.
7. Performance: Programmable controllers are able to completely execute DDC PID control loops at frequency adjustable down to once per second. Select execution times consistent with mechanical process under control.
8. Multiple Alarm Annunciation: Each workstation on network receive alarms within 5 seconds of other workstations.

B. Reporting Accuracy: System reports values with minimum end-to-end accuracy listed in Reporting Accuracy Table below.

1. Reporting Accuracy Table:

Measure Variable	**Reported Accuracy**
Space Temperature	Plus or Minus 1 degree F
Ducted Air	Plus or Minus 1 degrees F
Outside Air	Plus or Minus 2 degrees F
Dew Point	Plus or Minus 3 degrees F
Water Temperature	Plus or Minus 1 degree F
Delta-T	Plus or Minus 0.25 degree F
Relative Humidity	Plus or Minus 5 percent RH
Water Flow	Plus or Minus 2 percent of full scale

2. Note 1: Accuracy applies to 10 percent-100 percent of scale
3. Note 2: For both absolute and differential pressure
4. Note 3: Not including utility-supplied meters

C. Control Stability and Accuracy. Control loops maintain measured variable at setpoint within tolerances listed in Control Stability and Accuracy Table below.

1. Control Stability and Accuracy Table:

Controlled Variable	**Control Accuracy**	**Range of Medium**
Air Pressure	Plus or minus 0.2 inch wg	0-6 inch wg
	Plus or minus 0.01 inch wg	-0.1 to 0.1 inch wg
Airflow	Plus or minus 10 percent of full scale	
Space Temperature	Plus or minus 2.00 degrees F	
Duct Temperature	Plus or minus 3.0 degrees F	
Humidity	Plus or minus 5 percent RH	
Fluid Pressure	Plus or minus 1.5 PSI	1-150 PSI
	Plus or minus 1.0 inch wg	0-50 inch wg differential

PART 2 - PRODUCTS

2.1 WASHINGTON MANUFACTURERS

A. Distech Controls

B. ATS Automation

C. Delta Controls/Ainsworth

D. Duct/Spot-Type Smoke Detectors (Project with Fire Alarm System):

1. See Division 28 for Products.

2.2 COMMUNICATIONS

A. Each controller to have communication port for connection to operator interface.

1. Internetwork operator interface and value passing to be transparent to internetwork architecture.
2. Operator interface connected to controller to allow operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, reports, system software, and custom programs to be viewable and editable from each internetwork controller.

B. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers to be readable by each controller on internetwork.

C. Operator Workstation to be capable of simultaneous direct connection and communication with BACnet/IP, OPC and TCP/IP networks without use of interposing devices such as PC or gateway with hard drive.

D. Workstations, Building Control Panels and Controllers with real-time clocks use time synchronization service. System automatically synchronizes system clocks daily from operator-designated device via internetwork. System automatically adjusts for daylight saving and standard time as applicable.

E. Wireless Network Communications:

1. Wireless communications take place using modular wireless transceivers at each device, which eliminates need for communication cabling.
2. Wireless transceiver utilizes 2.4 GHz in license free global Industrial Scientific and Medical (ISM) band.
3. Wireless transceiver is encased in plenum-rated enclosure. If application dictates, wireless transceiver is able to be installed in metal enclosure utilizing remote mounted antenna.
4. Wireless transceiver channel is factory set and capable of being field set to different channel if interference with IEEE 802.11 devices or other 2.4 GHz products is encountered.
5. Wireless transceiver is 24 VAC powered.
6. Wireless transceiver gives a visual indication that it is powered and communicating.
7. Wireless transceiver has a field-settable network identifier that allows multiple networks to occupy same channel for maximum scalability.

2.3 OPERATOR INTERFACE

A. Operator Interface: PC-based workstations reside on high-speed network with building controllers. Each workstation or each standard browser connected to server is able to access system information.

B. Hardware: Each operator workstation or web server consists of the following:

1. Computer: Hardware meets or exceeds DDC system manufacturer's recommended specifications and meet response times specified elsewhere in this document. Following hardware requirements also apply:
   a. Hard disk have sufficient memory to store:
      1) Required operator workstation software.
      2) One year of trend data based on points specified to be trended at specified trend intervals.
   b. Minimum hardware configuration includes:
      1) Intel i7 Processor
      2) 22-in LCD Monitor with at least 1024 x 768 Resolution
      3) 8 GB of RAM
      4) 48x CD-RW/DVD Optical Drive
      5) 1 TB Hard Disk Drive Providing Data at 3 GB/sec
      6) Ethernet 10/100 Network Interface Card
      7) High Performance Graphics Card
      8) Keyboard and Mouse
      9) Color Inkjet Printer
      10) UPS (uninterruptible power supply) installed at server, sized with sufficient capacity to allow full operation for 10 minutes or more.
2. Portable Operator's Terminal: Portable Operator's Terminal capable of accessing system data. This device may be connected to any point on system network or to any controller for programming, setup, and troubleshooting. Portable Operator's Terminal is IBM-compatible notebook-style PC including software and hardware required. PC contains at minimum:
   a. Intel i5 Processor
   b. 15-in LCD Monitor with at least 1024 x 768 Resolution
   c. 8 GB of RAM
   d. 1 TB Hard Drive
   e. Touch-Pad or Other Internal Pointing Device
   f. High-Performance Graphics Adapter
   g. Ethernet 10/100 Network Interface Card
   h. Integrated Wireless 802.11 b/g/n
   i. Serial Port and CD/RW-ROM

C. System Software:

1. Operating System: Furnish concurrent multi-tasking operating system. Operating system also supports use of and includes other common software applications such as Microsoft Excel, Word, Microsoft Access and Adobe Acrobat. Acceptable operating systems are Windows 10 and Windows 11.
2. Dynamic Color Graphics:
   a. Real-time color graphic displays dynamic and able to update displays.
   b. Provide operator ability to change values (setpoints) and states in system controlled equipment directly from graphic display.
   c. Custom Graphics. Provide custom graphics generation package.

d. Graphics Library. Furnish library of standard HVAC equipment graphics and include standard symbols for fans, pumps, coils, valves, piping, dampers, and ductwork.

3. Software to be manufacturer's most current version at the time of installation.

D. System Applications: Each workstation provides operator interface and offline storage of system information. Provide following applications at each workstation:

1. Automatic System Database Save and Restore: Each workstation stores on hard disk copy of current database of each Building Controller. This database automatically updated whenever change is made in any system panel.
2. Manual Database Save and Restore: System operator able to manually save or clear database and initiate download of specified database from/to any panel.
3. System Configuration: Workstation software provides method of configuring system to allow for changes or additions by users and performs following tasks:
   a. Create, delete or modify control strategies.
   b. Add/delete objects to system.
   c. Tune control loops through adjustment of control loop parameters.
   d. Enable or disable control strategies.
   e. Generate hard copy records of control strategies on printer.
   f. Select points to be alarmed and define alarm state.
   g. Select points to be trended and initiate automatic recording of values.
   h. Start/Stop binary objects and adjust analog objects.
4. Security: Operator required to log on to system with user name and password in order to view, edit, add, or delete data. System security selectable for each operator.
5. System Diagnostics: System automatically monitor operation of workstations, printers, modems, network connections, building management panels, and controllers. Failure of any device to be annunciated.
6. Alarm Indication and Handling:
   a. Workstation provides visual means of alarm indication. Alarm indication becomes highest priority regardless of application(s) running.
   b. System provides and archive log of alarm messages to hard drive. Alarm messages to include description of event-initiating object, source, location and time/date of alarm.
7. Trend Logs: Operator able to define custom trend log for any data object and include interval, start time, and stop time. Trend data sampled and stored on building controller panel, is archived on hard disk, and is retrievable for use in spreadsheets and standard database programs.
   a. System server to periodically gather historically recorded data stored in the building controllers and archive the information. Archived files to be appended with new sample data, allowing samples to be accumulated.
   b. Software to be included that is capable of graphing the trend logged object data. Software capable of creating two-axis (x,y) graphs that display object values relative to time.
   c. Operator able to change trend log setup information. This includes the information to be logged as well as the interval at which it is to be logged. Input, output, and value object types in the system may be logged. Provide operations password protected. Setup and viewing may be accessed directly from any graphics on which object is displayed.

d. BAS Contractor to enable trending for any system points (physical or virtual) as directed by the Engineer, Owner or Cx Authority (Commissioning Authority). There will be no limit on the number of trended points the BAS Contractor is to set up. BAS Contractor will modify trend setup parameters as directed by the Commissioning Authority during testing. BAS Contractor to be proactive and enable trending for major system points during system startup/programming. BAS Contractor is not to wait for direction to begin trending points. Trend data for each point to be archived on the main server for a minimum of one year. Trend data archiving to be enabled immediately upon trend setup, or as soon as communication between the field panel and sever is established. Trend data uploads from field panel to server set up to be automatically performed with sufficient frequency to ensure no data gaps or loss of trend data.
e. Trend points as identified in the points list. Provide system specific trend data in two-axis (x,y) graphs that display object values relative to time to Engineer, Owner, or Commissioning Authority.

8. Standard Reports: Standard system reports provided for this project. Provide ability for Owner to readily customize these reports for this project:
   a. Objects: System (or subsystem) objects and their current values.
   b. Logs:
      1) Alarm History
      2) System Messages
      3) System Events
      4) Trends
9. Electrical and Weather Report:
   a. System server capable of periodically gathering energy log data stored in the field equipment and archive the information. Archive files appended with new data, allowing data to be accumulated.
   b. Operator able to change the energy log setup information as well. This includes the meters to be logged, meter pulse value, and the type of energy units to be logged. Meters monitored by the system may be logged.
   c. System to display archived data in tabular format form for both consumption and peak values. Data shown in hourly, daily, weekly, monthly and yearly formats. In each format the user shall be able to select a specific period of data to view.
   d. Electrical Meter Report: Provide monthly report showing daily electrical consumption and peak electrical demand with time and date stamp for each building meter and for each electrical sub-meter on individual building panels, circuits, equipment (such as chillers), and variable frequency drives. Provide an annual (12-month) report showing monthly electrical consumption and peak electrical demand with time and date stamp for each individual meter.
   e. Weather Data Report: Provide monthly report showing daily minimum, maximum, and average outdoor air temperature (dry bulb, wet bulb) and humidity. Provide annual (12-month) report showing minimum, maximum, and average outdoor air temperature for month.

E. Interfaces to Third Party Systems: BAS connects to third party systems (VFDs, heat pumps, emergency generators, rooftop AC units, etc.). Communication protocol specified for third party system, and BAS provides compatible protocol to assure proper two way communication. Points, alarms, and commands displayed on BAS as indicated.

F. Workstation Applications Editors: Each PC workstation supports editing of system applications, which downloaded and executed at one or more controller panels.

2.4 CONTROLLER SOFTWARE

A. Furnish following applications software for building and energy management. Software applications reside and operate in system controllers. Software to be manufacturer's most current version at the time of installation. Software and associated functions (scheduling, optimum start/stop, etc.) noted in this specification are to be configured and enabled for this project. Incorporate into sequence of operation submittals for review prior to installation.

B. System Security:

1. User access secured using individual security passwords and user names.
2. Restrict user passwords to objects, applications, and system functions as assigned by system manager. Provide monitoring only access to Engineer of Record and Commissioning Authority for period of one year for trouble shooting purposes.
3. Record user Log On/Log Off attempts.
4. Provide passwords, user names, and access assignments adjustable at the operator's terminal. Each user to have a set security level, which defines access to displays and individual objects the user may control. System to include ten separate and distinct security levels for assignment to users.
5. System to include an Auto Logout Feature that will automatically logout user when there has been no keyboard or mouse activity for a set period of time. Time period to be adjustable by System Administrator. Auto Logout may be enabled and disabled by System Administrator. Operator terminal to display message on screen that user is logged out after Auto Logout occurs.

C. Scheduling: Provide capability to schedule each object or group of objects in system. Coordinate schedule with Owner and program accordingly. Each schedule consists of:

1. Operator's workstation to show information in easy-to-read daily format. Priority for scheduling: Events, holidays and daily with events being the highest.
2. Holiday and special event schedules to display data in calendar format. Operator able to schedule holidays and special events directly from these calendars.
3. Operator able to change information for a given weekly or exception schedule if logged on with the appropriate security access.

D. Optimum Start/Stop: Provide software and program system to start equipment on sliding schedule based upon indoor and outdoor conditions. Determine minimum time of HVAC system operation needed to satisfy space environmental requirements and also determine earliest possible time to stop mechanical systems (i.e. shut down cooling/heating and only provide ventilation one hour prior to scheduled unoccupied period). Optimum start/stop program operates in conjunction with scheduled start/stop and night setback programs.

E. Alarms:

1. Operator's workstation to provide visual means of alarm indication. The alarm dialog box to always become the top dialog box regardless of the application(s), currently running.
2. System to provide log of alarm messages. Alarm log to be archived to the hard disk of the system operator's terminal. Each entry to include a description of the event-initiating object generating the alarm. Entry to include time and date of alarm occurrence.
3. Alarm messages in user-definable text and entered either at the operator's terminal or via remote communication.
4. Each binary object set to alarm based on operator-specified state.
5. Each analog object is to have both high and low alarm limits.

6. Alarms must be able to be automatically and manually disabled.
7. Alarms are routed to appropriate workstations based on time and other conditions. An alarm is able to start programs, print, be logged in event log, generate custom messages, and display graphics.
8. System have ability to dial out in event of alarm.
9. Alarm Levels:
    a. Provide 5 levels of alarm as follows, and program alarm levels for every required and specified alarm:
        1) Level 1: Critical/life safety.
        2) Level 2: Significant equipment failure.
        3) Level 3: Non-critical equipment failure/operation.
        4) Level 4: Energy conservation monitor.
        5) Level 5: Maintenance indication, notification.
    b. Prior to training of Owner's Authorized Representative, submit the complete Points List and suggested Alarm Levels to the Owner.
    c. During training of Owner's Authorized Representative(s):
        1) Discuss Alarm Levels and the alarms currently included in the BAS.
        2) Provide additional alarms without addition of new hardware points, as required by Owner's Authorized Representative.
        3) Agree with the Owner's Authorized Representative on action(s) to be taken for each alarm level and implement same for each alarm. Said action to include visual and/or audible alarm(s) at the Operator workstation including whether Operator acknowledgement is required or not, email messages, and text messages.

F. Demand Limiting:

1. System to include demand limiting program that includes two types of load shedding. One type of load shedding to shed/restore equipment in binary fashion based on energy usage when compared to shed and restore settings. The other type of shedding to adjust operator selected control setpoints in an analog fashion based on energy usage when compared to shed and restore settings. Shedding may be implemented independently on each and every zone or piece of equipment connected to system.
2. Status of each and every load shed program capable of being displayed on every operator terminal connected to system. Status of each load assigned to an individual shed program displayed along with the description of each load.
3. Demand-limiting program monitor building power consumption from signals generated by pulse generator (provided by BAS contractor) mounted at building power meter or from watt transducer or current transformer attached to building feeder lines.
4. Demand-limiting program predicts probable power demand so that when demand exceeds demand limit, action will be taken to reduce loads in predetermined manner. When demand limit will not be exceeded, action will be taken to restore loads in predetermined manner.

G. Maintenance Management: System monitors equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits. Coordinate settings with Owner.

H. Sequencing: Provide application software based upon sequences of operation specified to properly sequence designated systems. Provide points to achieve specified sequences.

I. Staggered Start: This application prevents controlled equipment from simultaneously restarting after a power outage. Order in which equipment (or groups of equipment) is started, along with time delay between starts to be user-selectable.

J. Energy Calculations: Provide software to allow instantaneous power (e.g. kW) or flow rates (e.g. L/s (gpm)) to be accumulated and converted to energy usage data.

K. Anti-Short Cycling: Binary output objects protected from short cycling by allowing minimum on-time and off-time to be selected.

L. On/Off Control with Differential: Provide algorithm that allows binary output to be cycled based on controlled variable and setpoint. Algorithm direct-acting or reverse-acting and incorporate adjustable differential.

M. Run-Time Totalization: Provide software to totalize run-times for binary input objects.

2.5 WEB BASED ACCESS

A. General Description: BAS supplier to provide web-based access to the system as part of standard installation. Provide access to user of displays of real-time data that are part of the BAS via a standard web browser. Web browser to tie into the network via Ethernet network connection. Provide web-page host that resides on the BAS network. Web page software not to require a per user licensing fee or annual fees. The web page host must be able to support at least 50 simultaneous users with the ability to expand the system to accommodate an unlimited number of users. Software to be manufacturer's most current version at time of installation.

B. Browser Technology: Browser to be standard version of Microsoft Edge (latest edition). No special vendor-supplied software needed on computers running browser. Displays viewable and the web page host to directly access real-time data from the BAS network. Data displayed in real time and update automatically without user interaction. User able to change data on displays if logged in with the appropriate user name and password.

C. Display of Data: Webpage graphics shown on browser to be replicas of the BAS displays. User is to need no additional training to understand information presented on Web pages when compared to what is shown on BAS displays. Web page displays to include animation just as BAS displays. Fans to turn, pilot lights to blink, and coils to change colors, and so on. Real-time data shown on browser web pages. This data must be directly gathered via the BACnet network and automatically updated on browser webpage displays without any user action. Data on the browser to automatically refresh as changes are detected without re-drawing the complete display. User to be able to change data from browser web page to if the user is logged on with the appropriate password. Clicking on a button or typing in a new value to change digital data. Using pull-down menus or typing in a new value to change analog data. Data displays navigated using pushbuttons on the displays that are simply clicked on with the mouse to select a new display. Alternatively, the standard back and forward buttons of the browser can be used for display navigation.

D. Web Page Generation: Web pages generated automatically from the BAS displays that reside on the BAS server. User to access web page host via the network and initiate a web page generation utility that automatically takes the BAS displays and turns them into web pages. The web pages generated are automatically installed on the web page host for access via any computer's standard browser. Any system that requires use of an HTML editor for generation of web pages will not be considered.

E. Password Security and Activity Log: Access via web browser to utilize the same hierarchical security scheme as BAS system. User asked to log in once the browser makes connection to web page host. Once the user logs in, any changes that are made are to be tracked by the BAS system. User shall be able to change only those items that the user has authority to change. A user activity report to show any activity of the users that have logged in to the system regardless of whether those changes were made using a browser or via the BAS workstation.

F. Communication: Web-page host to communicate using the specified protocol standard to devices on the BAS network.

2.6 BAS GRAPHICS

A. Develop customized graphics showing the project building(s) and their floor plans, mechanical and electrical equipment, flow and control diagrams, and other relevant features on Workstation graphic screens. Associated input, output, and virtual objects (e.g., temperature and pressure setpoints) listed in the Sequence of Operation, and shown on the Input/Output Objects List included in the graphic screens and bound to the database. Real-time value of objects updated on the display of each graphic automatically. For projects where existing campus and/or building controls systems exist, replicate graphics used in the existing BAS graphics screens.

B. Graphics to have links to the Print function and to display a Standard Legend in the corner of the graphic. Graphics, except pop-ups, to have the date and time displayed in the upper corner of the graphic. Each graphic titled.

C. Weather: Graphics, except pop-ups, to have the outdoor temperature and humidity in the upper corner of the graphic.

D. Alarms: System and component summary alarms located near the top of each relevant graphic screen. Provide links to the associated system/component as part of these tags to assist trouble shooting. Other alarms placed near the associated system/device as depicted in the graphic. Provide text and color of information tags that describe each object and alarm value consistent with a graphics color legend.

E. The following graphics provided as a minimum:

1. A building graphic, typically a photograph of the building, with links to each floor plan and other links as defined below.
2. A central plant graphic with equipment (chillers, boilers, pumps, heat exchangers, storage tanks, etc.), temperature sensors, pressure sensors, flow sensors and refrigeration leak detectors. The central plant graphic to have links to each building on the campus.
3. Central equipment such as air handler, package rooftop equipment, supply fans, exhaust fans, and smoke control systems.
4. Floor plans of each floor, with temperature sensors, pressure sensors, temperature control zones, heating/cooling zones, ventilation zones, and supply air zones identified. Rooms grouped on a graphic only to the extent that detailed and complete sensing information can be comfortably viewed by an operator and the bound points updated in less than 10 seconds. Each zone to have a temperature symbol that changes color over the range from low (blue) through normal (green) to high (red) and indicate an alarm (flashing red). The zone temperature and or pressure symbol(s) to be a link to a zone control pop-up graphic. Individual floor plan graphics to provide links to related mechanical systems. The mechanical room plan graphics to show the relative location of, and provide links to, either the equipment pop-up or flow and control graphic for mechanical equipment monitored or controlled by the BAS.

5. Pop-up graphics provided for each zone control system showing a flow diagram and related monitoring and control points and system parameters. Pop-up graphics provided for each piece of equipment that is not shown on a flow and control graphic.
6. Flow and control diagrams for each system including but not limited to fan coils, generators, packaged equipment, heating hot water systems, heat exchangers, pumps, storage tanks, combination fire and smoke damper status, and ventilation systems. The flow and control graphics to have parameters grouped in the lower portion of the graphics. Standard equipment graphics used. Pumps, fans, dampers and other elements to dynamically indicate their state (i.e. pumps and fans to rotate when on and damper positions to dynamically adjust and be shown in their current position, etc.). System flow and control graphics displayed in a general left to right flow or loop arrangement. Return and exhaust air flow shown on top and return water shown on the bottom of the graphic.
7. Individual equipment/component screens showing sensing and control information available for each device provided.

F. Penetration: The graphic interface to consistently apply a convention whereby a left-click to always penetrate to more detailed information. The text windows to represent the deepest level of penetration. A right-click to always produce a menu of options that are specific to the item selected.

G. Navigation: Graphics organized to provide a "branching structure" that allows an operator to move from a "macro view" to a "micro view" and return. These links to other associated graphics, or allow a return to a previous macro view, provided and arranged horizontally along the bottom of each graphic screen. From left to right, the graphic links as follows: site/building map, building/trailer floor plans, and major mechanical systems at each building. Pop-up right click menus provided as needed on the lower button bar to allow for uncluttered navigation.

H. Clutter Minimization: Each graphic to have separate check boxes in the lower right corner that show/hide setpoints, alarms/safeties, and devices/equipment.

I. Templates: To the maximum extent possible, use standard graphics as templates to provide a consistent look throughout the interface.

J. Color Scheme: The graphics to use dynamic color changes to communicate equipment type, or object status consistent with the graphics color legend.

K. Symbols and Animations: Fans, pumps, dampers, coils, and generation equipment to be dynamic symbols indicating rotation, state, or position, movement, flow, etc.

L. Macros: When macros are used to add functionality to the graphics, detailed documentation provided.

M. Configure Mode: Access to “Configure Mode” for editing of the graphics password protected to prevent unauthorized changes to the graphics. This password supplied to the appropriate personnel.

N. Graphics Version: Graphics provided in the most current format available at time of control system programming.

O. Points and graphics checked for the proper binding and graphic programming, settings to ensure that the correct system, location, point values and dynamics are shown in the proper location and rotate in the proper directions.

P. After graphics have been accepted, provide, on a CD ROM in an agreed upon file structure. If the graphics have active-x controls or other files that must be placed outside the graphics folder structure a set-up program provided on the disk to place the files in the correct locations.

2.7 BUILDING CONTROLLERS

A. General: Provide adequate number of building controllers to achieve performance specified. Panels to meet the following requirements.

1. Building Automation System (BAS) to be composed of one or more independent, stand-alone, microprocessor-based building controllers to manage global strategies described in Controller Software article.
2. Provide sufficient memory to support operating system, database, and programming requirements.
3. Share data between networked building controllers.
4. Distributed controllers to share real and virtual object information and allow for central monitoring and alarms.
5. Controllers that perform scheduling have real-time clock.
6. Continually check status of its processor and memory circuits and if abnormal operation is detected, controller:
   a. Assume predetermined failure mode.
   b. Generate alarm notification.
7. Building Controller communicates with other devices on internetwork including BACnet communications according to specified protocol.

B. Communication:

1. Each building controller resides on network using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and performs routing to network of custom application and application specific controllers.
2. Controller provides a service communication port for connection to a portable operator's terminal.

C. Environment:

1. Controllers used outdoors and/or in wet ambient conditions mounted within NEMA waterproof enclosures and rated for operation at 0 degrees F to 150 degrees F.
2. Controllers used in conditioned space are mounted in NEMA dust-proof enclosures and rated for operation at 32 degrees F to 120 degrees F.

D. Keypad: Local keypad and display to be provided for each controller. Security password to be available to prevent unauthorized use of keypad and display.

E. Serviceability: Provide diagnostic LEDs for power, communication, and processor. Wiring connections are made to modular terminal strips or to termination card connected by ribbon cable.

F. Memory: Building controller maintains BIOS and programming information in event of power loss for at least 72 hours.

G. Immunity to power and noise: Controller able to operate at 90 percent to 110 percent of nominal voltage rating and performs an orderly shutdown below 80 percent nominal voltage. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3-feet.

H. Controller to have a battery to provide power for orderly shutdown of controller and storage of data in nonvolatile flash memory. Battery backup to maintain real-time clock functions for a minimum of 10 days.

2.8 APPLICATION SPECIFIC CONTROLLERS

A. Application specific controllers (ASCs) are microprocessor-based DDC controllers, which through hardware or firmware design, are dedicated to control a specific piece of equipment. Controllers to be fully programmable using graphical programming blocks.

1. ASC controllers communicate with other devices on internetwork.
2. Each ASC capable of stand-alone operation without being connected to network.
3. Each ASC will contain sufficient I/O capacity to control target system.
4. Application controllers to include universal inputs with minimum 10-bit resolution that accept thermistors, 0-10VDC, 0-5 VDC, 4-20 mA and dry contact signals. Any input on a controller may be either analog or digital with at least 1 input that accepts pulses. Controller to also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller to include binary and analog outputs on board. Provide analog outputs switch selectable as either 0-10VDC or 0-20mA. Software to include scaling features for analog outputs. Application controller to include 24VDC voltage supply for use as power supply to external sensors.
5. Program sequences stored on board application controller in EEPROM. No batteries needed to retain logic program. Program sequences executed by controller 10 times per second and capable of multiple PI and PID loops for control of multiple devices. Calculations completed using floating-point math and system to support display of information in floating-point nomenclature at operator's terminal. Programming of application controller completely modifiable in the field over installed BAS LANs or remotely via modem interface. Operator to program logic sequences by graphically moving function blocks on screen and tying blocks together on screen.
6. Application controller to include support for room sensor. Display on room sensor programmable at application controller and include an operating mode and a field service mode. Provide button functions and display data programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

B. Communication:

1. Controller resides on network using MS/TP Data Link/Physical layer protocol.
2. Each controller connected to building controller.
3. Each controller capable of connection to laptop computer or portable operator's tool.

C. Environment:

1. Controllers used outdoors and/or in wet ambient conditions mounted within NEMA waterproof enclosures and rated for operation at 0 degrees F to 150 degrees F.
2. Controllers used in conditioned space mounted in NEMA dust-proof enclosures and rated for operation at 32 degrees F to 120 degrees F.

D. Serviceability: Provide diagnostic LEDs for power, communication, and processor.

E. Memory: ASC use nonvolatile memory and maintains BIOS and programming information in event of power loss.

2.9 ADVANCED APPLICATION CONTROLLERS

A. General:

1. Expandable application controller capable of providing control strategies for the system based on information from any connected inputs. Provide program implementing these strategies completely flexible and user definable. Provide program execution of controller a minimum of once per second.
2. Programming: Object-oriented using control program blocks. Controller to support a minimum of 500 Analog Values and 500 Binary Values. Each and every analog and binary value to support standard specified protocol priority arrays.
3. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's terminal or field computer.
4. Controller to have adequate data storage to ensure high performance and data reliability. Battery to retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative). Provide field-replaceable battery (non-rechargeable) lithium type. Unused battery life: 10 years.
5. The onboard, battery-backed real time clock must support schedule operations and trend logs.
6. Global control algorithms and automated control functions should execute via 32-bit processor.
7. Controller to include both on-board Ethernet specified protocol communication over twisted pair cable (UTP) and to include specified protocol IP communication. In addition, controller to include specified protocol PTP connection port.
8. The base unit of the controller to host up to 8 expansion modules with various I/O combinations. These inputs and outputs to include universal 12-bit inputs, binary triac outputs, and 8-bit switch selectable analog outputs (0-10V or 0-20 mA). Inputs to support thermistors, 0-5VDC, 0-10VDC, 4-20mA, dry contacts and pulse inputs directly.
9. Outputs must have onboard Hand-Off-Auto switches and a status indicator light. HOA switch position to be monitored. Each analog output to include a potentiometer for manually adjusting the output when the HOA switch is in the Hand position.
10. The position of each and every HOA switch to be available system wide as a specified protocol object. Expandable Controller to provide up to 176 discreet inputs/outputs per base unit.

B. Schedules: Each controller to support a minimum of 50 Schedule Objects.

C. Logging Capabilities: Each controller to support a minimum of 200 trend logs. Any object in the system (real or calculated) may be logged. Sample time interval adjustable at the operator's workstation.

D. Alarm Generation:

1. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
2. Alarm log provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.
3. Controller must be able to handle up to 200 alarm setups stored as event enrollment objects - system destination and actions individually configurable.

2.10 INPUT/OUTPUT INTERFACE

A. Input/output points protected such that shorting of point to itself, to another point, or to ground will cause no damage to controller. Input and output points protected from voltage up to 24 V.

B. Binary inputs (BI or DI) allow monitoring of On/Off signals from remote devices. Binary inputs sense “dry contact” closure without external power (other than that provided by controller) being applied.

C. Pulse accumulation input objects accept up to 10 pulses per second for pulse accumulation.

D. Analog inputs (AI) allow monitoring of low-voltage (0 to 10 VDC), current (4 to 20 mA), or resistance signals (thermistor, RTD).

E. Binary outputs (BO or DO) provide for On/Off operation or pulsed low-voltage signal for pulse width modulation control. Binary outputs on building and custom application controllers have three-position (On/Off/Auto) override switches and status lights. Outputs selectable for either normally open or normally closed operation.

F. Analog outputs (AO) provide a modulating signal for control of end devices. Outputs provide either a 0 to 10 VDC or a 4 to 20 mA signal as required to provide proper control of the output device. Analog outputs on building controllers have status lights and two-position (AUTO/MANUAL) switch and adjustable potentiometer for manual override. Analog outputs not exhibit drift of greater than 0.4 percent of range per year.

G. Tri-State Outputs. Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices limited to zone control and terminal unit control applications (VAV terminal units, duct-mounted heating coils, zone dampers, radiation, etc.). Control algorithms run zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

2.11 POWER SUPPLIES AND LINE FILTERING

A. Control transformers UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in both primary and secondary circuits. Limit connected loads to 80 percent of rated capacity.

B. DC power supply output match output current and voltage requirements. Unit operates between 32 degrees F and 120 degrees F.

C. Line voltage units UL listed and CSA approved.

D. Power line filtering. Provide transient voltage and surge suppression for workstations and controllers.

2.12 CONTROL PANELS

A. Control Panels:

1. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures to be NEMA 12 when installed in other than a clean environment. Outdoor enclosures must be NEMA 3R. Provide (hinged door) key-lock latch and removable subpanels. Single key common to field panels and subpanels. In existing campus or building settings, key lock to match existing keys.
2. Interconnections between internal and face-mounted devices prewired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections UL listed for 600 volt service, individually identified per control/ interlock drawings, with adequate clearance for field wiring. Control terminations for field connection individually identified per control drawings.
3. Provide ON/OFF power switch with overcurrent protection for control power sources to each local panel.
4. Provide laminated plastic nameplates for enclosures in any mechanical room or electrical room labeled with TCP number. Laminated plastic to be 1/8-inch thick sized appropriately to make label easy to read.

2.13 AUXILIARY CONTROL DEVICES

A. Temperature Instruments:

1. Low-voltage or Line-voltage Thermostats: Bimetal-actuated, snap acting SPDT contact, enclosed, UL listed for electrical rating, exposed setpoint adjustment on cover with heat anticipator. Thermostat operates within 55 degrees F to 85 degrees F setpoint range, with 2 degrees F maximum differential.
2. Room Thermostats:
   a. For packaged equipment, including direct expansion split and VRF units, provide thermostats/controllers as manufactured by packaged equipment manufacturer.
   b. Electronic BACnet Thermostat/Controller: Wall mounted, 24 VAC, LED display, up to three universal inputs, up to four outputs, dedicated temperature sensor, up to four pre-programmed control strategies, CO2, RH, temp display, and occupancy override.
3. Room Temperature Sensors: Thermistor or platinum RTD type with accuracy of plus or minus 0.5 degrees F at 70 degrees F; operating range 30-120 degrees F; linear signal; single point sensing element in wall-mounted ventilated enclosure with insulating back plate if mounted on exterior wall; plug-in portable operators terminal port.
4. Room Temperature Sensor: Thermistor or platinum RTD type with accuracy of plus or minus 0.5 degrees F at 70 degrees F; operating range 30-120 degrees F; linear signal; single point sensing element in wall-mounted ventilated enclosure with insulating back plate if mounted on exterior wall; push button for occupancy override; digital setpoint adjustment plus or minus 2 degrees F in both directions; LCD temperature display indicating setpoint only. Setpoint adjustment to revert to building programmed standard temperature upon next building occupancy schedule change (user adjustable). Room temperature sensor may have integral space carbon dioxide sensor with minimum performance characteristics identified within this specification.
5. Averaging Duct Temperature Sensors: Thermistor or platinum RTD element with accuracy of plus or minus 0.5 degrees F at 32 degrees F, consisting of array of single point sensing elements, securely mounted in duct or plenum; operating range 20-120 degrees F; linear signal; 1-foot element per 2 SF of duct cross-sectional area. Use when duct is 9 SF or larger or where air is subject to temperature stratification.
6. Probe Duct Temperature Sensors: Thermistor or platinum RTD element with accuracy of plus or minus 0.5 degrees F at 32 degrees F, consisting of single point sensing elements, securely mounted in duct or plenum; operating range 20-120 degrees F; linear signal; 24-inch rigid probe. Use where duct is less than 9 SF cross-sectional area.

7. Outside Air Temperature Sensor: Thermistor or platinum RTD element with accuracy of plus or minus 0.5 degrees F at 32 degrees F; Range -58 to 120 degrees F, single element, linear, with weather and sun shield for exterior mounting.
8. Low Temperature Limit Thermostat: Minimum 20-foot capillary sensing element, triggering on low temperature as sensed by any 12-inch segment; snap acting, normally open contacts, manual reset, line voltage.
9. Liquid Immersion Temperature Sensor: Thermistor or platinum RTD element, with accuracy of plus or minus 0.5 degrees F at 32 degrees F, stainless steel well and assembly, range 30 to 250 degrees F.

B. Humidity Sensors:

1. Space Humidity Sensors: Operating range 10 to 95 percent relative humidity, accuracy plus or minus percent RH, surface mounted ventilated enclosure for wall mounting.
2. Duct Humidity Transmitter: Capacitive type sensor and transmitter, linear output signal; automatic temperature compensating; air filter; plus or minus 2 percent RH accuracy from 0 to 100 percent RH.
3. Humidity sensor's drift not exceed 1 percent of full scale per year.

C. Dewpoint Transmitter:

1. Uninterrupted, accurate and stable dewpoint measurement in condensing environments. Provide with integral temperature sensor.
2. Calculate:
    a. Relative Humidity
    b. Absolute Humidity
    c. Difference between ambient and dewpoint temperature.
    d. Mixing Ratio of Air
    e. Wet Bulb Temperature of Air
3. Provide hand held field calibration.
4. Provide with local display and connection to BAS (analog output signal from device to BAS 4-20 mA signal).
5. Dust and Chemical Resistant.
6. NEMA 4 Housing.
7. NIST Traceable with Certificate.
8. Specifications:
    a. Dewpoint Measurement Range: -40 degrees F to 212 degrees F
    b. Response Time: 15 seconds
    c. Temperature Measurement Range: 40 degrees F to 356 degrees F
    d. Accuracy: 0.18 degrees F
    e. Typical Ranges:
        1) Relative Humidity: 0 to 100 percent
        2) Dewpoint Difference: 0 to 90 degrees F
        3) Mixing Ration: 0 to 3500 gr/lb
        4) Absolute Humidity: 0 to 262 gr/ft^3
        5) Wet Bulb Temperature: 32 degrees F to 212 degrees F
9. Manufacturers:
    a. Vaisala HMP243 with HMK41 field calibrator.
    b. Or approved equivalent.

D. Pressure Transmitters and Transducers:

1. Transducer have linear output signal; field adjustable zero and span. Sensing elements withstand continuous operating conditions of positive or negative pressure 50 percent greater than calibrated span without damage.
2. Differential Pressure Switch: Setpoint adjustable with operating range of 0.5 to 12-inch WG for fans, and 5- to 30-feet WC for pumps. Switches UL listed; SPDT snap-acting; pilot duty rated (125 VA minimum); NEMA 1 enclosure; scale range and differential suitable for intended application.
3. Filter Differential Pressure Switch: Setpoint adjustable with operating range of 0.1- to 5-inch WG; auto reset. Contactor to close when pressure differential setting is met or exceeded. Provide mounting bracket, metallic tubing and appropriate fittings for connection to duct or air-handling unit.
4. Duct Static Differential Pressure Transducer: Operating range 0- to 5-inch WC for duct mounted transmitter; ceramic capacitive sensing element with probe securely mounted in duct; digital input terminal and push button to zero output. Accuracy plus or minus 1 percent of full scale; maximum response time 2 seconds.
5. Building Static Pressure Transducer: Operating range of -0.1- to 0.1-inch WC, linear signal. Sensing tubes located inside and outside building use shielding and/or surge tanks to minimize effects of wind. Accuracy plus or minus 1 percent of full scale.
6. Piping Pressure Transmitter: Operating range 0 to 50 PSIG, linear signal; stainless steel diaphragm; digital input terminal and push button to zero output. Accuracy plus or minus 1 percent of full scale.

E. Motorized Control Dampers:

1. Performance: Maximum leakage of 3 CFM/SF at 1-inch WG differential pressure, AMCA Class 1A, maximum pressure rating of 13-inch WG differential pressure, maximum velocity of 6,000 fpm, -72 degrees F to 275 degrees F temperature rating.
2. Multi-blade type, except where either dimension is less than 10-inch single blade may be used. Maximum blade length to be 48-inch.
3. Provide parallel blades for modulating mixing service and opposed blades for throttling service.
4. Blades to be interlocking; minimum 16 gauge galvanized steel; compression type edge seals and side seating stops. In copper, aluminum and stainless steel duct work, damper material matches duct work material.
5. Damper blades are reinforced, have continuous full length axle shafts, axle to axle linkage, and/or operating “jackshafts” as required to provide coordinated tracking of blades.
6. Bearings: Self-lubricating stainless steel sleeve or Celcon bearing.
7. Dampers over 25 SF in area to be in two or more sections, with interconnected blades.
8. Provide remote damper blade position status with binary input.
9. Tested in accordance with AMCA Standard No. 500.

F. Motorized Control Valves:

1. Body pressure rating and connection type construction conforms to pipe, fitting and valve schedules.
2. Fluid valve close-off ratings and spring ranges operate at maximum flows and maximum available pump heads scheduled without leakage.
3. Screwed ends except 2-1/2-inch and larger valves with flanged ends.
4. Motorized Control Valves (Pressure Independent Control Valves):
    a. Description: Valve consists of pressure compensating cartridge, actuated ball or Y pattern globe valve, and multiple pressure/temperature test ports in a single valve housing.

b. Construction: Rated for no less than 125 PSI and 250 degrees F. 2-inch and Smaller: brass with threaded connections. 2-1/2-inch and larger: cast iron with flanged connections.
c. Performance: Flow rate controlled linearly to within 5 percent of target flow rate, for any actuator position (0 to 100 percent), over an operating differential pressure range of 6 to 50 PSI across the valve. Provide valve with integral test ports to verify pressure differential.
d. Manufacturers: Belimo, Danfoss, Flow Control Industries, Griswold, Tour and Andersson, or approved equivalent.

5. Fluid three-way valves globe valves with linear plug with composition disc for tight shutoff.
6. Pressure drop equal to twice pressure drop through heat exchanger (load), 50 percent of pressure difference between supply and return mains, or 5 PSI, whichever is greater, except two-position valves to be line size.
7. Bubble-tight line size butterfly valves acceptable on 2-1/2-inch lines and above for two-position action only; cast iron body; aluminum bronze disc; EPDM seat, 200 PSI wg.
8. For modulating service that require valve sizes above 6-inch, butterfly or v-port ball valves are allowed.

G. Electronic Pressure Independent Control Valves:

1. General: Assembly consisting of electric control valve, flow measuring station and control to provide constant flow regardless of varying pressure differentials. Flow setpoint electronically adjustable.
2. Communication: BACnet MS/TP.
3. Control Type: Modulating.
4. Fluid: Chilled or hot water, up to 60 percent glycol.
5. Materials:
   a. Valve body: Nickel plated brass (1/2-inch to 2-inch), cast iron (2-1/2-inch to 6-inch).
   b. Sensor housing: Nickel plated forged brass (1/2-inch to 2-inch), ductile iron (2-1/2-inch to 6-inch).
   c. Ball: Stainless steel.
   d. Stem: Stainless steel.
   e. Characterized disc: Tefzel (1/2-inch to 2-inch), stainless steel (2-1/2-inch to 6-inch).
6. Fluid Temperature Range: 14F to 250F.
7. Pressure Rating: 360 PSIG (1/2-inch to 2-inch), ANSI 125, Class B (2-1/2-inch to 6-inch.
8. Close-off Pressure: 200 PSID (1/2-inch to 2-inch), 100 PSID (2-1/2-inch to 6-inch).
9. Leakage: 0 percent.
10. Rangeability: 100:1.
11. Flow control tolerance: +/-5 percent.
12. Flow measurement tolerance: +/-2 percent.
13. Connections: Flanged or threaded to match piping.
14. Power Loss Fail Position: Last position.
15. Actuator: Manual override, electrically reversable.
16. Listing: UL or CSA.
17. Communication feedback: Actual flow, valve position.
18. Manufacturer: Belimo ePIV or approved equivalent.

H. Electric Damper/Valve Actuators:

1. Provide mechanical or electronic stall protection for each actuator.

2. Where indicated provide internal mechanical, spring-return mechanism or provide uninterruptible power supply (UPS). Non-spring-return actuators have external manual gear release to position damper/valve when actuator is not powered.
3. Proportional actuators accepts 0 to 10 VDC or 0 to 20 mA control signal and provide 2 to 10 VDC or 4 to 20 mA operating range.
4. Actuator sized for torque required plus 25 percent; UL or CSA listed; electronic current overload protection.
5. For system differential pressure control valves, provide fast acting valve actuator with valve open or close time of 30 to 60 seconds.
6. VAV Actuators: Actuators proportional 24 VAC actuators using a 4 to 20 mA range of control signals; stops automatically at end of travel; include permanently lubricated gear train.
7. Actuators for emergency generator damper control rated for 350 degree F. maximum operating temperature and capable to drive fully open and close within 15 seconds.

I. Room Pressure Monitor: Active room pressure monitor and alarm which provides local audio alarm and analog and alarm signals to DDC system. Wall mounted panel with LED differential pressure readout; audible and visual alarm; mute button; range of -0.05 to +0.05-inch WC; accurate to 1 percent of full scale; repeatability plus or minus 1.0 percent of full scale per year, alarm delay ability between 0-30 seconds. Provide door switch to deactivate alarm when space door(s) are open. Input status from BAS to deactivate alarm in unoccupied or shutdown modes. Phoenix Controls APM100.

J. Duct Mounted Carbon Dioxide Sensor:

1. Duct mounted CO2 sensor consists of infrared sensing element with heated stannic dioxide semiconductor. Operating range 0-2000 ppm plus 50 ppm plus 2 percent of measured value; maximum duct velocity of 1500 fpm; duct mounting kit.

K. Wall Mounted Space Carbon Dioxide Sensor:

1. Sensor to employ non-dispersive infrared technology (N.D.I.R.).
2. Sensor Repeatability: Plus or minus 20 ppm. 0-2000.
3. Sensor Accuracy: Less than or equal to 75 ppm over 0-1500 ppm range.
4. Sensor Response Time: Less than 1 minute.
5. Sensor to employ reference channel design for long-term stability.
6. Sensor to have field selectable 0-10VDC, or 4-20mA outputs.
7. Sensor power requirement less than 3W.
8. Sensor Input Voltage: 20 to 30VAC/DC.
9. Sensor Operating Temperature Range: 0 degrees C to 50 degrees C.
10. Sensor to have models for wall mounting or duct mounting.
11. Sensor to provide at least a 1-year factory warranty from date of purchase.
12. Sensor to match cover in color and look to temperature sensor.
13. Sensor to have display.
14. Manufacturers:
    a. Telaire
    b. Vaisala
    c. Veris

L. Occupancy Sensor: Dual technology infrared and ultrasonic sensing device, ceiling or wall mounted, built-in self-adjusting settings, timer settings of 30 seconds to 30 minutes, with manual and automatic modes. Provide multiple devices in parallel when area served is greater than a single device sensing capability. Provide integral power pack, 120 VAC input, 24 VDC output, with manual override switch. Leviton OSC-MOW series.

M. Paddle Type Flow Switches: Paddle type switches (water service only) UL listed, SPDT snap-acting with pilot duty rating (125 VA minimum) and have adjustable sensitivity with NEMA 1 enclosure.

N. Relays:

1. Control relays UL listed plug-in type with dust cover and LED “energized” indicator. Contact rating, configuration, and coil voltage to be suitable for application.
2. Time delay relays UL listed solid-state plug-in type with adjustable time delay. Delay adjustable plus or minus 200 percent (minimum) from setpoint or as indicated. Contact rating, configuration, and coil voltage to be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

O. Override Timers: Override timers spring-wound line voltage, UL Listed, with contact rating and configuration as required by application. Provide 0-to-6-hour calibrated dial unless otherwise specified. Timer suitable for flush mounting on control panel face and located on local control panels or where shown.

P. Current Transmitters:

1. AC current transmitters are self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4 to 20 mA two-wire output. Unit range compatible with actual applied span of current value, with internal zero and span adjustment and plus or minus 1 percent full-scale accuracy at 500 ohm maximum burden.
2. Transmitter meets or exceeds ANSI/ISA S50.1 requirements and UL/CSA recognized.
3. Unit split-core type for clamp-on installation on existing wiring.

Q. Current Transformers: AC current transformers UL/CSA recognized and completely encased (except for terminals) in approved plastic material; plus or minus 1 percent accuracy at 5 A full-scale.

R. Voltage Transmitters: AC voltage; self-powered single-loop (two-wire) type; 4 to 20 mA output with zero and span adjustment; UL/CSA recognized at 600 VAC rating and meet or exceed ANSI/ISA S50.1. Ranges include 100 to 130 VAC, 200 to 250 VAC, 250 to 330 VAC, and 400 to 600 VAC full-scale, adjustable, with plus or minus 1 percent full-scale accuracy with 500 ohm maximum burden.

S. Voltage Transformers: AC voltage transformers UL/CSA recognized, 600 VAC rated; built-in fuse protection; suitable for ambient temperatures of 40 degrees F to 130 degrees F; plus or minus 0.5 percent accuracy at 24 VAC and a 5 VA load.

T. Power Monitors: Selectable rate pulse output for kWh reading; 4-20 mA output for kW reading; N.O. alarm contact; ability to operate with 5.0 amp current inputs or 0-0.33 volt inputs; plus 1.0 percent full-scale true RMS power accuracy; plus 0.5 Hz, voltage input range 120-600 V, and auto range select; NEMA 1 enclosure. Current transformers having a 0.5 percent FS accuracy, 600 VAC isolation voltage with 0-0.33 V output. If 0-5 A current transformers are provided, a three-phase disconnect/shorting switch assembly is required.

U. Overflow Switch: Insertion flow sensor, brass, impeller flow design with analog transmitter unit. Data Industrial Model 220BR.

V. Pressure-Electric (PE) Switches: Metal or neoprene diaphragm actuated; operating pressure rated 0-25 PSIG; calibrated scale setpoint range of 2-18 PSIG minimum; UL listed. Provide one- or two-stage switch action SPDT, DPST, or DPDT, as required by application. Electrically rated for pilot duty service (125 VA minimum) and/or for motor control. Permanent indicating gauge on each pneumatic signal line to PE switches.

2.14 WIRING AND RACEWAYS

A. General: Provide copper wiring, plenum cable, and raceways as specified in applicable Sections of Division 26, Electrical.

B. Insulated wire to be copper conductors, UL labeled for 90 degrees C minimum service.

C. Field panels and controllers to be supplied by building emergency power system where systems being monitored or controlled are on emergency power.

D. Run control wiring as follows:

1. Mechanical Rooms: In conduit.
2. Exposed in Building Spaces: In conduit.
3. Concealed in Building Walls and Ceilings: Plenum rated cable.
4. Concealed in Building Ceilings: Plenum rated cable in cable tray.

E. Field and Subfield Panels: Voltage in panels not-to-exceed 120 volts.

F. Motor Control Centers: Responsibility for correct voltage of holding coils and starter wiring in pre-wired motor control centers interfacing with automatic controls is included hereunder.

G. Wiring for BAS systems communications buses two conductor minimum 18 gauge foil-shielded, stranded twisted pair cable rated at 300 VDC or more than 80 degrees C.

2.15 SMOKE DETECTION (FOR PROJECTS WITH A FIRE ALARM SYSTEM)

A. See Division 28 for Products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the Owner's Authorized Representative in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not begin work until unsatisfactory conditions are resolved.

3.2 CONTROL SYSTEM CHECKOUT AND TESTING

A. Testing completed before Owner's Authorized Representative is notified of system demonstration.

B. Calibrate and prepare for service of instruments, controls, and accessory equipment furnished under this specification.

C. Verify that control wiring is properly connected and free of shorts and ground faults.

D. Enable control systems and verify calibration and operation of input and output devices.

E. Verify that system operation adheres to sequences of operation.

F. Commissioning and Verification: In addition to commissioning requirements specified elsewhere, provide the following commissioning on the HVAC instrumentation and controls system:

1. Control systems completely commissioned to ensure aspects of the system are operating as intended and at optimum tuning.
2. Wiring connections verified and traced from field device to panel to ensure proper connections.
3. Measured values verified by a hand held calibrated device to validate that value indicated by the control system is in fact the actual measured value.
4. Loops properly tuned to obtain the desired control value. Each loop to be "upset" and put back in control to demonstrate its ability to stabilize quickly.
5. Provide a final point-by-point report submitted that indicates the date of each verification, the results, and initialed on each page by the person performing the reading.

3.3 ACCEPTANCE TESTING AND TRAINING

A. Site Testing:

1. Contractor provides personnel, equipment, instrumentation, and supplies necessary to perform testing. Owner or Owner's Authorized Representative will witness and sign off on acceptance testing.
2. Contractor demonstrates compliance of completed control system with Contract Documents. Using approved test plan, physical and functional requirements of project demonstrated.

B. Training:

1. General: Contractor conducts training courses for up to three other designated personnel in operation and maintenance of system. Training manuals provided for each trainee, with two additional copies provided for archival at project site. Manuals include detailed description of subject matter for each lesson. Copies of audiovisuals delivered to Owner. Training day is defined as 8 hours of classroom instruction, including two 15-minute breaks and excluding lunch time, Monday through Friday, during normal first shift in effect at training facility. Notification of any planned training given to Owner's Authorized Representative at least 15 days prior to training.

2. Operator's Training I: First course taught at supplier's facility for period of two consecutive training days. Upon completion, each student should be able to perform elementary operations with guidance and describe general hardware architecture and functionality of system.
3. Operator's Training II: Second course taught at project site for a period of one training day after completion of contractor's field testing. Course includes instruction on specific hardware configuration of installed system and specific instructions for operating installed system. Upon completion, each student should be able to start system, operate the system, recover system after failure, and describe specific hardware architecture and operation of system.
4. Operator's Training III: Third course taught at project site for period of one training day no later than six months after completion of the acceptance test. Course will be structured to address specific topics that students need to discuss and to answer questions concerning operation of system. Upon completion, students should be fully proficient in system operation and have no unanswered questions regarding operation of installed system.

3.4 COMMUNICATION WIRING

A. Follow manufacturer's installation recommendations for communication cabling.

B. Verify integrity of network following cable installation.

C. Communication wiring unspliced length when that length is commercially available; labeled to indicate origination and destination data.

D. Grounding of coaxial cable in accordance with NEC regulations article on “Communications Circuits, Cable, and Protector Grounding.”

3.5 WIRING AND RACEWAYS

A. Provide electrical wiring required to control systems specified in this Section. Control and interlock wiring complies with national, state and local electrical codes and Division 26, Electrical of this specification.

B. Power wiring required for building control panel(s) to be dedicated circuit(s).

C. Verify location of operator work station with Owner prior to installation.

D. NEC Class 1 (line voltage) wiring UL Listed in approved raceway according to NEC and Division 26, Electrical requirements.

E. Low-voltage wiring meets NEC Class 2 requirements. (Low-voltage power circuits subfused when required to meet Class 2 current limit.)

F. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used provided that cables are UL listed for intended application.

G. Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for purpose of interfacing (e.g., relays and transformers).

H. Where Class 2 wiring is run exposed, wiring run parallel along surface or perpendicular to it and tied at 10 foot intervals.

I. Where plenum cables are used without raceway, support from structural members. Do not support cables with ductwork, electrical raceways, piping, or ceiling suspension systems.

J. Make wire-to-device connections at terminal block or terminal strip. Make wire-to-wire connections at terminal block.

K. Maximum allowable voltage for control wiring 24 V. If only higher voltages are available, provide step-down transformers.

L. Wiring installed as continuous lengths, with no splices permitted between termination points.

M. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at penetrations.

N. Include one pull string in each raceway 1-inch or larger.

O. Control and status relays are to be located in designated enclosures. Enclosures include packaged equipment control panels unless they also contain Class 1 starters.

P. Install raceway to maintain a minimum clearance of 6-inches from high-temperature equipment (e.g., steam pipes or flues).

Q. Secure raceways with raceway clamps fastened to structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

R. Install insulated bushings on raceway ends and openings to enclosures. Seal top end of vertical raceways.

S. Flexible metal raceways and liquid-tight, flexible metal raceways not-to-exceed 3-feet in length and be supported at each end. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways to be used.

T. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections joined with couplings. Terminations made with fittings at boxes.

U. Input and output terminations to be labeled at the controller to identify if they are AI, DI, AO, DO, and function (i.e. pump start, OM Sensor).

3.6 INSTALLATION OF AUXILIARY CONTROL DEVICES

A. General:

1. Install sensors and thermostats in accordance with manufacturer's recommendations.
2. Room sensors and thermostats installed at 48-inches AFF to top of sensor on concealed junction boxes properly supported by wall framing at the locations shown on the Drawings.
3. Low-limit sensors used in mixing plenums installed in a serpentine manner horizontally across duct.

4. Pipe-mounted temperature sensors installed in wells with heat-conducting fluid in thermal wells.
5. Install outdoor air temperature sensors on north facing wall or screen, complete with sun shield at designated location.
6. Chiller or Heat Pump differential pressure sensor: Locate immediately at the chiller or heat pump piping connections, before any fittings or accessories.

B. Flow Switch: Use correct paddle for pipe diameter. Adjust flow switch in accordance with manufacturer's instructions.

C. Actuators:

1. General:
   a. Mount and link control damper actuators according to manufacturer's instructions.
   b. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
2. Actuator Mounting for Damper and Valve Arrangements to Comply with the Following:
   a. Damper Actuators: Do not install in the air stream.
   b. Use a weather proof enclosure (clear and see through) if actuators are located outside.
   c. Damper or valve actuator ambient temperature not-to-exceed 122 degrees F through any combination of medium temperature or surrounding air. Provide appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation as necessary. Mount per manufacturer's recommendations.
   d. Actuator cords or conduit to incorporate a drip leg if condensation is possible. Do not allow water to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point to be avoided to prevent water from condensing in conduit and running into actuator.
   e. Damper mounting arrangements to comply with the following:
      1) Furnish and install damper channel supports and sheet metal collars.
      2) Jack shafting of damper sections not allowed.
      3) Multi-section dampers arranged so that each damper section operates individually. Provide one electronic actuator direct shaft mounted per section.
   f. Size damper sections based on actuator manufacturers specific recommendations for face velocity, differential pressure and damper type. In general: Damper section not-to-exceed 24 ft-sq. with face velocity 1500 FPM.
   g. Multiple section dampers of two or more arranged to allow actuators to be direct shaft mounted on the outside of the duct.
   h. Multiple section dampers of three or more sections wide arranged with a 3-sided vertical channel (8-inch wide by 6-inch deep) within the duct or fan housing and between adjacent damper sections. Vertical channel anchored at the top and bottom to the fan housing or building structure for support. Connect sides of each damper frame to the channels. Holes in the channel to allow damper drive blade shafts to pass through channel for direct shaft mounting of actuators. Face open side of channel downstream of the airflow, except for exhaust air dampers.
   i. Multiple section dampers to be mounted flush within a wall or housing opening to receive either vertical channel supports as described above or sheet metal standout collars. Sheet metal collars (12-inch minimum) to bring each damper section out of the wall to allow direct shaft mounting of the actuator on the side of the collar.

D. Control Valve:

1. Valves installed in accordance with manufacturer's recommendations.
2. Slip-stem control valves installed so that stem position is not more than 60 degrees from vertical up position. Ball type control valves installed with stem in horizontal position.
3. Control valves accessible and serviceable.
4. Install isolation valves so that control valve may be serviced without draining supply/return side piping system. Install unions at connections to screw-type control valves.
5. Valve Sizing for Water Coil:
    a. On/Off Control Valves: Line size.
    b. Modulating control valve body size may be reduced, at most, two pipe sizes from the line size or not less than 1/2 the pipe size. BAS contractor to size water coil control valves for the application as follows:
        1) Booster-heat valves sized not-to-exceed 4-9 PSI differential pressure. Size valve for 50 percent valve authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.
        2) Primary valves sized not-to-exceed 5-15 PSI differential pressure. Size valve for 50 percent valve authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.
        3) Butterfly valves sized for modulating service at 60 to 70 degree rotation. Design velocity 12-feet per second or less when used with standard EPDM seats.
    c. Valve Mounting Arrangements to Comply with the Following:
        1) Provide unions on ports of two-way and three-way valves.
        2) Install three-way equal percentage Characterized Control valves in a mixing configuration with the “A” port piped to the coil.
        3) Install 2-1/2-inch and above, three-way globe valves, as manufactured for mixing or diverting service to the coil.

E. Control Damper:

1. Dampers installed in accordance with manufacturer's instructions. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.
2. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

3.7 SMOKE DETECTION (FOR PROJECTS WITH A FIRE ALARM SYSTEM)

A. Smoke detector furnished and powered/wired under Division 28, Electronic Safety and Security. Coordinate with fire alarm equipment supplier. Installation of duct smoke detector housing and sampling tube under Division 23, HVAC.

B. Install smoke detectors in supply air systems greater than 2000 CFM.

C. Install smoke detectors at each story prior to connection to return air riser in systems greater than 15,000 CFM and serving more than one story.

3.8 SEQUENCES OF OPERATION AND POINTS LISTS

A. Where local energy code dictates certain sequences (such as night setback, night flush, pressure and temperature reset, terminal unit sequences, etc.), the sequences are not necessarily repeated in the documents. It is not the intent of this specification or documentation to reiterate the energy code. Provide energy code mandated sequences and document in sequence of operations submittals at no additional cost to the Owner. Provide required points to achieve the appropriate sequences.

B. See control diagrams and sequences on drawings in addition to sequences below.

C. Variable Frequency Drives: For a VFD dependent on an external input for its output setting (e.g., the VFD gets “Frequency” as an input), loss of that external input to result in the VFD holding its last value. If the VFD is running its own PID loop and the external input to the VFD is a setpoint (e.g. duct static pressure setpoint), the VFD to hold the last setpoint. If the VFD loses its process variable (e.g. duct static pressure), the VFD to go to its minimum speed setting.

D. Except as specified otherwise, throttling ranges, proportional bands, and cycle differentials to be centered on the associated setpoint. Modulating feedback control loops to include the capability of having proportional, integral, and derivative action. Unless the loop is specified “proportional only” or “P+I”, Contractor to apply appropriate elements of integral and derivative gain to each control loop to result in stable operation, minimum settling time and maintain the primary variable within the specified maximum allowable variance.

E. Provide a real time clock and schedule controller with sufficient scheduling capability to schedule required controllers and sequences. Schedule functionality may reside in a controller. If a controller is used, document scheduling functionality including names and types on controller points list submittal. Set up initial schedules in coordination with Owner.

F. Scheduling Terminology: When air handlers are scheduled throughout the day, the following defines the terminology used:

1. Occupied Period: Period of time when the building is in use and occupied. Confirm schedule with Owner. Exclude all national holidays. Generally systems will be fully operational throughout this period and ventilation air to be continuously introduced. Space temperature setpoints will generally be in the “normal” range of 68 degrees to 78 degrees F.
2. Unoccupied period: Period of time when the building or zone is not in use and unoccupied. Ventilation air not to be introduced.
3. Preoccupancy Period: Time prior to the Occupied period when the systems are returning the space temperatures from setback to “normal” or occupied setpoints (warm-up and cool-down). Ventilation air shall not be introduced unless outside air conditions permit free-cooling or to support a pre-occupancy purge sequence. Time period to be determined by an optimum start strategy unless otherwise specified.
4. Setback Period: Setback will typically start with the end of the occupied period and end with the start of the preoccupancy period, however it shall be provided with its own schedule. Generally systems will be off except to maintain a “setback” temperature, economization may be enabled to maintain “setback” cooling setpoint when applicable.

G. Where any sequence or occupancy schedule calls for more than one motorized unit to start simultaneously, the BAS start commands to be staggered by 5 second (adj.) intervals to minimize inrush current.

H. Wherever a value is indicated as adjustable (adj.), it shall be modifiable, with the proper password level. For these points, it is unacceptable to have to modify programming statements to change the setpoint.

I. When a power failure is detected in any phase, the BAS start commands to be retracted immediately from electrically powered units served by the failed power source. If the associated controller is powered by normal or emergency power, it may monitor its own power source as an indication of power status. If the controller is powered by uninterruptible power supply (UPS), or if it is not capable of monitoring its own power for use in sequences, provide at least one voltage monitor (three phase when applicable) per building. When the BAS detects that normal or emergency power has been restored, all equipment for which the BAS start command had been retracted to be automatically restarted in an orderly manner on staggered 5 second intervals to minimize inrush current.

J. Where reset action is specified in a sequence of operation, but a reset schedule is not indicated on the drawings, employ one of the following methods:

1. Determine a fixed reset schedule to result in stable operation and maintain the primary variable within the specified maximum allowable variance.
2. Use a floating reset algorithm which increments the secondary variable setpoint (setpoint of control loop being reset) on a periodic basis to maintain primary variable setpoint. The recalculation time and reset increment to be chosen to maintain the primary variable within the specified maximum allowable variance.
3. Primary variable to control the devices directly using a PID feedback control loop without resetting the secondary variable. However, the control devices to still modulate as necessary to maintain upper and lower limits on the secondary variable. Proportional band, integral gain, and derivative term to be selected to maintain the primary variable within the specified maximum allowable tolerance while minimizing overshoot and settling time. Gain prior approval for implementing this method of reset.

K. BAS to provide for adjustable maximum rates of change for increasing and decreasing output from the following analog output points:

1. Speed control of variable speed drives
2. Control Reset Loop
3. Valve Travel Limit

L. Wherever a value is indicated to be dependent on another value (i.e., setpoint plus 5 degrees F) BAS to use that equation to determine the value. Simply providing a virtual point that the operator must set is unacceptable. In this case three virtual points to be provided. One to store the parameter (5 degrees F), one to store the setpoint, and one to store the value which is the result of the equation.

M. Trend points as identified in the points list. Trends to be grouped system specific and setup in two-axis (x,y) graphical format that display object values relative to time. Setup trends to record data in 5 minute increments.

N. **Heating Water Primary Pumps (HWP-1,2), Constant Speed Lead-Standby:**

1. When ASHP is commanded on, lead heating water pump operates at flow as set by balancer (VFD speed set by balancer).
2. Current transformer signals controller which generates alarm when lead pump/controller fails to operate and start standby pump.

3. Controller switch lead and standby pumps on operator defined schedule to allow for even wear.
4. Heating Water Primary Pumps (HWP-1,2), Constant Speed Lead-Standby Points List:

Points List	Analog In	Analog Out	Digital In	Digital Out	Alarms	Trend
Lead Pump Start/Stop				X		
Lead Pump Status (current transformer)			X		Fail	X
Lead Pump VFD Speed Feedback (Hz)	X					X
Lead Pump VFD Speed		X				
Lead Pump VFD Error/Failure			X		Fail	
Standby Pump Start/Stop				X		
Standby Pump Status (current transformer)			X		Fail	X
Standby Pump VFD Speed Feedback (Hz)	X					
Standby Pump VFD Speed		X				
Standby Pump VFD Error/Failure			X		Fail	
Supply Hot Water Temp	X					X
Return Hot Water Temp	X					X
Differential Pressure Sensor	X					X

O. **Heating Water Pumps (HWP-1,2), Variable Speed Lead-Standby:**

1. Pump controller receives signal from building controller commanded on whenever any heating valve is modulated open and calling for heat.
2. Pump Operation:
   a. When pumps operate, differential pressure sensor, located at most remote heating valve signals controller, which varies speed of lead pump to maintain setpoint (as set by balancer).
3. Controller switches lead and standby pumps on operator defined schedule to allow for even wear.
4. Current transformer signals controller which generates alarm when lead pump/controller fails to operate and start standby pump.
5. Controller receives RPM signal from pumps variable frequency drives.
6. Each variable frequency drive signals controller to generate alarm in event of drive/control failure.
7. Heating Water Pumps (HWP-1,2), Variable Speed Lead-Standby Points List:

Points List	**Analog In**	**Analog Out**	**Digital In**	**Digital Out**	**Alarms**	**Trend**
Lead Pump Start/Stop				X		
Lead Pump Status (Current Transformer)			X		Fail	X
Lead Pump VFD Speed		X				
Lead Pump VFD Speed Feedback (Hz)	X					X
Lead Pump VFD error/failure			X		Fail	
Lag Pump Start/Stop				X		
Lag Pump Status (Current Transformer)			X		Fail	X
Lag Pump VFD Speed		X				
Lag Pump VFD Speed Feedback (Hz)	X					X
Lag Pump VFD Error/Failure			X		Fail	

Differential Pressure Sensor	X					X
Supply Hot Water Temp	X					X
Return Hot Water Temp	X					X

P. **Recirculating Domestic Hot Water Pump:**

1. Pump controller receives signal from building controller, which initiates occupied or unoccupied mode. During occupied mode pump will run continuously. During unoccupied mode pump will be off.
2. Current transformer signals controller which generates alarm when pump/controller fails to operate.
3. Recirculating Domestic Hot Water Pump Points List:

Points List	Analog In	Analog Out	Digital In	Digital Out	Alarms	Trend
Pump Start/Stop	X			X		
Pump Status (current transformer)			X		Fail	X

Q. **Electric Boiler (EB-1) and Boiler Circulating Pumps (BCP-1):**

1. Summary: Boiler act as supplement/backup heat to the central heating ASHP. Boiler loop is positioned downstream of primary ASHP loop and acts to boost heat delivered to the building loop. The boiler is matched with an associated circulator pump. DDC connected through BACnet allowing building system control, monitoring, and collection of logged data from the boiler controller.
2. When building loop supply water temperature drops below setpoint (120F) minus 10F (adj.) for 10 minutes (adj.), command on boiler circulator and boiler. Boiler to energize heating stages in a cascading sequence until return temperature reaches setpoint. Boiler is then commanded of and delayed operation for 10 minutes (adj.) before permitted to be recommended on, to prevent temperature above setpoint form being delivered back to the ASHP, and permit ASHP to take lead heating operation.
3. Provide full graphic user interface for monitor and control setpoint adjustments in unit.
4. Electric Boiler (EB-1) and Boiler Circulating Pumps (BCP-1) Points List:

Points List	Analog In	Analog Out	Digital In	Digital Out	Alarms	Trend
Start/Stop				X		
System Return Water Temperature	X					X
System Supply Water Temperature	X					X

Heating Water Setpoint		X				
Status			X			X
Boiler Return Water Temperature	X					
Boiler Supply Water Temperature	X					

R. **Pool and Spa Heat Exchangers (HX-1,2,3):**

1. Pool Water Heating (refer to pool consultant design package for pool water and space temperature setpoints):
   a. Pool Return Water Sensor: Sense pool temperature. If pool is 0.5 degrees F below setpoint (adj.), modulate open associated heating valve.
   b. Spa Return Water Sensor: Sense spa return water temperature. If spa is 1 degree F below setpoint (adj.), enable heat modulation.

S. **General Exhaust Fans (EF-1 through 6):**

1. EF-1 and EF-6: Fan controller receives signal from building controller, which initiates occupied or unoccupied mode. During occupied mode open isolation damper and run fan continuously. During unoccupied mode close isolation damper and fan off.
2. EF-2 through 5: Fans operate continuously 24/7.
3. Current transformer signals controller which generates alarm when fan/controller fails to operate.
4. General Exhaust Fans (EF-1 through 6) Points List:

Points List	Analog In	Analog Out	Digital In	Digital Out	Alarms	Trend
Exhaust Fan Start/Stop				X		
Exhaust Fan Status (Current Transformer)			X		Fail	X
Damper Open/Close				X		

T. **Variable Frequency Drives (VFD):**

1. Variable speed drives monitored by controller though LAN communications port on each drive. Reference Section 23 09 13, Variable Frequency Drives. As a minimum, monitor the following points:
   a. Frequency output - Hz
   b. Speed - RPM
   c. Current - Amps
   d. Power - Percentage
   e. Runtime - Hours
   f. System Fault

g. Input speed setpoint - RPM

U. **Air Source Heat Pump (ASHP-1):**

1. Refer to unit's specification, Section 23 81 43, Air Source Heat Pumps. Unit to include factory microprocessor controller and control sequence. The unit's controls are to be hard contact and BACnet tied into the BAS via BACnet interface.
2. Provide full graphic user interface for monitor and control setpoint adjustments in unit.
3. Summary: Each heat pump module contains an integrated microprocessor control system with full BACnet connection for building automation system control, monitoring, and data logging. ASHP modules are linked together to operate in an internally programmed energy optimized "cascading" sequence. In general, the building automation system determined heating water set-points, relays the setpoints to the microprocessor control system, and the unit operates using internal optimized sequence to meet heating water set-point temperature based on demand.
4. Air Source Heat Pump (ASHP-1) Points List: Map points via BACnet interface and/or hard contact (coordinate with unit manufacturer).

Points List	Analog In	Analog Out	Digital In	Digital Out	Alarms	Trend
Start/Stop				X	X	
System Heating Water Return Temperature	X					X
System Heating Water Supply Temperature	X					X
Heating Water Setpoint		X				
Status/Alarm			X			X
Electrical Power Current	X					X
Electrical Power Voltage	X					X
General Alarm	X				Fail	X

V. **Ducted and Ductless Heat Pump and Fan Coils (HP-1 through 10, and FCU-1 through 10):**

1. Refer the unit's specification, Section 23 81 26, Small Split System and Unitary HVAC Equipment.

2. Ductless and ducted split heat pump equipment supplier to provide a standalone manufacturer central controller to integrate all split systems fan coils into a single control platform. Central BAS controller to act as programmable time clock/calendar and control on/off function on schedule determined by the BAS time schedule. The unit's controls are to be hard contact and BACnet tied into the BAS.
3. Provide full graphic user interface for monitor and control setpoint adjustments in unit.
4. Occupied Mode Operation: Indoor fan coil units operate to maintain space temperature set point.
5. Unoccupied Mode Operation: Indoor fan coil units operate to maintain unoccupied space temperature set point.
6. Ducted and Ductless Heat Pump and Fan Coils (HP-1 through 10, and FCU-1 through 10) Points List: Map points via BACnet interface and/or hard contact (coordinate with unit manufacturer).

Points List	Analog In	Analog Out	Digital In	Digital Out	Alarms	Trend
Unit Start/Stop				X		
Zone Temp	X					X
Occupancy Override			X			X
Condensate Pump	X				High	

W. **Energy Recovery Units (ERV-1 through 3):**

1. Refer the unit's specification section. Unit to include factory controller and control sequence. The unit's controls are to be hard contact and BACnet tied into the BAS.
2. Provide full graphic user interface for monitor and control setpoint adjustments in unit.
3. Units controller to receive signal from building controller, which initiates occupied or unoccupied mode.
4. Occupied Mode:
   a. Isolation dampers open.
   b. Fans run continuously.
   c. Discharge Air Temperature sensor signals controller. Factory controller aux heating to maintain DAT no lower than 60F.
   d. Frost control: Supply air blower shuts down and outside air damper closes. Warm exhaust air defrosts the core for a predetermined duration.
5. Shutdown Mode:
   a. Supply fan and exhaust fan are not operating.
   b. Dampers in normal closed positions.
6. Unoccupied Mode:
   a. System remains off.
7. General Alarm Dry Contact: When the unit goes into alarm mode, a dry contact (NO) is closed. BAS to indicate alarm.
8. Energy Recovery Units (ERV-1 through 3) Points List: Map points via BACnet interface and/or hard contact (coordinate with unit manufacturer).

Points List	Analog In	Analog Out	Digital In	Digital Out	Alarms	Trend
Supply Fan Start/Stop				X		

Supply Fan VFD Error/Fail	X				Fail	
Exhaust Fan Start/Stop				X		
Exhaust Fan VFD Error/Fail	X				Fail	
OA Damper Position		X				X
Relief Air Damper Position		X				X
Discharge Air Temp	X					X
OA Temp	X					X
Return Air Temp	X					X
Aux Heat Coil Operation		X				X
General Alarm	X				Fail	
Defrost Operation	X					

X. **Packaged Heat Pump Rooftop Units (RTU-1 through 5) DX Cooling/Heating, Aux Electric Heating, Dehumidifying, and Heat Recovery up to 100 Percent Outside Air:**

1. Refer the unit's specification section. Unit to include factory controller and control sequence. The unit's controls are to be hard contact and BACnet tied into the BAS.
2. Provide full graphic user interface for monitor and control setpoint adjustments in unit.
3. Units controller to receive signal from building controller, which initiates occupied or unoccupied mode.
4. RTU-3 serving locker rooms to be set for continuous "occupied" operation 24/7 to control high humidity environment. RTU 3 supply and exhaust set to track to maintain space at 0.05" WC negative pressure relative to surrounding spaces. (All others set to 0.05" positive pressure)
5. Occupied Mode:
   a. Isolation dampers open.
   b. Fans run continuously.
   c. BAS Room temperature and humidity sensor signals controller. Factory controller modulates DX cooling, heating, economizer, and aux heating to maintain space setpoint temperature and humidity.
   d. CO2: Monitors space CO2.
   e. Heat Recovery Wheel operates during Occupied Mode unless in full economizing bypass mode. Upon detection of frost conditions, factory controller system internal defrost cycle until the ice/moisture dissipates.

6. Shutdown Mode:
   a. Supply fan and exhaust fan are not operating.
   b. Dampers in normal closed positions.
7. Unoccupied Mode:
   a. System remains off unless night setback temperatures are exceeded, upon which unit operates in recirc mode to maintain setback temperatures. (78F summer, 68 winter).
8. Morning warmup
   a. Winter operations shall set a 2 hr (adj) warmup period before reaching full occupied mode.
9. Unoccupied Mode:
   a. Night Purge Control: Night purge initiated whenever outdoor air temperature is 65 degrees F or below and any space temperature is 75 degrees F or above. Supply and exhaust fans operate during night purge. During night purge outdoor air dampers open, relief dampers open, bypass dampers open, heating cooling are disabled. When spaces are 70 degrees F or below for 30 minutes, switch to shutdown mode.
   b. Unoccupied Mode Override: Upon receiving an “override” signal from designated space temperature sensors, controller changes zone to occupied mode for a period of 2 hours (adjustable). When supply and return fans operate in unoccupied mode, they operate as described for occupied mode.
10. Alarms and Safeties:
    a. Smoke detectors located in return air ducts signal controller which initiates shutdown mode upon detection of smoke in airstream and generate alarm.
    b. Low limit detection thermostat signal warning at 35F and below.
    c. Each variable frequency drive signals controller to generate alarm in event of drive/control failure.
11. Packaged Heat Pump Rooftop Units (RTU-1 through 5) DX Cooling/Heating, Aux Electric Heating, Dehumidifying, and Heat Recovery up to 100 Percent Outside Air Points List: Map points via BACnet interface and/or hard contact (coordinate with unit manufacturer).

Points List	**Analog In**	**Analog Out**	**Digital In**	**Digital Out**	**Alarms**	**Trend**
Supply Fan Start/Stop				X		
Supply Fan VFD Error/Fail	X				Fail	
Exhaust Fan Start/Stop				X		
Exhaust Fan VFD Error/Fail	X				Fail	
Heat Wheel Start/Stop				X		
OA Damper Position		X				X

Relief Air Damper Position		X				X
Heat Wheel Bypass Dampers		X				X
Discharge Air Temp	X					X
OA Temp	X					X
Return Air Temp	X					X
Space Static Pressure	X					X
Filter Delta-P	X				X	
Duct Smoke Detector			X		X	
Freeze/Low Temp	X				X	
Heating / Cooling Operation		X				X
Aux Heat Coil Operation		X				X
Space Temp/RH	X					X
Space CO2	X				High 1300 ppm (adj)	X
Heat Wheel Operation	X					

Y. **Air Handling Temperature and Dehumidification Unit for Pool Environments (DHU-1), HW Heating, OA Cooling and Dehumidifying, up to 100 Percent Outside Air Purge:**

1. Refer the unit's specification for sequence, Section 23 84 00, Humidity Control Equipment. The unit’s controls are to be hard contact and BACnet tied into the BAS.
2. Provide full graphic user interface for monitor and control setpoint adjustments in unit.
3. The following set points shall be accessible and adjustable from the operator panel, and mapped to BAS for monitoring and adjustability.
   a. Space temperature
   b. Space relative humidity
4. The following sensors shall be unit-mounted and monitored at the operator panel, remote panel, and mapped to BAS for monitoring. All information from these items shall be actively used in the system control and operation strategies:
   a. Return air temperature

b. Supply air temperature
c. Return air relative humidity
d. Outdoor air temperature
e. Outdoor air humidity

5. System Fault: Shall indicate via text message to the display and mapped to BAS graphic interface what systems require attention or servicing. Built-in monitoring and diagnostics shall allow the user to view the following:
   a. Power failure
   b. Dirty air filter
   c. System off
6. Sequence of Operation copied here for quick reference only:
   a. System Startup:
      1) Power is turned on or the system is started
      2) After a short initial delay to allow the sensors to stabilize, the blowers start and operate continuously.
      3) Based on sensor feedback, the system shall begin, or resume operation based on the sequence below.
   b. Airside Configuration:
      1) The system continuously delivers the specified supply air volume to the natatorium to achieve minimum 6ACH.
      2) The minimum exhaust air volume is set to meet the engineer's schedule, and as set by balance to achieve and maintain ASHRAE recommended 0.05-0.15” WC negative pressure relative to surrounding spaces. NOTE: exhaust fan dedicated to exhaust behind the spa is also operating continuously and must be operating when determining fan speed settings to maintain negative space pressure.
      3) Unit Microprocessor will control modulation of dampers and exhaust fan(s) to exhaust a set % offset more than introduced outside air to maintain a negative space pressure. (As determined by balancer)
   c. Dehumidification Mode:
      1) The return air relative humidity is above the humidity setpoint: 50% RH (adj.)
      2) Return air dewpoint is above dewpoint setpoint: 59.7F (adj.) based on space temp set at 80F (adj.)
      3) The microprocessor sends an output signal to modulate the dampers and fan speeds to increase OA percentage based on return air temperature, relative humidity, and dewpoint.
      4) The microprocessor heating output signal (0-10 volts) is sent to the heating coil controller if needed based on return air temperature, relative humidity, and dewpoint.
   d. Space Cooling Mode:
      1) The return air temperature is above the room temperature setpoint 82F (adj.)
      2) The microprocessor sends an output signal to modulate the dampers and fan speeds to increase OA percentage based on return air temperature,
   e. Space Heating Mode:
      1) The return air temperature is below the room temperature setpoint 80F (adj.)
      2) The microprocessor space heating output signal (0-10 volts) is sent to the heating coil controller. The signal output will regulate based on the return air temperature.
   f. Exhaust Air Heat Recovery Mode:
      1) The minimum outdoor air damper and minimum exhaust fan(s) and will operate as continuously as programmed, minimum OA occupied and setback by 50% OA unoccupied.

2) Outdoor air temperature is compared with the return air temperature, if the differential is greater or equal to10°F(Adjustable), the glycol pump shall circulate a glycol mixture between the exhaust air and the outdoor air heat recovery coils to precool or preheat the incoming outside air.

g. Purge Mode:
   1) This mode is triggered automatically if cooling mode or dehumidification mode requires up to 100% OA; Or this mode is manually triggered by an operator when super-chlorinating the pool. It can be manually triggered at the unit-mounted,remote operator panel, through the online WebSentry interface, or by the BACnet interface controller on the BAS graphic user interface.
   2) Manual triggered Purge Mode has an adjustable timed duration (3hr adj.) after which the system automatically resumes normal operation.
   3) Once manually triggered by the operator:
   4) A signal from the microprocessor sets the exhaust fan(s) to their maximum CFM.
   5) The unit-mounted outdoor air dampers open fully and the return air dampers close
   6) The system stays in 100% outdoor air ventilation mode.
   7) After the timed period expires, all dampers and fans return to normal operating settings and the system resumes normal operation.
   8) During Purge Mode, the system will control heating based on supply air temperature

h. Economizer Cooling Mode:
   1) Same as cooling mode above since system uses outside air as primary cooling and dehumidifying.

i. Economizer Dehumidification Mode:
   1) Same as dehumidification mode above since system uses outside air as primary cooling and dehumidifying.

j. Freeze Protection:
   1) The supply air temperature falls below the freezestat setpoint.
   2) Exhaust fan(s) are stopped and outdoor air damper(s) are fully closed.
   3) When the freezestat alarm is tripped, it must be manually cleared by the operator.

Z. **Electric Wall Heaters (WH-1 through 5):**

1. Operate via integral thermostat to maintain space setpoint temperature.

AA. **High Volume Low Speed Ceiling Fans (HVLS-1,2):**

1. Large Ceiling Fans
   a. Dedicated manual on/off, speed, and direction control located in space near fans. Confirm location with Owner.

END OF SECTION 23 09 00

SECTION 23 09 13 - VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Variable Frequency Drive
2. Protection Circuits
3. Display and Control Interface
4. Adjustments

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Current edition of IEEE Standard 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.
2. Current edition of UL 508, Industrial Control Equipment.
3. Current edition of NEMA ICS 7, Industrial Control and Systems: Adjustable-Speed Drives; National Electrical Manufacturers Association, latest edition.
4. Current edition of IEC 16800 parts 1, 2 and 3.
5. Current edition of NEC 430.120, Adjustable-Speed Drive Systems.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Data: Indicate voltage, controller size, ratings and size of switching and overcurrent protection devices, short circuit ratings, dimensions, weights and enclosure detains.
2. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and name plate legends.
3. Test Reports: Subject VFD to preliminary functional test, and final test at 104 degrees F, at full rated load. Indicate field test and inspection procedures and test results.
4. Manufacturer's Instructions: Include installation instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.
5. Maintenance Data: Include routine preventive maintenance schedule.
6. Rated input: Maximum electric load rating in amperes and line reactor impedance.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet following:

1. Qualifications:
   a. Provide VFDs and options UL listed as a complete assembly. Base VFD UL listed for 100 KAIC without the need for input fuses.
   b. CE Mark: VFD to meet product standard EN 61800-3 for the First Environment restricted level. (RFI/EMI Filter specification.)
   c. Entire VFD enclosure, including the bypass, seismically certified and labeled in accordance with the International Building Code:
      1) VFD manufacturer to provide Seismic Certification and Installation requirements at time of submittal.
      2) Seismic importance factor of 1.5 rating is required, and based upon actual shake test data as defined by International Code Council AC-156.
      3) Seismic ratings based upon calculations alone are not acceptable. Certification of Seismic rating must be based on testing done in all three axis of motion by a certified lab.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ABB

B. Allen Bradley

C. Cerus

D. Danfoss

E. Eaton

F. Emerson

G. General Electric

H. Siemens

I. Schneider Electric/Square D

J. Toshiba

K. Yaskawa

2.2 VARIABLE FREQUENCY DRIVE

A. Description:

1. Variable Frequency Drive: Solid state, with Pulse Width Modulated (PWM) output waveform in a UL listed enclosure (enclosures with only NEMA ratings are not acceptable), completely assembled and tested by manufacturer. Employ full wave rectifier, AC or DC Line Reactor, capacitors, and Insulated Gate Bipolar Transistors (IGBTs) as output switching device.
2. Enclosure: UL rated and UL listed as a plenum rated VFD with NEMA 1 enclosure (indoors), NEMA 3R (outdoors), NEMA 12 (for indoor dusty locations), NEMA 8 (hazardous, Class I, Div I) and NEMA 9 (Class II, Div I). Manufacturer's standard enamel.
3. Drive manufacturer to supply the drive and necessary options specified. VFDs that are manufactured by a third party and "brand labeled" are not acceptable. Provide VFDs installed on this project from the same manufacturer.

B. Operating Requirements:

1. Rated Input Voltage: VAC as scheduled on Drawings, plus or minus 10 percent, 3 phase, 48 to 63 Hz.
2. Rated Output Voltage: 0 to input voltage, 3 phase, 0 to 120 Hz.
3. Fundamental Power Factor: Between 1.0 and 0.97, lagging, over entire range of operating speed and load.
4. Minimum Efficiency at Full Speed and Full Load: 97 percent or better.
5. Volts Per Hertz Adjustment: Plus or minus 10 percent.
6. Current Adjustment: 60 to 110 percent or rated.
7. Acceleration Rate Adjustment: 0.5 to 300 seconds.
8. Deceleration Rate Adjustment: 1 to 300 seconds.
9. Transient protection against normal transients and surges in incoming power line.
10. Environmental Conditions: 32 degrees F to 104 degrees F at 4kHz switching frequency, 0 to 3000-feet above sea level, less than 95 percent RH, noncondensing. Circuit boards to have conformal coating.
11. Seismic Testing: Tested to ICC AS-156. Submit certificate of compliance.

C. Standard Features:

1. VFDs to have the same customer interface, including digital display and keypad, regardless of horsepower rating. Provide removable keypad, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
2. Fault Mode on Loss of Input:
   a. Display fault.
   b. Run at programmable preset speed as selected by user.
3. Utilize English digital display (code numbers are not acceptable). Digital Display: Three configurable lines of LCD display, backlit, adjustable contrast. Set up parameters, indications, faults, warnings, status indicators and other information in words without use of manual or cross reference table.
4. Automatic restart after overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. Programmable number of restart attempts, trial time, and time between reset attempts.
5. Capable of starting into rotating load (forward or reverse) and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).
6. Automatic extended power loss ride-through circuit.
7. Customer terminal strip isolated from line and ground.

8. Keypad Hand-Off-Auto Switch: When in "Off" VFD will be stopped. When in "Auto" VFD will start via external contact closure and its speed will be controlled via external speed reference. When in “Hand” VFD will be controlled via keypad up and down arrows.
9. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.
10. Input Line Reactor or DC Line Choke: Five percent impedance AC or DC, to reduce harmonics to power line and to add protection from AC line transients.
11. Output filters for VFDs located more than 350 conductor feet from motor served.
12. Optimized for 4 kHz carrier frequency to reduce motor noise.
13. Disconnecting Means: Include door interlocked, UL 508C listed circuit breaker or fused disconnect switch.
14. Control circuit transformer with fused primary and secondary circuits.
15. Motor overload protection: Fused disconnects and thermal overloads for each motor when serving multiple motors from one drive.
16. Input current rating of the VFD to be no more than 3 percent greater than the output current rating. VFDs with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.120.
17. VFD to provide a programmable loss-of-load (broken belt/broken coupling) Form-C relay output. Provide programmable drive to signal the loss-of-load condition via a keypad warning, Form-C relay output, and/or over the serial communications bus.

2.3 PROTECTION CIRCUITS

A. Overload Rating: 110 percent of its variable torque current rating for 1 minute every 10 minutes at 104 degrees F, and 140 percent of its H torque current rating for 2 seconds every 15 seconds.

B. 350 percent instantaneous overcurrent trip.

C. 130 percent to 65 percent over and under voltage trip.

D. Over temperature trip at 115 degrees F.

E. Short circuit protection, either running or at start, for phase to phase and phase to ground faults, phase rotation insensitive.

F. Adaptable Electronic Motor Overload (I2t).

G. EMI/RFI Filters: VFDs to include EMI/RFI filters. Onboard filters to allow the entire VFD assembly to be CE Marked and the VFD to meet product standard EN 61800-3 for the First Environment restricted. No Exceptions.

H. Orderly Shutdown: In event of any of above conditions, shutdown drive safely without component failure.

2.4 DISPLAY AND CONTROL INTERFACE

A. Serial Communications:

1. VFD to have an EIA-485 port as standard. Standard protocols: Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet MS/TP. The use of third party gateways and multiplexers is not acceptable. Protocols “certified” by the governing authority (i.e. BTL Listing for BACnet).

B. Display operating information at VFD and provide separate interface signal for Building Automation System (BAS) via communications port to display and control following:

1. Frequency Output - Hz
2. Output voltage - Volts
3. Current - Amps
4. Speed - RPM
5. Runtime - Hours
6. System Fault
7. Input Speed Setpoint - RPM
8. On/Off Control Signal
9. Calculated Motor Power - percentage or kW
10. kWh meter

2.5 ADJUSTMENTS

A. Three programmable critical frequency lockout ranges.

B. Two programmable analog inputs. Analog inputs to include filters programmable from 0.01 to 10 seconds to remove any oscillation in input signal.

C. Six programmable digital inputs for maximum flexibility in interfacing with external devices.

D. Three remote contacts for fault including on/off status, fault, and future configuration.

E. Two programmable analog outputs proportional to frequency, motor speed, output voltage, output current, or scalable parameter selected by Owner.

F. Run permissive circuit: Provide a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad command, input contact closure, time-clock control, or serial communications), the VFD is to provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) to close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Provide a minimum of two separate safety interlock inputs. When any safety is opened, the motor commanded to coast to stop and the damper commanded to close.

G. The VFD control is to include a programmable time delay for VFD start and a keypad indication that this time delay is active. A Form C relay output provides a contact closure to signal the VAV boxes open. This will allow VAV boxes to be driven open before the motor operates.

H. The VFD is to include a fireman's override input. Mode to override other inputs (analog/digital, serial communication, and keypad commands), except customer defined safety run interlocks, and force the motor to run at a preset speed or in a separate PID mode.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with manufacturer's installation instructions. Maintain manufacturer's and NEC service clearances.

B. Install on strut support stand and brace for seismic.

C. Select and install overload heater elements in motor controllers to match installed motor characteristics.

D. Power wiring completed by the contractor, to NEC code 430.122 wiring requirements based on the VFD input current.

E. Factory certified service representative to supervise start-up in accordance with manufacturer's instructions.

F. Make final adjustments to assure proper operation of load system. Demonstrate final set-up and programming to Owner.

G. Test unit in modes of operation and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

H. Adjust ramp times to provide stable control during the balancing and commissioning process.

I. Program drive to limit speed when current rating is exceeded.

END OF SECTION 23 09 13

SECTION 23 21 13 - HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Hydronic Piping, Above Grade
2. Equipment Drains and Overflows
3. Unions
4. Refrigerant Piping

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Welding Certificates: Copies of certificates for welding procedures and personnel.
2. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
   a. Test procedures used.
   b. Test results that comply with requirements.
   c. Failed test results and corrective action taken to achieve requirements.
3. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at project site.
4. Grooved couplings, fittings, valves, and specialties: Show grooved joint couplings and fittings on Shop Drawings and product submittals, and specifically identify with the applicable coupling style number.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Installer Qualifications: Company specializing in performing work of the type specified in this Section, with documented experience.
2. Welder Qualifications: Certify in accordance with ASME (BPV IX).

3. ASME Compliance: Comply with ASME B31.9 "Building Services Piping" for materials, products, and installation. Provide safety valves and pressure vessels with the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 01.
4. Grooved couplings, fittings, valves, and specialties: Provide all grooved couplings, fittings, valves, and specialty products from a single manufacturer. Utilize only grooving tools from the same manufacturer as the grooved components. Date-stamp all castings used for couplings housings, fittings, or valve and specialty bodies for quality assurance and traceability.
5. Refrigerant Piping:
    a. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX "Welding and Brazing Qualifications."
    b. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
    c. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."
    d. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical" or UL 429 "Electrically Operated Valves."

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 HYDRONIC PIPING, ABOVE GRADE

A. Steel Pipe:

1. Sizes 10-inches and Under: ASTM A 53/A 53M, Schedule 40, black, Type E (electric resistance welded), Grade B.
    a. Fittings: ASME B16.3, malleable iron or ASTM A 234/A 234M, wrought steel welding type.
    b. Wrought Cast and Forged Steel Flanges and Flanged Fittings: ASME B16.5 including bolts, nuts, and gaskets of the following material group, end connections, and facings:
        1) Material Group: 1.1.
        2) End Connections: Butt welding.
        3) Facings: Raised face.
    c. Joints: Threaded or AWS D1.1 welded.

B. Copper Tube: ASTM B 88 (ASTM B 88M), Type L, hard drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
2. Joints: Solder, lead free ASTM B32, HB alloy (95-5 tin antimony), or tin and silver.
3. Joints: Brazed, AWS A5.8, Classification BAg-36, non-cadmium silver alloy. Pipes 2-1/2-inches or larger or piping routed over computer rooms, telecommunications rooms, or electrical rooms.

C. Polypropylene Random (PPR):

1. Manufacturers:
    a. Aquatherm Blue Pipe. SDR 11 standard dimension ratio.

b. Nupi Niron Pipe PP-RCT SDR11.
2. Heat fusion connections with corrosion resistant properties.
3. Valves: Polypropylene.
4. Accessories and insert wells, stainless steel.

D. Stainless Steel:

1. Type 316L Stainless Steel, ASTM A-312/ASME SA-312, Wrought joints/fittings ANSI B16.9 OR ANSI B16.28 welded. Valves stainless steel.

2.2 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), drawn.

1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
2. Joints: Solder, lead free, ASTM B 32, HB alloy (95-5 tin-antimony), or tin and silver.
3. Joints: Brazed, AWS A5.8, Classification BAg-36, non-cadmium silver alloy. Pipes 2-1/2-inch or larger or piping routed over computer rooms, telecommunications rooms, and electrical rooms.

2.3 UNIONS

A. Unions for Pipe 2-inches and Under:

1. Ferrous Piping: 150, 250, and 300 PSIG malleable iron, threaded, ASME B16.39.
2. Copper Pipe: Bronze, soldered joints, ASME B16.22.

B. Dielectric Connections: Provide dielectric waterway or brass nipple fitting with threaded ends. Dielectric unions are not allowed.

2.4 REFRIGERANT PIPING

A. Piping:

1. Copper Tube: ASTM B 280, Type ACR, annealed-temper tube, clean, dry and capped.
   a. Fittings: ASME B16.22 wrought copper.
   b. Joints: Braze, AWS A5.8 Classification BCuP-5, 15 percent silver alloy.

B. Valves:

1. Manufacturers:
   a. Hansen Technologies Corporation
   b. Henry Technologies
   c. Danfoss Flomatic
   d. Substitutions: See Section 23 00 00, HVAC Basic Requirements, Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
2. Packaged Ball Valves:
   a. Two piece bolted forged brass body with Teflon ball seals and copper tube extensions, brass seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of and maximum temperature of 300 degrees F.

C. Flexible Connectors:

1. Manufacturers:
   a. Metraflex, VRF Flex, model VAV-RF8
   b. Or approved equivalent.
2. Provide stainless steel refrigerant flexible connector with copper ends, operating at 700 psi, cleaned and bagged per PRAXAIR 99.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's written instructions and requirements.

B. Install hydronic piping in accordance with the following:

	Above Grade			Below Grade Preinsulated Pipe					Below Grade Uninsulated Piping			
Service	W/S	GC	Cu	Stl	Cu	PEX	PVC	HDPE	Stl	Cu	PVC	HDPE
Heating Hot Water	X		X	X			N/A		N/A	N/A	N/A	N/A

1. Key:
   a. W/S = Welded/Screwed Steel
   b. GC = Grooved Coupling Steel
   c. Cu = Copper
   d. Stl = Steel

C. Preparation:

1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
2. Remove scale and dirt on inside and outside before assembly.
3. Prepare piping connections to equipment with flanges or unions.
4. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

D. Above Grade Piping Installation:

1. Install per manufacturer's written instructions and requirements.
2. Install heating water and glycol piping to ASME B31.9 requirements.
3. Route piping in orderly manner, parallel to building structure, and maintain gradient.
4. Install piping to conserve building space and to avoid interference with use of space.
5. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
6. Sleeve pipe passing through partitions, walls and floors allowing adequate space for pipe insulation.
7. Slope piping at 0.2 percent upward in direction of flow and arrange to drain at low points.
8. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
9. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

10. Drawings are diagrammatic and do not necessarily show top connections in all cases. Install branch connections to mains using tee fittings in main, with takeoff coming out of the top unless trade coordination conditions preclude it.
11. Anchor piping for proper direction of expansion and contraction.
12. Inserts:
    a. Provide inserts for placement in concrete formwork.
    b. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
    c. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4-inches.
    d. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
    e. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.
13. Pipe Hangers and Supports:
    a. Install in accordance with Section 23 05 29, Hangers and Supports for HVAC Piping, Ductwork and Equipment.
    b. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
    c. Place hangers within 12-inches of each horizontal elbow.
    d. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
    e. Support vertical piping at top, bottom, and not less than every other floor. Support riser piping independently of connected horizontal piping.
    f. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
    g. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
    h. Provide copper plated hangers and supports for copper piping.
    i. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
14. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
15. Provide access where valves and fittings are not exposed.
16. Use eccentric reducers to maintain top of pipe level.
17. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
18. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

E. Field Quality Control:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush system with clean water. Clean strainers.
4. Isolate equipment from piping. If a valve is used to isolate equipment, provide closure capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
6. Perform the following tests on hydronic piping:
    a. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.

b. While filling system, use vents installed at high points of system to release trapped air. Use drains installed at low points for complete draining of liquid.
c. Check expansion tanks to determine that they are not air bound and that system is full of water.
d. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the design pressure. Test pressure not-to-exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A of ASME B31.9, "Building Services Piping."
e. After hydrostatic test pressure has been applied for at least four hours, examine piping, joints and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
f. Prepare written report of testing.

F. Flushing and Cleaning of Piping Systems:

1. Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the piping systems in service. Provide temporary connections for cleaning, purging, and circulating fluids through the piping system.
2. Use temporary strainers and temporary pumps that can create a minimum fluid velocity of 6-feet per second and maximum of 10-feet per second to flush and clean the piping systems. Do not use Owner's permanent strainers to trap debris during pipe flushing operations. Fit the temporary construction strainers with a line size blowoff valve.
3. Install bypass piping or hoses at the supply and return piping connections at heat exchangers, chillers, cooling towers, pumps, and cooling coils, etc., to prevent debris from being caught or causing damage to equipment which will be connected to the piping system.
4. Circulate a chemical cleaner in heating water piping systems to remove mill scale, grease, oil, and silt. Cleaner to be selected by chemical treatment vendor on project. Circulate for 48 hours, flush system and replace with clean water. Dispose of chemical solution in accordance with local codes. The heating water system should then be treated with chemicals and inhibitors to be selected by chemical treatment vendor on project. When the chemical cleaning is complete, remove, clean, and reinstall all permanent screens. Notify Owner so that the reinstallation of clean strainer screens may be witnessed.

G. Pipe Painting Requirements:

1. Paint all ferrous metal pipe including flanges. Do not paint flange bolts, washers and nuts. At flexible coupling the only the flanges are to be painted. All rubber portions are to remain unpainted.
2. Paint exterior uninsulated steel piping with exterior latex, semi-gloss (AE), Master Painters Institute MPI 11, suitable for metallic surfaces B, Haze Gray color.
3. Use ready-mixed (including colors) paint. Prime paint with pigment and vehicle, compatible with substrate and finish coats specified. Volatile Organic Compounds (VOC) content of paint materials shall not exceed 50g/l for exterior latex paints and primers. Lead-based paint is not permitted.
4. Do not apply coating when air or substrate conditions are:
   a. Less than 5 degrees F above dew point.
   b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the product manufacturer.
5. Do no exterior painting when it is windy and dusty. Do not paint in direct sunlight or on surfaces that the sun will soon warm.

6. Apply only on clean, dry and frost-free surface. Remove all materials the will affect the ability of the paint to adhere to the pipe including painted pipe identification labels.
7. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign. Remove loose mill scale, rust, and paint, by hand or power tool cleaning. All surfaces are to be dry at the time paint is applied.
8. Apply paint in two coats; prime, and finish. Apply each coat evenly and cover substrate completely. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions.
9. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects. Apply by brush, roller or spray.

3.2 REFRIGERANT PIPING INSTALLATION

A. Install systems in accordance with ASHRAE Standard 15.

B. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

C. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

D. Flood piping system with nitrogen when brazing.

E. Follow ASHRAE Standard 15 procedures for charging and purging of systems and for disposal of refrigerant.

F. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

G. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

H. Fully charge completed system with refrigerant after testing.

I. Install flexible connectors at connection to equipment with compressors or at fan coil units installed with a vibration isolator.

J. Field Quality Control:

1. Test refrigeration system in accordance with ASME B31.5.
2. Pressure test system with dry nitrogen to 200 PSI. Perform final tests at 27-inches vacuum and 200 PSI using electronic leak detector. Test to no leakage.

END OF SECTION 23 21 13

SECTION 23 21 16 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Bladder Type Expansion Tanks
2. Buffer Tanks
3. Air Vents
4. Coalescing Type Air and Dirt Separator
5. Pressure Reducing Valves
6. Liquid Flow Switches
7. Differential Pressure Regulator
8. Differential Pressure Switches
9. Instrument Probe Fittings
10. Strainers
11. Relief Valves

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. ASME (BPV VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 01 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.
2. Certificates: Inspection certificates for pressure vessels from Authority Having Jurisdiction (AHJ).
3. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
4. Project Record Documents: Record actual locations of flow controls.
    a. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section, with minimum three years of documented experience.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bladder Type Expansion Tanks:

1. Amtrol Inc.
2. ITT Bell & Gossett
3. Taco, Inc.
4. Armstrong
5. Wessels
6. John Wood JAER Series

B. Buffer Tanks:

1. Taco
2. Armstrong
3. Wessels
4. Or approved equivalent.

C. Air Vents:

1. Armstrong International, Inc.
2. ITT Bell & Gossett
3. Taco, Inc.
4. Hoffman
5. Amtrol

6. Metraflex

D. Coalescing Type Air and Dirt Separator:

1. Spirovent VDNT
2. Caleffi
3. Aurora

E. Pressure Reducing Valves:

1. Armstrong
2. ITT Bell & Gossett
3. Taco, Inc.
4. Amtrol
5. Kunkle

F. Liquid Flow Switches:

1. McDonnell & Miller
2. Dwyer
3. Or approved equivalent.

G. Differential Pressure Regulator:

1. Clayton
2. Jordan
3. Hoffman

H. Differential Pressure Switches:

1. Dwyer Instruments
2. Or approved equivalent.

I. Instrument Probe Fittings:

1. Pete's Plug
2. Or approved equivalent.

J. Strainers:

1. Armstrong International
2. Mueller
3. Keckley
4. Hoffman

K. Relief Valves:

1. Armstrong
2. ITT Bell & Gossett
3. Taco, Inc.
4. Amtrol

2.2 BLADDER TYPE EXPANSION TANKS

A. High pre-charged steel expansion tank with replaceable heavy duty butyl rubber bladder. The tank is to have a system and drain NPT connection. The tank is to also have a standard Schrader valve to facilitate on-site charging of the tank to meet system requirements. The tank is to be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code and stamped 125 PSI working pressure. Provide steel support stand.

2.3 BUFFER TANKS

A. Construction: Carbon steel, ASME Code Section VIII, Division 1, registered with the National Board of Pressure Vessel Manufacturers.

B. Design Pressure: 150 PSIG.

C. Capacity: As scheduled.

D. Connections: Flanged or grooved inlet and outlets to match piping system. Provide threaded Weldolet drain and air vent taps. Locate connections as shown on Drawings. Vertical or horizontal orientation as shown on Drawings.

E. Baffle: Provide solid internal steel baffle designed to maximize flow path length and minimize short circuiting of inlet water to the outlet.

F. Mounting: Provide saddle (for horizontal tanks) or base ring (for vertical tanks) engineered for anchorage to floor to resist seismic and gravity forces. Importance Factor = 1.5.

G. Exterior Coating: Manufacturer’s standard primer paint.

H. Insulation: Provide factory installed thermal insulation suitable for exterior use.

1. Insulation type and thickness: See Section 23 07 00, HVAC Insulation.
2. Provide insulation around supports sufficient to prevent condensation.
3. Jacket: Aluminum with seams sealed to prevent moisture entry.
4. Provide access hole with removable plug for access to tank nameplate or provide metal standoff equal to insulation thickness.

2.4 AIR VENTS

A. Manual Type: Short vertical sections of pipe to form air chamber, with 1/8-inch brass needle valve at top of chamber.

B. Automatic Float Type: Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, drain connection, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.5 COALESCING TYPE AIR AND DIRT SEPARATOR

A. Description: Fabricated steel tank stamped in accordance with Section VIII of ASME Boiler and Pressure Vessel Code for Unfired Vessels, stamped for 150 PSI, with tangential inlet and outlet connections, integral copper tube bundle to fill internal area and venting chamber with float actuated automatic air vent. Separator shell include valved side tap to flush floating dirt for bleed. Internal medium to force dirt and sediment to fall from flow path to collection chamber for blow down. Provide steel support stand.

2.6 PRESSURE REDUCING VALVES

A. Brass body, adjustable range, inlet check valves, removable inlet strainer, noncorrosive valve seat and stem, 3/4-inch size unless otherwise shown, factory set at fill pressure as indicated on drawings.

2.7 LIQUID FLOW SWITCHES

A. Description: Brass for wetted parts with packless construction, paddle with removable segments for pipe size and flow velocity, vapor proof electrical compartment for switches mounted on cold hydronic piping systems, switches for 115V, 60 Hz, 1-phase with 7.4A rating.

2.8 DIFFERENTIAL PRESSURE REGULATOR

A. Description: Externally piloted differential pressure regulating valve. Ductile iron construction, stainless steel and bronze trim and 316 SS seats.

2.9 DIFFERENTIAL PRESSURE SWITCHES

A. Sensing Range: 0- to 1.0-inch water column. Diaphragm operated with switching accomplished by photocell controlled relays, adjustable switch setpoints that close contacts on the relay if the differential pressure sensed raised above the setpoint, incorporate a pointer type gauge with divisions of 0.02-inch WC.

2.10 INSTRUMENT PROBE FITTINGS

A. Brass or stainless steel body and cap, high pressure rated, valve material neoprene, Nordal or Viton to suit temperature range, 1/4-inch or 1/2-inch NPT tailpiece.

2.11 STRAINERS

A. Size 2-inches and Under: Screwed brass or iron body for 175 PSI working pressure, Y pattern with 1/16-inch stainless steel perforated screen.

B. Size 2-1/2-inches and Larger: Flanged or grooved and above: iron body for 175 PSI working pressure, Y pattern with 1/16 stainless steel perforated screen.

C. Basket Pattern: Flanged iron body for 175 PSI working pressure, basket pattern with 1/8-inch stainless steel perforated screen, clamped or bolted cover.

2.12 RELIEF VALVES

A. Size and capacity as selected by installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code.

B. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210 degrees F, and pressure relief at 125 PSI.

C. Pressure Relief Valves: Bronze body, test lever, ASME rated. Provide pressure relief as indicated on Drawings.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install specialties in accordance with manufacturer's instructions.

B. Support pump fittings with floor mounted pipe and flange supports. Provide vibration isolation, same as pump, to avoid short circuiting.

3.2 BLADDER TYPE EXPANSION TANKS INSTALLATION

A. Install tank in accordance with manufacturer's instructions. Charge tank with air per manufacturer's instructions. Prior to making connection from the tank to the system, check the air charge. Valve is to be opened to the system when it is determined that the air pressure is equal to the minimum system pressure at the tank location.

3.3 BUFFER TANKS INSTALLATION

A. Mount tank level. Secure to slab per Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

B. Support piping so that tank does not carry weight of piping.

C. Insulate piping at connection to tank.

D. Provide full size ball valve drain and cap with hose connection.

E. Provide automatic air vent with discharge piped to nearest sanitary drain. Slope air vent discharge piping continuously downward to drain.

3.4 AIR VENTS INSTALLATION

A. Where large air quantities can accumulate, provide enlarged air collection standpipes.

B. Automatic: Furnish and install automatic air vents in mechanical equipment rooms and outdoors only. Install at high points of system piping, at heat transfer coils, and elsewhere as required for system air venting. Vents: 3/4-inch with 1/2-inch IPS drain piping to the nearest floor drain or other approved location. Provide a ball valve and union ahead of all automatic air vents. Do not install above ceilings or locations where discharge may occur and cause damage.

C. Manual Vents: Provide at high points of system piping, at heat transfer coils, and elsewhere as required for system venting where automatic air vents are not to be installed. Provide 10-inch length of 1/4-inch copper tube with 180 degree bend down to discharge into hand-held bucket.

3.5 COALESCING TYPE AIR AND DIRT SEPARATOR INSTALLATION

A. Install in pump suction lines and as indicated. Run piping to expansion tank with 1/4-inch per foot (2 percent) upward slope towards tank. Install drain valve on units 2 inches and over.

3.6 PRESSURE REDUCING VALVES INSTALLATION

A. Install as indicated, and in accordance with manufacturer's instructions with three valve bypass.

3.7 LIQUID FLOW SWITCHES INSTALLATION

A. Install on inlet to heat pump chiller and on other equipment as indicated. Install in horizontal pipe with switch mounted in tee on top of pipe with minimum of 24 inches of straight pipe with no fitting both upstream and downstream of switch. Remove segments of paddle to fit in accordance with manufacturer's instructions.

3.8 DIFFERENTIAL PRESSURE REGULATOR INSTALLATION

A. Install per manufacturer's recommendations.

3.9 DIFFERENTIAL PRESSURE SWITCHES INSTALLATION

A. Install per manufacturer's recommendations.

3.10 INSTRUMENT PROBE FITTINGS INSTALLATION

A. Test Plugs: Install where indicated and in accordance with the manufacturer's recommendations.

3.11 STRAINERS INSTALLATION

A. Provide valved drain and hose connection on strainer blow down connection.

3.12 RELIEF VALVES INSTALLATION

A. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

B. Pipe relief valve outlet to nearest floor drain.

C. Where one line vents several relief valves, make cross-sectional area equal to sum of individual vent areas.

D. Water Relief Valves: Install as indicated, and on expansion tanks, hot water tanks and pressure vessels. Pipe discharge to floor drain. Comply with ASME Boiler and Pressure Vessel Code.

END OF SECTION 23 21 16

SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. General Pump Requirements
2. In-Line Circulators
3. Vertical In-Line Pumps

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association, current edition.
2. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; National Electrical Manufacturers Association, current edition.
3. NFPA 70 - National Electrical Code; National Fire Protection Association, current edition.
4. UL 778 - Standard for Motor-Operated Water Pumps; Underwriters Laboratories Inc., current edition.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
2. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.
3. Millwright's Certificate: Certify that base mounted pumps have been aligned.
4. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirement.

B. In addition, meet the following:

1. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.
2. Alignment: Base mounted pumps will be aligned by qualified millwright.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Mechanical Seals: One mechanical seal for each pump.

1.10 PERFORMANCE REQUIREMENTS

A. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Armstrong Pumps, Inc.

B. ITT Bell & Gossett

C. Taco

D. Paco

E. Grundfos

F. Wilo

G. Weil

H. Xylem

I. Or approved equivalent.

2.2 GENERAL PUMP REQUIREMENTS

A. Pump Units: Factory assembled and tested.

B. Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. Select each motor to be nonoverloading over full range of pump performance curve.

C. Motors Indicated to Be Energy Efficient: Minimum efficiency as indicated according to IEEE 112, Test Method B. Provide premium efficiency motors according to IEEE 112, Test Method.

2.3 IN-LINE CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 PSI maximum working pressure.

B. Casing: Cast iron, with threaded companion flanges for piping connections, and threaded gauge tappings at inlet and outlet connections.

C. Impeller: Cast bronze keyed to shaft, statically and dynamically balanced, closed, overhung, single suction, and keyed to shaft.

D. Motor Bearings: Oil-lubricated bronze sleeve.

E. Pump Bearings: Oil-lubricated, bronze journal and thrust type.

F. Shaft: Alloy steel with copper sleeve, integral thrust collar.

G. Seal: Mechanical seal maximum continuous operating temperature. Include carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.

H. Drive: Flexible coupling, capable of absorbing torsional vibration and shaft misalignment.

I. Motor: Resiliently mounted to pump casing.

J. Performance Electrical Characteristics:

1. As Scheduled. 1750 RPM motors unless specified otherwise; reference Section 23 05 13, Common Motor Requirements for HVAC Equipment.
2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

K. Variable Flow Controller: Provide integral pump speed controller. Pump control based on:

1. Pressure.

2.4 VERTICAL IN-LINE PUMPS

A. Type: Vertical in-line, centrifugal, single stage, flexible coupled, radially split casing, for in-line mounting, for 125 psi working pressure.

B. Casing: Cast iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug at low point of volute, flanged suction and discharge.

C. Impeller: ASTM B584 cast bronze, fully enclosed, keyed directly to motor shaft or extension, statically and dynamically balanced, closed, overhung, single suction.

D. Shaft: Stainless steel with stainless steel impeller cap screw or nut and stainless steel sleeve.

E. Wear Rings: Replaceable, bronze casing ring.

F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.

G. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 250 degrees F maximum continuous operating temperature.

H. Motor: Directly mounted to pump casing and with lifting and supporting lugs in top of motor enclosure.

I. Performance Electrical Characteristics:

1. As Scheduled. 1750 RPM motors unless specified otherwise; reference Section 23 05 13, Common Motor Requirements for HVAC Equipment.
2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

J. Variable Flow Controller: Provide integral pump speed controller. Pump control based on:

1. Pressure.

PART 3 - EXECUTION

3.1 GENERAL PUMP INSTALLATION

A. Install in accordance with manufacturer's instructions according to ANSI/HI 1.1-1.5 "Centrifugal Pumps for Nomenclature, Definitions, Application and Operation."

B. Provide access space around pumps for service including removing motors, impellers, couplings, and accessories. Provide no less than minimum space recommended by manufacturer.

C. Decrease from line size with long radius reducing elbows or reducers. Eccentric reducers where necessary to prevent air entrapment. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4-inches and over. Provide vibration isolation to ensure there is no short circuiting of pump vibration isolator. Refer to Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment.

D. Unless indicated otherwise on Drawings, provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve and shut off valve on pump discharge. Triple duty valves not allowed.

E. Provide totally enclosed fan cooled motors when motor is located outdoors, whether under a cover or not, or exposed to moisture. Provide protective covering for electronically commutated motors located in outdoor or wet/wash-down locations.

F. Lubricate pumps before start-up.

G. Piping installation requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

H. Install piping adjacent to pumps to allow service and maintenance.

I. Connect piping to pumps. Install valves that are the same size as piping connected to pumps.

J. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

K. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

L. Install pressure gauges on pump suction and discharge. Install at integral pressure-gauge tappings where provided.

M. Install temperature and pressure-gauge connector plugs in suction and discharge piping around each pump.

N. Install electrical connections for power, controls, and devices.

O. Electrical power and control wiring and connections are specified in Division 26, Electrical Sections.

P. Ground equipment.

Q. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

R. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.
2. Review data in maintenance manuals. Reference Division 01, General Requirements.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

S. Examine equipment foundations and anchor -bolt locations for compliance with requirements for installation.

1. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

2. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

T. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 IN-LINE CIRCULATORS INSTALLATION

A. Install per manufacturer's written instructions and requirements.

3.3 VERTICAL IN-LINE PUMPS INSTALLATION

A. Install per manufacturer's written instructions and requirements.

END OF SECTION 23 21 23

SECTION 23 25 00 - HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Chemical Feed Description
2. Chemical Feeding Equipment
3. Chemical Treatment Test Equipment
4. Chemicals
5. Glycol-Water System
6. Supplemental Services/Components

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Data: Include rated capacities; water-pressure drops; shipping, installed, and operating weights; and furnished products listed below:
   a. Pumps
   b. Chemical Solution Tanks
   c. Agitators
   d. Control Equipment and Devices
   e. Test Equipment
   f. Chemicals
   g. Filters
   h. Chemical Feeders
   i. Shop Drawings: Detail equipment assemblies indicating dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   j. Wiring Diagrams: Detail power and control wiring and differentiate between manufacturer-installed and field-installed wiring.
   k. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.
   l. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
   m. Maintenance Data: For pumps, agitators, filters, system controls, and accessories to include in maintenance manuals specified in Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Qualifications: Firms regularly engaged in manufacture of components of types and sizes required.
2. Installer Qualifications: An experienced installer who is an authorized representative of the chemical treatment manufacturer for both installation and maintenance of chemical treatment equipment required for this Project.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

A. Maintain water quality for HVAC systems that controls corrosion and build-up of scale and biological growth for maximum efficiency of installed equipment without posing a hazard to operating personnel or the environment.

B. Base chemical treatment performance requirements on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction. Consult equipment manufacturer prior to acceptance of values noted below.

1. Closed System: Maintain system essentially free of scale, corrosion, and fouling to sustain the following water characteristics:
   a. pH: Maintain a value within 9.0 to 10.5.
   b. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
   c. Boron: Maintain a value within 100 to 200 ppm.
   d. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
   e. Soluble Copper: Maintain a maximum value of 0.20 ppm.
   f. TDS: Maintain a maximum value of 10 ppm.
   g. Ammonia: Maintain a maximum value of 20 ppm.
   h. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
   i. Microbiological Limits:
      1) Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
      2) Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
      3) Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
      4) Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
      5) Iron Bacteria: Maintain a maximum value of 0 organisms/ml.
2. Passivation for Galvanized Steel (for the first 60 days of operation):
   a. pH: Maintain a value within 7 to 8.
   b. Calcium Carbonate Hardness: Maintain a value within 100 to 300 ppm.
   c. Calcium Carbonate Alkalinity: Maintain a value within 100 to 300 ppm.

1.8 MAINTENANCE

A. Scope of Service: Provide chemicals and service program for maintaining optimum conditions in the circulating water for inhibiting corrosion, scale, and organic growths in the heating hot-water piping and equipment. Services and chemicals provided for a period of one year from date of Substantial Completion, including the following:

1. Initial water analysis and recommendations.
2. Startup assistance.
3. Periodic field service and consultation.
4. Customer report charts and log sheets.
5. Laboratory technical assistance.
6. Analyses and reports of chemical items concerning safety and compliance with government regulations.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Chemicals: Furnish quantity equal to 50 percent of amount initially installed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Aqua-Chem, Inc.; Cleaver-Brooks Div.

B. Betz Dearborn, Inc.

C. Calgon Corp., ECC International

D. ITOH2 Industrial Treatment of Water

E. Nalco Chemical Co.

F. US Water Services

G. Chemcoa

H. Cleaver-Brooks

I. Sarco

J. Or approved equivalent.

2.2 CHEMICAL FEED DESCRIPTION

A. Closed-Loop System: One bypass feeder on each system with isolating and drain valves downstream from circulating pumps, unless otherwise indicated.

1. Introduce chemical treatment through bypass feeder when required or indicated by test.

B. Closed-Loop, Heating Steam and Condensate Piping: Lead-lag switch controls the sequence of boilers and introduces the chemical to the boiler through a bypass feeder.

1. Chemical feed pump introduces sequestering agent and base from solution tank into boiler or feedwater line close to boiler, with minimum of one pump per boiler. Use agitator as required.
2. Activate chemical solution pump when feedwater pumps are running.
3. Activate chemical solution pump from meter on makeup water line only when one boiler is used.
4. Continuously run pump for feeding chemical when multiple boilers are used.
5. Liquid-level switch, in each solution tank, deactivates chemical solution pump and signals alarm.
6. Conductivity controller samples boiler water on timed cycle and operates solenoid blowdown valve.

2.3 CHEMICAL FEEDING EQUIPMENT

A. Bypass Feeders: Cast iron or steel, for introducing chemicals into system; with funnel shutoff valve on top, air-release valve on top, drain valve on bottom, and recirculating shutoff valves on sides.

1. Capacity: 1.8 gallon for systems with less than 1,000 gallon volume and 5 gallon for systems with more than 1,000 gallon volume.
2. Working Pressure: 125 PSIG or 175 PSIG.

2.4 CHEMICAL TREATMENT TEST EQUIPMENT

A. Test Kit: Manufacturer recommended equipment and chemicals, in a carrying case, for testing pH, total dissolved solids, dissolved oxygen, biocount, chloride, and total alkalinity and for calcium hardness field tests.

B. Corrosion Test Coupon Assembly: Constructed of corrosion material, complete with piping, valves, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test coupon assembly.

1. Three station rack for closed-loop system.
2. Four station rack for open condenser water systems.

2.5 CHEMICALS

A. Furnish chemicals recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment.

B. System Cleaner: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

C. Biocide: Chlorine release agents or microbiocides.

D. Closed-Loop, Water Piping Chemicals: Sequestering agent to reduce deposits and adjust pH, corrosion inhibitors, and conductivity enhancers.

2.6 GLYCOL-WATER SYSTEM

A. Propylene glycol to be inhibited with 1.75 percent dipotassium phosphate. Do not use automotive anti-freeze because the inhibitors used are not needed and can cause sludge precipitate that interferes with heat transfer.

B. Provide required amount of glycol to obtain the percent by volume for glycol-water systems as follows and to provide one-half tank reserve supply: 25 percent for hydronic system.

C. Glycol-Water Make-up System:

1. Glycol-Water Storage Tank: Self supporting polyethylene, minimum 90 mil thickness, with removable cover or black steel with 90 mil polyethylene insert. Capacity to be 55 gallons, with approximate diameter of 23-inches and height of 36-inches. Reinforced threaded pipe connections to be provided for connections. Provide identification for tank showing name of the contents.
2. Glycol-Water Make-up Pump: Bronze fitted, self priming, high head type suitable for pumping a 33 percent to 50 percent glycol-water solution in intermittent service. The pump to be provided with a mechanical shaft seal and be flange connected to a 1750 rpm NEMA Type C motor. The pump capacity to be 3 gpm or 50 PSIG discharge pressure with a suction lift capability of 5-inches of mercury, with a 1/3 horsepower drip proof motor. The pump may be a "gear-within-a-gear" positive displacement type with built-in relief valve set for 43 PSIG, or the pump may be a regenerative turbine type providing self-priming with built-in relief valve set for 43 PSIG, or the pump may be a regenerative turbine type providing self-priming with built-in external relief valve set for design head of the pump.
3. Back Pressure Regulating Valve: Spring loaded, diaphragm actuated type with bronze or steel body, stainless steel trim with capacity to relieve 100 percent of pump flow with an allowable rise in the regulated pressure of 10 PSIG above the set point. Set point to be 15 PSIG above system PRV setting.
4. Low Water Level Control: Steel or plastic float housing, stainless steel or plastic float, positive snap acting SPST switch mechanism, rated 10 amps-120 volt AC, in General Purpose (NEMA 1) enclosure. the control to be rated for pressures to 150 PSIG and make alarm circuit on low water level. The alarm circuit to be wired to an alarm light on the nearest local Temperature Control panel (LTCP). Provide remote output relay to indicate alarm condition at the Building Control System.

2.7 SUPPLEMENTAL SERVICES/COMPONENTS

A. Drain and makeup water piping to comply with the requirements of Division 22, Plumbing. Drains which connect to sanitary sewer systems to be connected by means of an indirect waste.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Water Analysis:

1. Perform an analysis of supply water to determine the type and quantities of chemical treatment needed to maintain the water quality as specified in "Performance Requirements" Article.

B. Installation:

1. Install treatment equipment level and plumb. Provide power to all system devices.
2. Add cleaning chemicals as recommended by manufacturer.
3. To prevent dirt and solids from lodging the coils, before adding cleaning chemical to the closed system, air handling coils and fan coil units to be isolated by closing the inlet and outlet valves and opening the bypass valves Do not valve in or operate system pumps until after system has been cleaned.
4. After chemical cleaning is satisfactorily completed, open the inlet and outlet valves to each coil and close the by-pass valves. Also, clean strainers.

C. Connections:

1. Piping installation requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
2. Provide a by-pass line around water meters and bleed off piping assembly. Provide ball valves to allow for bypassing, isolation, and servicing of components.
3. Bleed off water piping with bleed off piping assembly to be piped from pressure side of circulating water piping to a convenient drain. Bleed off connection to main circulating water piping to be upstream of chemical injection nozzles.
4. Provide piping for the flow assembly piping to the main control panel and accessories.
    a. The inlet piping to connect to the discharge side of the circulating water pump.
    b. Piping to connect to the water piping service the cooling tower downstream of the heat source.
    c. Provide inlet Y-strainer and ball valves to isolate and service main control panel and accessories.
    d. Install injection nozzles with corporation stops in the water piping service the cooling tower downstream of the heat source.
    e. Provide piping for corrosion monitor rack per manufacturers installation instructions. Provide ball valves to isolate and service rack.
    f. Provide piping for erosion chemical feeder per manufacturer's installation instructions. Provide ball valves to isolate and service feeder.
5. Install piping adjacent to equipment to allow service and maintenance.
6. Confirm applicable electrical requirements in Division 26, Electrical Sections for connecting electrical equipment.
7. Ground equipment.
    a. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D. Field Quality Control:

1. Inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
    a. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
    b. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC systems' startup procedures.
2. Test chemical feed piping as follows:
    a. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
    b. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

c. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
d. Cap and subject piping to static water pressure of 50 PSIG (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
e. Repair leaks and defects with new materials and retest piping until satisfactory results are obtained.
f. Prepare test reports, including required corrective action.

E. Adjusting:

1. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare certified test report for each required water performance characteristic. Where applicable, comply with ASTM D 3370 and the following standards:
   a. Silica: ASTM D 859.
   b. Steam System: ASTM D 1066.
   c. Acidity and Alkalinity: ASTM D 1067.
   d. Iron: ASTM D 1068.
   e. Water Hardness: ASTM D 1126.
2. Occupancy Adjustments: Within 12 months of Substantial Completion, perform two separate water analyses to prove that automatic chemical feed systems are maintaining water quality within performance requirements specified in this Section. Perform analyses at least 60 days apart. Submit written reports of water analysis.

F. Gauge Adjusting and Cleaning:

1. Adjust faces of meters and gauges to proper angle for best visibility.
2. Clean windows of meters and gauges and factory finished surfaces. Replace cracked or broken windows, repair scratched or marred surfaces with manufacturer's touch-up paint.

G. Demonstration:

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.
   a. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Review manufacturer's safety data sheets for handling of chemicals.
3. Review data in maintenance manuals, especially data on recommended parts inventory and supply sources and on availability of parts and service.
4. Schedule at least four hours of training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 23 25 00

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Ductwork, Joints, and Fittings
2. Laundry Clothes Dryer Vent
3. Insulated Flexible Duct
4. Textile Air Dispersion System
5. Fiberglass Reinforced Ductwork
6. Ductwork Joint Sealers and Sealants

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 23 05 29, Hangers and Supports for HVAC Piping, Ductwork and Equipment.
2. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Welding Certificates.
2. Field Quality Control Reports.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. NFPA Compliance:
   a. NFPA 90A, Installation of Air Conditioning and Ventilating Systems.
   b. NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
2. Comply with SMACNA's HVAC Duct Construction Standards - Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Provide sheet metal materials free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

3. Provide ductwork pressure testing and leakage testing per Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Duct design is generally diagrammatic and is not meant to be scaled. Major changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

PART 2 - PRODUCTS

2.1 DUCTWORK, JOINTS, AND FITTINGS

A. Materials:

1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, lock-forming quality, ASTM A 653/A 653M FS Type B, with G90/Z275 coating, minimum 26 gauge except where heavier material is specified. Ducts to have mill phosphatized finish for surfaces exposed to view.
2. Aluminum Ducts: ASTM B 209 (ASTM B 209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Minimum 24 gauge except where heavier matieral is specified; alloy 6061-T651 or of equivalent strength with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts with liquid-tight joints when containing condensate vapor or liquids in suspension.
3. Stainless Steel: Fabricated in accordance with ASTM A167 and A480 with liquid-tight joints when containing condensate vapor or liquids in suspension.

B. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems not-to-exceed deflection limits according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.
3. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

C. Formed-On Flanges: construct according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Duct Size: Maximum 30-inches wide and up to 2-inch wg pressure class.
2. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

3. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19-inches and larger and 0.0359-inch thick or less, with more than 10 SF of nonbraced panel area unless ducts are lined.

D. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of material specified in this Section according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible.

1. Ducts up to 20-inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21- to 72-inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger than 72-inches in Diameter: Companion angle flanged joints per SMACNA HVAC Duct Construction Standards-Metal and Flexible, Figure 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's HVAC Duct Construction Standards-Metal and Flexible, with metal thicknesses specified for longitudinal-seam straight ducts.

F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

G. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows to be 1.5 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's HVAC Duct Construction Standards-Metal and flexible, unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg (minus 500 to plus 500 Pa):
    a. Ducts 3- to 36-inches in Diameter: 0.034-inch.
    b. Ducts 37- to 50-inches in Diameter: 0.040-inch.
    c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
    d. Ducts 62- to 84-inches in Diameter: 0.064-inch.
3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
    a. Ducts 3- to 26-inches in Diameter: 0.034-inch.
    b. Ducts 27- to 50-inches in Diameter: 0.040-inch.
    c. Ducts 52- to 60-inches in Diameter: 0.052-inch.
    d. Ducts 62- to 84-inches in Diameter: 0.064-inch.
4. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
5. Round Elbows:
    a. 8-inches and Less in Diameter: Fabricate die-formed elbows for 45 and 90-degree elbows and pleated elbows for 30, 45, 60 and 90 degrees only. Fabricate nonstandard bend-angle configurations or non-standard diameter elbows with gored construction.
    b. 9 through 14-inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60 and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.

c. Larger than 14-inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.

6. Die-Formed Elbows for Sizes through 8-inches in Diameter and Pressures 0.040-inch thick with two-piece welded construction.
7. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
8. Pleated Elbows for Sizes through 14-inches in Diameter and Pressures through 10-inch wg (2500 Pa): 0.022-inch.
9. Not acceptable:
   a. Corrugated or flexible metal duct.
   b. Adjustable elbows.

2.2 LAUNDRY CLOTHES DRYER VENT

A. Aluminum sheet metal, minimum 24 gauge. Substantially airtight duct except for openings required for operation and maintenance. Duct to have smooth interior surface. Do not assemble with sheet metal screens or other devices that extend into the airstream.

2.3 INSULATED FLEXIBLE DUCT

A. Manufacturers:

1. ATCO
2. Flexmaster
3. J.P. Lamborn Co.
4. Hart and Cooley

B. Construction: Standard factory fabricated product. Inner wall: Impervious vinyl or chlorinated polyethylene, permanently bonded to a vinyl or zinc-coated spring steel helix.

C. Insulation: Fiberglass blanket insulation covered by an outer wall of vinyl or fiberglass-reinforced metalized vapor barrier.

D. Listing: UL 181 listed Class 1 flexible air duct material. Overall thermal transmission: No more than 0.25 BTU/in or hr/sq. degrees F at 75 degrees F differential, per ASTM C335.

E. Vapor transmission value no more than 0.10 perm, per ASTM E96.

F. Pressure Rating: 4-inch wg positive pressure and 1-inch wg negative pressure.

G. Performance Air Friction Correction Factor: 1.3 maximum at 95 percent extension. Working air velocity: Minimum 2000 FPM.

H. Flame Spread Rating: No more than 25.

I. Smoke Development Rating: No more than 50 as tested per ASTM E84.

J. Insertion Loss: Minimum attenuation of 29 DB for 10-foot straight length at 8-inch diameter at 500 Hz.

2.4 TEXTILE AIR DISPERSION SYSTEM

A. Manufacturers:

1. FabricAir (Basis of Design)

2. Duct Sox
3. Durkee Nanosox

B. General: Air dispersion system of a woven fire retardant fabric.

C. Construction:

1. Permeable polyester or non-permeable polyester with airflow orifices.
2. Color: To be determined by Architect.
3. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the requirements of NFPA 90-A.
4. Refer to drawings for nozzle locations and directions for airflow pattern to wash interior wall and ceiling surfaces.

D. Accessories:

1. Inlet connection to metal duct via fabric draw band with anchor patches. Anchor patches to be secured to metal duct via zip screw fastener.
2. Zipper at inlet connection for easy removal and maintenance.
3. All required zippers as specified by manufacturer.
4. Connectors to accommodate suspension system.

E. Suspension System:

1. Tension cable system including multiple runs of cable attached to structure.
2. Provide cable, eye bolts, thimbles, cable clamps, glides, track and turnbuckles as required.
3. Track system. All stainless steel track, suspension rods, connectors, and any ancillary components.

2.5 FIBERGLASS REINFORCED DUCTWORK

A. Manufacturers:

1. ATS
2. Spunstrand
3. Or approved equivalent.

B. General: Provide fume exhaust ducts (except for flammable vapor exhaust) listed for use without necessity for internal fire protection sprinklers, or any devices relied on to cut off air flow (including collapse or close off of duct) in event of fire, by the following.

1. Factory Mutual Research
2. International Conference of Building Officials
3. State Fire Marshal
4. Test ducts to ASTM-E-84 standard on both inside and outside surfaces and in thicknesses up to 3/8-inch. Ducts listed by Factory Mutual as having flame spread ratings of 5 and smoke developed ratings of 5.

C. Duct and fitting thicknesses as follows:

1. 2 to 20-inches diameter: 1/8-inch
2. 22 to 36-inches diameter: 3/16-inch
3. 42 to 60-inches diameter: 1/4-inch

D. Fittings: Branch taps to be at 45 degree entry to mains at horizontal centerlines occurring on main ducts after transitions located upstream. Factory apply taps above 5-inches diameter with inside surfaces of tap joints finished with one layer of glass mat and veil thoroughly impregnated with resin. In addition to that required on exterior of connection for structural strength. Provide transitions with tapers at 150 maximum variation. Round elbows up to 36-inches diameter constructed of a single piece smooth flow type. Elbows above 36-inch three piece gored elbows. Elbows with a centerline radius of 1.5 times their diameter.

E. Construct duct and fittings to be seamless longitudinally; materials may not be cut from molds and rebonded. Elbows may not be shipped to job with their throats slit for field bonding. If necessary to use a two-piece mitered 90 degree elbow. Airfoil shaped turning vanes must be installed at miter.

F. Provide dampers with locking quadrants with blades and shafts which drop out in the event of fire. Blades have a minimum open area of 5 percent when fully closed.

2.6 DUCTWORK JOINT SEALERS AND SEALANTS

A. Manufacturers:

1. Ductmate
2. Duro Dyne
3. Hardcast
4. United McGill Corporation
5. Vulkem
6. Foster
7. Childer

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

C. Low Emitting Materials Requirement: Adhesives, sealants and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168.

D. Type: Heavy mastic or liquid, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure and leakage class of ducts.

E. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E 84.

F. Water Based Sealant for Brush-On Application: Flexible, adhesive sealant, resistant to UV light, UL-181A, and UL-181-B listed, complying with NFPA requirements for Class 1 ducts. Min. 69 percent solids, nonflammable. Hardcast Versa-Grip 181; Childers CP-146; Foster 32-19 for SMACNA 1/2, 1, 2, 3, 4, 6, and 10-inch WG duct classes, and SMACNA Seal Class A, B, or C.

G. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use O.

H. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

I. Polyurethane Sealant: General-purpose, exterior use, non-brittle sealant for gunned application. Vulkem 616 or equal.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. General: Use the following pressure seal, and leakage class(es) in design of ductwork specified in this section unless otherwise noted on Drawings.

SYSTEM	PRESSURE CLASS (Inches of Water)	SEAL CLASS	LEAKAGE CLASS ROUND DUCTS	LEAKAGE CLASS RECTANGULAR DUCTS
Low Pressure (downstream of terminal unit)	+ 1-inch	A	2	4
Return and Exhaust	0.5-inch more negative than return/exhaust fan pressure or -2-inch pressure class, whichever is more negative.	A	2	4
Hazardous Exhaust	-6-inch	A	2	4

B. Ductwork Installation:

1. General: Install entire duct system in accordance with drawings, Specifications, and latest issues of local Mechanical Code, NFPA 90A, and SMACNA Duct Construction Manual. At Contractor's option, rectangular ductwork may be resized to maintain an equivalent air velocity and friction rate, while maintaining a maximum aspect ratio of 3. Remove markings and tagging from ductwork exterior surface in mechanical rooms and other locations where ductwork is exposed.
2. The duct layout shown on the Contract Drawings is diagrammatic in nature. Coordinate the ductwork routing and layout, and make alterations to the ductwork routing and layout to eliminate physical interferences. Where deviations in the ductwork routing as shown in the Contract Drawings are required, alterations may be made so as not to compromise the air flow, pressure drop, and sound characteristics of the duct fitting or duct run as shown on the Contract Drawings. In the event Architect determines that the installed ductwork is inconsistent with the above mentioned criteria, remove and replace at no additional cost to the Owner.
3. Install ducts with fewest possible joints.
4. Install fabricated fittings for changes in directions, size, shape, and for connections.
5. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12-inches, with a minimum of 3 screws in each coupling.
6. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
7. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
8. Install ducts with a clearance of 1-inch, plus allowance for insulation thickness. Allow for easy removal of ceiling tile.

9. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
10. Coordinate layout with suspended ceiling, air duct accessories, lighting layouts, and similar finish work.
11. Electrical and IT Equipment Spaces: Route ducts to avoid passing through transformer vaults, electrical equipment spaces, IDF/MPOE rooms, and enclosures.
12. Boiler Rooms and Refrigeration Machinery Rooms: Only route ducts serving these rooms through these rooms.
13. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2-inches.
14. Fire- and Smoke-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire, smoke or combination fire and smoke dampers as governed by Building Code and AHJ, including sleeves, and firestopping sealant.
15. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Reference SMACNA's Seismic Restraint Manual: Guidelines for Mechanical Systems, Mason Seismic Restraint and Support Systems.
16. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's Duct Cleanliness for New Construction Advanced Level.
17. Paint interiors of metal ducts, that do not have duct liner, for 24-inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible duct material.
18. Install ductwork in the location and manner shown and detailed. Review deviations required by job conditions with Architect prior to any fabrication. Provide fittings for construction per SMACNA.
19. Install flexible ductwork to limit sag between support hangers to 1/2-inch per foot of spacing support.
20. Humidifier Duct:
    a. Supply duct section 15-feet downstream from humidifier.
        1) Seams water tight.

C. Flanged Take-Offs:

1. Install at branch takeoffs to outlets using round or flex duct.
2. Flanged take-offs secured with minimum 8-inch screw spacing (three screws minimum).
3. Provide ductwork taps and branches off of main ducts at 45 degrees whether shown on Drawings or not (drawings are diagrammatic).

D. Cleaning:

1. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.
2. Grille and Exposed Duct Cleaning:
    a. After completion of ductwork installation, operate each fan system (excluding exhaust fans) for a minimum of 30 minutes prior to installation of ceiling grilles and diffusers. After grilles and diffusers are installed, clean out accumulation of particles from grilles and diffusers prior to acceptance.
    b. Clean exterior surface of ducts exposed to public view of chalk, pencil and pen marks, labels, sizing tags, dirt, dust, etc., so that upon completion of installation, ducts are left in clean and unblemished manufactured conditions.

c. Exposed duct and grilles to remain free of dust entrained streaks due to leakage at joints and grille connections during warranty period. Clean leaks, seal and refinish to match existing if visible streaks develop.

3.2 DUCTWORK, JOINTS, AND FITTINGS INSTALLATION

A. Duct Materials - Applied Locations:

1. General: Use the following materials in design of ductwork specified in this Section unless otherwise noted on the Drawings.

Location or Application	Material
Supply, Return, Transfer, and Exhaust - Low Pressure (downstream of terminal units)	Single Wall, Galvanized Steel
General Exhaust Branch Serving Air Inlet in Shower Room or Toilet Room with Shower	Single Wall, Aluminum or Type 304 Stainless Steel
Supply, Return, Exhaust serving Natatorium, Pool, or Spa Area	Single Wall, Aluminum or Type 304 Stainless Steel
Ductwork for the First 15-feet Downstream of Humidifier	Single Wall, Type 316 Stainless Steel

B. Ductwork Installation:

1. Fabricate radius elbows with centerline radius not less than 1-1/2 duct diameters.
2. Do not install duct size transition pitch angles which exceed 30 degrees for reductions in duct size in the direction of airflow, and 15 degrees for expansions in duct size in the direction of airflow.
3. Install fixed turning vanes in square throat rectangular elbows and in tees.
4. Fabricate duct turns with the inside (smallest) radius at least equal to the duct width (supply ducts) and 1.5 times radius (return and exhaust ducts). Where necessary, square elbows may be used, with maximum available inside radius and with fixed turning vanes. In healthcare settings such as hospitals and medical office buildings, square elbows and turning vanes allowed on supply ductwork only.

3.3 LAUNDRY CLOTHES DRYER VENT INSTALLATION

A. Install vent in accordance with manufacturer's instructions and recommendations.

3.4 INSULATED FLEXIBLE DUCT INSTALLATION

A. Provide sheet metal plenum or rigid elbow and connect to diffusers and grilles with ductwork connections. Refer to Drawings for more information. Provide straight section of flexible duct with minimum length of 2-feet and maximum length of 5-feet and connect to sheet metal plenums and rigid elbows connected to diffusers and grilles, unless noted otherwise.

1. Provide round neck grilles/diffusers or square-to-round transitions. Flexible duct connections directly to diffuser and grilles is not allowed.
2. Flexible duct allowed in concealed spaces above lay-in ceilings only.

3.5 TEXTILE AIR DISPERSION SYSTEM INSTALLATION

A. Install per manufacturer's requirements.

3.6 FIBERGLASS REINFORCED DUCTWORK INSTALLATION

A. For under slab installations, excavate required trenches evenly. Backfill with pea gravel, sand, or excavated material.

3.7 DUCTWORK JOINT SEALERS AND SEALANTS INSTALLATION

A. Joints and Seam Joint Sealing:

1. Seal duct seams and joints according to SMACNA's HVAC Duct Construction Standards - Metal and Flexible, for duct pressure class indicated.
2. Seal transverse joints, longitudinal seams and duct wall penetrations including screw, fastener, pipe, rod, and wire.
3. Seal ducts before external insulation is applied.
4. Tape joints of PVC coated metal ductwork with PVC tape.
5. Fasteners such as sheet-metal screws, machine screws or rivets to be cadmium plated.
6. Rectangular Ductwork: Where intermediate joint reinforcement is required for duct of negative pressure class, pre-drill stiffening flange and provide fastener maximum 8-inches on center. Where retaining flanges are welded to duct wall, paint welds with zinc coating.
7. Single Wall Round Ductwork: Joint to incorporate beaded slip collar with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.
8. Seal joints and seams. Apply sealant to make end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
9. Double Wall Round Ductwork: Joint to incorporate beaded slip collar or flanged connection, with minimum #8 sheet metal screws 8-inches on center. Seal ductwork as specified in this Section.
10. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
11. Provide openings in ductwork where required to accommodate thermometers and control devices. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
12. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities as well as Code required clearances.

END OF SECTION 23 31 00

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Sheet Metal Materials
2. Backdraft Dampers
3. Dampers
4. Concealed Damper Hardware
5. Access Doors
6. Duct Test Holes
7. Control Dampers
8. Duct Silencers
9. Turning Vanes
10. Flexible Connectors
11. Air Flow Measuring Station (Hot Wire Anemometer Type)

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Manufacturer's catalog data and fabrication/installation drawings for each factory fabricated duct accessory. Include leakage, pressure drop and maximum back pressure data.
2. Shop Drawings: Indicate air duct accessories.
3. Manufacturer's installation instructions: Provide instructions for each factory fabricated duct accessory.
4. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    a. See Division 01, General Requirements, Product Requirements for additional provisions.
    b. Extra Fusible Links: One of each type and size.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section, with minimum five years of documented experience.
2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
3. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
4. AMCA 511 - Certified Ratings Program for Air Control Devices.
5. AMCA 611, latest edition - Certified Ratings Program - Product Rating Manual for Airflow Measurement Stations.
6. AMCA 610, latest edition - Laboratory Methods of Testing Airflow Measurement Stations for Performance Rating.
7. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
8. NFPA 92A - Smoke-Control Systems.
9. NFPA 92B - Smoke Control Systems in Atria, Covered Malls and Large Areas.
10. NFPA 101 - Life Safety Code.
11. UL 555 - Standard for Safety; Fire Dampers.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M. Galvanizing: 1-1/4 ounces per square foot total both sides; ducts to have mill-phosphatized finish for surfaces exposed to view.

C. Stainless Steel: ASTM A 480/A 480M.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36-inches or less; 3/8-inch minimum diameter for lengths longer than 36-inches.

2.2 BACKDRAFT DAMPERS

A. Manufacturers:

1. Air Balance
2. Cesco
3. Greenheck
4. Nailor
5. Ruskin

B. Basis-of-Design: Ruskin CB D6.

C. Description: Multiple-blade gravity balanced with center pivoted blades with sealed edges, assembled in rattle free manner with 90-degree stop, adjustment device to permit setting for varying differential static pressure.

D. Frame: 0.125-inch thick 6063-T5 extruded aluminum channel with galvanized steel braces at mitered corners. Provide mounting flange.

E. Blades: Single piece, overlap frame, parallel action, horizontal orientation, minimum 0.07-inch 6063-T5 extruded aluminum material, maximum 6-inch width.

F. Bearings: Corrosion-resistant synthetic, formed as single piece with axles.

G. Blade Seals: Extruded vinyl, mechanically attached to blade edge.

H. Blade Axles: Corrosion-resistant, synthetic formed as single piece with bearings, locked to blade.

I. Tie Bars and Brackets: Galvanized steel.

J. Return Spring: Adjustable tension.

K. Damper Capacity:

1. Closed Position: Maximum back pressure of 16-inches water gauge.
2. Open Position: Maximum air velocity of 2,500-feet per minute.

L. Counterbalances: Adjustable zinc plated steel weights mechanically attached to blade. Must be capable of operating over wide range of pressures.

M. Finish: Mill aluminum.

N. Temperature Rating: -40 degrees F to 200 degrees F.

O. Operation of Blade:

1. Start to Open: 0.01-inch wg
2. Fully Open: 0.05-inch.

P. Pressure Drop: Maximum 0.15-inch wg at 1,500-feet per minute through 24-inch by 24-inch damper.

Q. Factory Sleeve: Minimum 20 gauge thickness, 12-inches in length.

R. Screen: At outdoor intake or discharge. 1/4-inch aluminum.

2.3 DAMPERS

A. Manufacturers:

1. Air Balance
2. Cesco
3. Greenheck
4. Nailor
5. Ruskin

B. Basis-of-Design:

1. Rectangular ductwork for velocities and pressures up to 1,500 fpm and 2.5-inch wg, respectively: Ruskin MD-35.
2. Rectangular ductwork for velocities and pressures up to 3,000 fpm and 4-inch wg, respectively: Ruskin CD-60.
3. Round ductwork for velocities and pressures up to 3,000 fpm and 4-inch wg, respectively: Ruskin CDSR-15.

C. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

D. Rectangular Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design with linkage concealed in frame and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum 16 gauge thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
    a. Roll-Formed Steel Blades: Galvanized sheet steel, 16 gauge thick for velocities up to 1,500 fpm, and 14 gauge thick for velocities up to 3,000 fpm.
    b. Blade Axles: Minimum 1/2-inch diameter, plated steel, hex shaped, mechanically attached to blade.
    c. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.
    d. Tie Bars and Brackets: Galvanized steel.
    e. Mill galvanized.

E. Round Volume Dampers: Single-blade suitable for horizontal or vertical applications.

1. Steel Frames: Galvanized, roll formed, minimum of 20 gauge thick with beads at each end.
2. Blades: Minimum 14 gauge thick, galvanized sheet steel, round, single-piece.
3. Blade Axles: Minimum 1/2-inch square, plated steel, mechanically attached to blade.
4. Bearings: Molded synthetic sleeve, turning in hole in frame.
5. Finish: Mill galvanized.
6. Capacity:
    a. Closed Position: Maximum pressure of 4-inches wg.
    b. Open Position: Maximum air velocity of 3,000-feet per minute.
7. Leakage: Maximum 20 cfm at 4-inches wg.
8. Pressure Drop: Maximum 0.02-inch wg at 1,500-feet per minute through 20-inch diameter dampers.

F. Jackshaft: 1-inch diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
2. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include 2-inch elevated platform for insulated duct mounting.

2.4 CONCEALED DAMPER HARDWARE

A. Manufacturers:

1. Young Regulator Company

B. Concealed Damper Hardware: For dampers above non-removable ceilings (gyp, plaster, decorative, etc.) where access panels have not been shown on Architectural drawings or in locations where dampers are more than 2-feet above the ceiling, provide:

1. Concealed Damper Regulator: Young Regulator Company Model 315 or approved equivalent.
2. Cable System: Young Regulator Company or approved equivalent.
3. Controller: Young Regulator Company 270-275 or approved equivalent.
4. Control wrenches, wire stops, casing nuts, and stainless steel wire.
5. Paint cover plate to match ceiling color or as directed by Architect.

2.5 ACCESS DOORS

A. Manufacturers:

1. Ductmate
2. Cesco
3. Ruskin
4. Nailor
5. Outdoor Installation: Karp MX insulated exterior access door.

B. Duct Pressure Class 2-inch WC and Greater: Sandwich-type design with threaded locking bolt assembly. Closed cell neoprene gasket permanently bonded to inside panel. Zinc-coated steel wing nuts or polypropylene molded knobs with threaded metal inserts - zinc coated bolts sealed to inner panel.

C. Duct Pressure Class 1-1/2-inch WC and Less: Galvanized steel assembly incorporating frame, door, hinges, and latch(es). Frame tabbed for attachment to duct panel. Double wall door panel with 1-inch insulation. Open cell neoprene gasket attached to frame. Cam latches for tight closure.

D. Plenum Doors: Extruded aluminum frames with extruded santoprene seals. Double-wall 20 gauge galvanized steel door panel with fiberglass insulation.

E. Size: Maximum size available to fit rectangular duct panel dimension or round duct diameter. Plenum doors minimum 2-feet wide by 4-feet high.

F. For outdoor installation, only provide waterproof access doors installed vertically.

2.6 DUCT TEST HOLES

A. Manufacturers:

1. Ventlok

B. Temporary Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

C. Permanent Test Holes (where shown on Drawings): Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.7 CONTROL DAMPERS

A. Manufacturers:

1. Ruskin
2. Greenheck
3. Cesco
4. Air Balance
5. Nailor

B. Basis-of-Design:

1. Ruskin Model CDR25, low leakage, for use in low pressure round ductwork up to 24-inch diameter.
2. Ruskin Model CDO25, low leakage, for use in low pressure oval ductwork.
3. Ruskin Model CD60, ultra low leakage, for rectangular ducts or round ductwork larger than 24-inch diameter. Provide duct transition between round and rectangular connections.

C. Fabrication:

1. Frame: 16 gauge roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gauge U-channel.
2. Blades (Low Leakage Dampers):
   a. Style: Single skin with 3 longitudinal grooves.
   b. Action: Opposed blade for modulating applications, parallel blade for two position application.
   c. Orientation: Horizontal or vertical with thrust washers.
   d. Material: Minimum 16 gauge equivalent thickness, galvanized steel.
   e. Width: Nominal 6-inches.
3. Blades (Ultra Low Leakage Dampers):
   a. Style: Airfoil-shaped, single-piece.
   b. Action: Opposed blade for modulating applications, parallel blade for two position applications.
   c. Orientation: Horizontal or vertical with thrust washers.
   d. Material: Minimum 14 gauge equivalent thickness, galvanized steel.
   e. Width: Nominal 6-inches.
4. Bearings: Molded synthetic sleeve, turning in extruded hole in frame.
5. Seals:
   a. Blade: Inflatable PVC coated fiberglass material and galvanized steel. Mechanically attached to blade edge.
   b. Jamb: Flexible metal compression type.
6. Linkage: Concealed in frame.
7. Axles: Minimum 1/2-inch diameter plated steel, hex-shaped, mechanically attached to blade.
8. Mounting: Vertical or horizontal.
9. Finish: Mill galvanized for installation in galvanized sheet metal and Type 304 stainless steel for installation in stainless steel ductwork.

D. Performance Data (Low Leakage Dampers):

1. Capacity: Demonstrate capacity of damper to withstand HVAC system operating conditions.
   a. Closed Position: Maximum pressure of 5-inches wg at a 12-inch blade length.
   b. Open Position: Maximum air velocity of 2,000-feet per minute.
2. Leakage: Maximum 3.7 cubic-feet per minute per square foot at 1-inch wg for sizes 36-inches wide and above.
3. Pressure Drop: Maximum 0.07-inch wg at 1,500-feet per minute across 24-inch by 24-inch damper.

E. Performance Data (Ultra Low Leakage Dampers):

1. Leakage: Damper to have a maximum leakage of 3 cfm per square foot at 1-inch wg and be AMCA licensed as Class 1A.
2. Differential Pressure:
   a. Damper to have a maximum differential pressure rating of 13-inch wg for a 12-inch blade.
3. Velocity: Damper to have a maximum velocity rating of 6,000-feet per minute.
4. Temperature: Damper rated for -72 degrees F to 275 degrees F.
5. Pressure Drop: Maximum 0.1-inch wg at 2,000-feet per minute across 24-inch by 24-inch damper.

F. Actuator: Provide actuator. See Specification Section 23 09 00, Instrumentation and Control for HVAC.

G. Factory flange frame.

H. Factory Sleeve: Minimum 20 gauge thickness.

I. Duct Transition Connection: Per Drawings.

J. Factory Tests: Factory cycle damper assembly to assure proper operation.

2.8 DUCT SILENCERS

A. Manufacturers:

1. IAC Acoustics
2. Ruskin Co.
3. Vibro-Acoustics
4. Price Industries

B. General Description: Factory-fabricated and -tested, round or rectangular silencers with performance characteristics and physical requirements as indicated.

C. Fire Performance: Adhesives, sealants, packing materials, and accessory materials to have fire ratings not exceeding 25 for flame-spread index and 50 for smoke-developed index when tested according to ASTM E 84.

D. Rectangular Units: Fabricate casings with a minimum of 0.034-inch-thick, solid galvanized sheet metal for outer casing and 0.022-inch thick, ASTM A 653/A 653M, G90 Z275, perforated galvanized sheet metal for inner casing. Provide stainless steel (type to match ductwork) solid liner.

E. Round Units:

1. Outer Casings:
   a. ASTM A 653/A 653M, G90 Z275, galvanized sheet steel.
   b. Up to 24-inches in Diameter: 0.034-inch thick.
   c. 26 through 40-inches in Diameter: 0.040-inch thick.
   d. 42 through 52-inches in Diameter: 0.052-inch thick.
   e. 54 through 60-inches in Diameter: 0.064-inch thick.
   f. Casings fabricated of spiral lock-seam duct may be one size thinner than that indicated.
2. Interior Casing, Partitions, and Baffles:
   a. ASTM A 653/A 653M, G90 Z275, galvanized sheet steel. Provide stainless steel (type to match ductwork).
   b. At least 0.034-inch thick and designed for minimum aerodynamic losses.

F. Sheet Metal Perforations: 1/8-inch diameter for inner casing and baffle sheet metal.

G. Fill Material: Inert and vermin-proof fibrous material, packed under not less than 5 percent compression.

1. Erosion Barrier: Polymer bag enclosing fill and heat-sealed before assembly.

H. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.

1. Do not use nuts, bolts, or sheet metal screws for unit assemblies.
2. Lock form and seal or continuously weld joints.
3. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
4. Reinforcement: Cross or trapeze angles for rigid suspension.

I. Source Quality Control:

1. Acoustic Performance: Test according to ASTM E 477.
2. Record acoustic ratings, including dynamic insertion loss and self-noise power levels with an airflow of at least 2000-feet per minute face velocity.
3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg static pressure, whichever is greater.

2.9 TURNING VANES

A. Manufacturers:

1. Aerodyne
2. Ductmate Industries
3. Duro Dyno Corp.
4. Metalaire Inc.

B. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners to automatically align vanes.

C. Manufactured Turning Vanes: For medium pressure ductwork, ductwork upstream of terminal units, and in ductwork with equal inlet width and height dimensions and outlet width and height dimension, provide double thickness airfoil turning vanes. Low pressure ductwork and ductwork downstream of terminal units use either single thickness or double thickness turning vanes. For mitered rectangular elbows with changes in size from inlet to outlet, only use single thickness turning vanes. Use 2-inch radius vanes spaced on centers of 1.5-inches for single thickness. Use 2-inch radius vanes spaced on centers of 2.125-inches for double thickness.

D. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Duro Dyne Corp.
2. Ventfabrics Inc.
3. Ductmate Industries
4. Hardcast

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 4-inches wide attached to two strips of 2-3/4-inch wide, 0.028-inch thick, galvanized sheet steel or 0.032-inch thick aluminum sheets. Select metal compatible with ducts.

D. Provide a spring and bracket assembly to reinforce the fabric with sufficient tension to prevent connector collapse under negative or positive pressure. Number and positioning of spring-link fixture to be determined by the manufacturer to maintain straight axis and without kinks between two sections of duct, or between duct and the moving element. Hardcast Spring-Link SL-200, or equal.

E. Indoor System, Flexible Connector Fabric (FC-I): Glass fabric double coated with neoprene.

1. Minimum Weight: 30 ounces per square yard.
2. Tensile Strength: 395 pounds of force per inch in the warp and 255 pounds of force per inch in the filling.
3. Service Temperature: -40 degrees F to 200 degrees F.

F. Outdoor System, Flexible Connector Fabric (FC-O): Glass fabric double coated with Hypalon, resistant to UV rays and ozone.

1. Minimum Weight: 26 ounces per square yard.
2. Tensile Strength: 225 pounds of force per inch in the warp and 300 pounds of force per inch in the filling.
3. Service Temperature: -40 degrees F to 200 degrees F.

G. High-Corrosive-Environment System, Flexible Connectors (FC-HC): Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 ounces per square yard.
2. Tensile Strength: 450 pounds of force per inch in the warp and 340 pounds of force per inch in the filling.

3. Service Temperature: -67 degrees F to 500 degrees F.

2.11 AIR FLOW MEASURING STATION (HOT WIRE ANEMOMETER TYPE)

A. Manufacturers:

1. Ebtron
2. Air Monitor with Veltron II
3. Kurz Instruments
4. Ruskin
5. Greenheck

B. Hot wire anemometer probe airflow measuring station, with transmitter, factory calibrated, UL Standard 873 labeled, AMCA 610 certified.

C. Performance: System accuracy to be percent of reading over the sensor probe operating ranges. Installed accuracy to be better than plus or minus 2 percent of reading over the range of 0- to 5000-feet per minute for duct and plenum probes and plus or minus 3 percent for fan inlet probes.

D. Filters: Throwaway type, 1-inch thick fiberglass.

E. Provide electronic transmitter inputs and outputs fused and protected. Provide analog output signals user selectable (0 to 10 VDC or 4 to 20 mA).

F. Provide interface devices for communication to Building Automation System (BAS/BMS).

G. Ensure performance over entire operating range of airflow scheduled for each system.

PART 3 - EXECUTION

3.1 DUCT ACCESSORIES GENERAL INSTALLATION

A. Inspect areas to receive air duct accessories. Notify Engineer of conditions that would adversely affect the installation of the dampers. Do not proceed until conditions are corrected.

B. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

C. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

D. Do not compress or stretch damper frames into duct or opening.

E. Handle dampers using sleeve or frame. Do not lift dampers using blades, actuators, or jack shafts.

F. Adjust duct accessories for proper settings.

3.2 SHEET METAL MATERIALS INSTALLATION

A. Install bracing for multiple sections to support assembly weights and hold against system pressure. Install bracing as needed.

3.3 BACKDRAFT DAMPERS INSTALLATION

A. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated. Provide at outside air intakes where motorized dampers are not shown on drawings.

3.4 DAMPERS INSTALLATION

A. Where installing volume dampers in ducts with liner, avoid damage to and erosion of duct liner.

B. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts for air balancing. Install at a minimum of two duct widths from each branch takeoff. Provide balancing dampers for all air inlets and outlets.

C. Install dampers square and free from racking with blade running horizontally.

3.5 CONCEALED DAMPER HARDWARE INSTALLATION

A. Coordinate location in Reflected Ceiling Plan and color of concealed damper hardware with Architect prior to installation.

3.6 ACCESS DOORS INSTALLATION

A. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers, turning vanes and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot (15-m) spacing.
5. Install the following sizes for duct-mounting, rectangular access doors:
    a. One-Hand or Inspection Access: 8-inches by 5-inches.
    b. Two-Hand Access: 12-inches by 6-inches.
    c. Head and Hand Access: 18-inches by 10-inches.
    d. Head and Shoulders Access: 21-inches by 14-inches.
    e. Body Access: 25-inches by 14-inches.
    f. Body Plus Ladder Access: 25-inches by 17-inches.
6. Install the following sizes for duct-mounting, round access doors:
    a. One-Hand or Inspection Access: 8-inches in diameter.
    b. Two-Hand Access: 10-inches in diameter.
    c. Head and Hand Access: 12-inches in diameter.
    d. Head and Shoulders Access: 18-inches in diameter.
    e. Body Access: 24-inches in diameter.
7. Label access doors.

3.7 DUCT TEST HOLES INSTALLATION

A. Provide test holes at fan inlets and outlets where indicated and where required for air testing and balancing.

3.8 CONTROL DAMPERS INSTALLATION

A. Handle dampers using sleeve or frame. Do not lift dampers using blades, actuators or jack shafts.

B. Install control dampers in accordance with manufacturer's written instructions.

3.9 DUCT SILENCERS INSTALLATION

A. Install duct silencers independent of ducts with flexible duct connectors, lagged with loaded vinyl sheet on inlets and outlets.

3.10 TURNING VANES INSTALLATION

A. Vanes must be installed, eliminating every other vane is not allowed.

B. Single thickness vanes cannot be over 36-inches long without intermediate vane runner.

C. Install per SMACNA and fasten/support to prevent vibration, noise, and to maintain proper alignment at design velocity.

3.11 FLEXIBLE CONNECTORS INSTALLATION

A. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators. Provide sheet metal weather cover over flexible connections located outdoors. Attach sheet metal to either equipment side or ductwork side, but not both.

B. Per NFPA, do not use flexible connectors on grease exhaust fans.

C. Securely attach spring-lock brackets to the metal strips of the connector collar using No. 8 sheet metal screws.

D. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

E. Adjust the following types in the following locations:

1. FC-I: Indoors.
2. FC-O: Outdoors.
3. FC-HC: High corrosive systems inclusive of all laboratory exhaust systems.

3.12 AIR FLOW MEASURING STATION (HOT WIRE ANEMOMETER TYPE) INSTALLATION

A. Provide in ductwork with minimum of 4 diameters of straight ductwork upstream, and 1 diameter of straight ductwork downstream, or as shown on Drawings, whichever is greater.

B. Control contractor to provide power and control interface wiring unless noted otherwise.

C. Where provided in equipment, install per manufacturer's installation requirements.

END OF SECTION 23 33 00

SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Roof Exhaust Fans
2. In-Line Centrifugal Fans
3. Dryer Vent Exhaust Fans
4. High Volume Low Speed Fans

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gauges and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. For belt-driven fans, indicate the number of belts provided for design duty.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Motors: Premium efficiency per Section 23 05 13, Common Motor Requirements for HVAC Equipment. Electrically Commutated Motors (ECM) where scheduled on Drawings.
2. Sound power levels as scheduled on Drawings. If not scheduled, within 5 percent of Basis of Design at design flow.
3. Project Altitude: Base air ratings on sea-level conditions for project sites below 2,000 feet in elevation. Base air ratings on actual site elevations for project sites above 2,000 feet in elevation.
4. Operating Limits: Classify according to AMCA 99.

5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
6. AMCA Compliance: Products are to comply with performance requirements and are to be licensed to use the AMCA-Certified Ratings Seal.
7. NEMA Compliance: Motors and electrical accessories are to comply with NEMA standards.
8. UL Standard: HVAC Fans are to comply with UL 705. Fans used in grease exhaust applications are to be UL 762 listed for grease exhaust. Fans used for smoke control applications are to be UL listed for Power Ventilators for Smoke Control.
9. Belt-driven fans used for smoke control applications are to have 1.5 times the number of belts required for the design duty, with the minimum number of belts being two.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.8 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 ROOF EXHAUST FANS

A. Manufacturers:

1. Greenheck
2. Cook
3. Twin City

B. Description: Belt-driven or direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Wheel:

1. Single width, single inlet, backward inclined/airfoil blades.
2. Aluminum hub and wheel with steel inlet bell.
3. Statically and dynamically balanced with its own bearings.

D. Housing to match scheduled Basis of Design:

1. One piece heavy gauge spun aluminum dome, hinged for service.
2. Low silhouette type with arched heavy gauge galvanized hood.
3. Louvered type with heavy gauge extruded aluminum louvers.

E. Bearings and Drives:

1. Bearings: Heavy duty pillow block type, self greasing ball bearings with ABMA 9 L-10 life at 100,000 hours.
2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil.

F. Pulleys: Cast-iron, adjustable-pitch motor pulley.

G. Fan and motor isolated from exhaust airstream.

H. Curb: Prefabricated insulated roof curb, galvanized steel, mitered ad welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer, hinged with curb seal. Provide curb for flat, pitched or ridged roof as indicated.

1. Security grates in curb, 1/2-inch powder coated steel bars, 6- by 6-inch grid. Provide where scheduled.
2. Kitchen grease exhaust meeting NFPA-96 requirements with vented slots. Greenheck VPFV or equal.
3. Sound curb: Curb with sound-absorbing insulation matrix. Provide where scheduled.

I. Motor: Integrally mounted, 1800 RPM maximum, with pre-lubricated sealed ball bearings. ODP for motors located indoors and TEFC for motors exposed to moisture.

1. Inverter duty motor for use with variable frequency drive where indicated on Fan Schedule on Drawings.
2. Electrically Commutated Motor (ECM) where indicated on Fan Schedule on Drawings.

J. Accessories:

1. Inlet/Outlet Screens: Galvanized steel welded grid, removable.
2. Backdraft Damper: Parallel blade heavy duty steel or aluminum, where scheduled, damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever. Motorized where indicated and gravity actuated with counterweight, where motorized is not indicated.
3. AMCA 99 Type B spark proof construction where scheduled.
4. Protective coating on fan wheel and interior of fan housing where scheduled. Apply coating before balancing fans and repair any breaks in coating which occur during balancing. One 6-mil coat of white plastic #7122 and one 6-mil coat of black plastic #7122.

5. Variable-Speed Controller: Where scheduled on Drawings, provide solid-state control to reduce speed from 100 percent to less than 50 percent.
6. Disconnect Switch: Where not shown on Division 26, Electrical Drawings, provide nonfusible type, with thermal-overload protection mounted inside fan housing factory wired through an internal aluminum conduit.
7. Vibration Isolation: Wheel and motor mounted on integral double deflection neoprene isolators.

2.2 IN-LINE CENTRIFUGAL FANS

A. Manufacturers:

1. Greenheck
2. Cook
3. Twin City

B. Description: In-line centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Wheel: Cast aluminum backward inclined with inlet cone statically and dynamically balanced within its own bearings.

D. Housing:

1. Heavy gauge steel or aluminum housing, suitable for Fan Class, factory standard finish.
2. Removable panels for access to all interior components.
3. Horizontal or vertical configuration, as indicated.
4. Inlet and discharge duct collars.
5. 1-inch thick, 1.5 pounds per cubic foot density fiberglass liner.
6. Aluminum straightening vanes.
7. Support bracket adaptable to floor, sidewall, or ceiling mounting.

E. Bearings and Drives:

1. Bearings: Heavy duty pillow block type, self greasing ball bearings with ABMA 9 life at 50,000 hours.
2. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil.
3. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 5 hp and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 7.5 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of motor. Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
    a. Inverter duty motor for use with variable frequency drive where indicated on Fan Schedule on Drawings.
4. Drive: Direct drive matched to fan loads with speed controller. Motor encased in housing outside of airstream, factory wired to disconnect switch located on outside of fan housing.
    a. Electrically Commutated Motor (ECM) where indicated on Fan Schedule on Drawings.

F. Accessories:

1. Belt guard.
2. AMCA 99 Type B spark proof construction where scheduled.
3. Variable-Speed Controller: Provide solid-state control to reduce speed from 100 percent to less than 50 percent for motors 1/2 HP or smaller.
4. Discharge Dampers: Parallel blade for mixing or open/close applications and opposed blade for modulating . Heavy duty steel or aluminum, where scheduled. Damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever. Motorized where indicated and gravity actuated with counterweight, where motorized is not indicated.
5. Flat roof cap.
6. Hooded wall cap.
7. Pitched roof cap.
8. Elbow discharge with grille.
9. Louvered wall discharge with bird screen.

G. Inlet/Outlet Screens: Galvanized steel welded grid, removable.

H. Vibration Isolation: Wheel and motor mounted on integral double deflection neoprene isolators.

I. Vibration isolation as scheduled and specified. Reference Section 23 05 48, Vibration and Seismic Controls for HVAC Piping and Equipment.

1. Motor: Integrally mounted, 1800 RPM maximum, with pre-lubricated sealed ball bearings. ODP for motors located indoors and TEFC for motors exposed to moisture.

2.3 DRYER VENT EXHAUST FANS

A. Manufacturers:

1. Fantech Inc.
2. Tjernlund
3. Or approve equivalent.

B. Description: UL705-listed in-line dryer vent exhaust for suitable for high moisture, dust, and lint loadings. Suitable for temperatures up to 140 degrees F.

C. Housing constructed of galvanized steel.

D. Wheel: Backward curved impellers with venture inlet.

E. Suitable for gas dryers.

F. Accessories:

1. Secondary lint trap installed upstream of fan. Fantech DBLT4 or approved equivalent.
2. Automatic switch to turn on/off fan set at 0.05-inches WG with delay-on-break timer to maintain fan operation for up to 10 minutes after dryer is off.
3. Integral external electrical terminal box with Class B wiring and terminal strip.
4. Internally mounted capacitor.

2.4 HIGH VOLUME LOW SPEED FANS

A. Manufacturers:

1. Big Ass Fans
2. Kelley
3. MacroAir

B. General: Fan designed to move air for cooling, air movement, and destratification in large spaces. The fan and components designed specifically for high volume and low speed.

C. Comply with ANSI/AMCA 230-07.

D. Sound levels from the fan operating at maximum speed not to exceed 40dBA in accordance with ANSI/AMCA 230-07.

E. Fan blades: extruded aluminum, airfoil shape optimized for high airflow movement, winglets designed to direct outward airflow downward.

F. Motor: Constructed with permanent magnet brushless motor rated for continuous operation at maximum speed with capability of modulating the fan speed from 0 - 100 percent in 0 degrees F to 122 degrees F ambient conditions.

G. Mounting System: Designed for quick and secure installation from a structural support beam. All components in the mounting system to be stainless steel welded construction.

H. Provide stainless steel safety cables for additional means of securing the fan assembly to the building structure conditions.

I. Controller: Integral Variable Frequency Drive (VFD) pre-wired to the motor. The controller prewired to the motor.

J. Wall Control: Digital keypad device equipped with touchpad controls and an LCD for controlling the fan’s spin direction, operation, and speed. Communication between the fan drive and controller by standard CAT5 or higher Ethernet cable.

K. BAS/DDC Interface: Controller includes capability of monitoring and control by the BAS/DDC system, including control of fan on/off operation, speed, spin direction, status feedback, error reporting, and keypad lockout.

L. Provide corrosion resistant proofing on blades and frame, NEMA 4X controller enclosure.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with manufacturer's instructions.

B. Install power ventilators level and plumb.

C. Fans used for exhaust of kitchen grease hoods are to be UL 762 listed for grease exhaust. Provide fans with grease terminator. Pipe from grease terminator to Code approved location.

D. Fans used for exhaust of moist air are to be constructed of aluminum construction and be warranted for their application in moist conditions.

E. Fans used in welding, chemical, and/or fume exhaust applications are to be of spark-proof construction and are to be protected with coatings as required to protect parts in the air stream from the chemicals and materials the fan will be exposed to.

F. Install floor-mounting units on concrete bases.

G. Units using vibration isolation devices are scheduled on Drawings.

H. Support suspended units from structure threaded steel rods and vibration isolation device scheduled on Drawings.

I. In seismic zones, restrain support units.

J. Install units with clearances for service and maintenance.

K. Provide fixed sheaves required for final air balance.

L. Provide safety screen where inlet or outlet is exposed.

M. Pipe scroll drains to nearest floor drain.

N. Provide backdraft dampers on discharge of exhaust fans and as indicated on Drawings.

O. Duct installation and connection requirements are specified in other Division 23, HVAC Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors per Section 23 33 00, Air Duct Accessories.

P. Install ducts adjacent to power ventilators to allow service and maintenance.

Q. Ground equipment.

R. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

S. Equipment Startup Checks:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Verify lubrication from bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
7. Disable automatic temperature-control operators.

T. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.
2. Measure and record voltage and amperage.

U. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

V. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

W. Shut unit down and reconnect automatic temperature-control operators.

X. Replace fan and motor pulleys as required to achieve design airflow.

Y. Provide totally enclosed fan cooled motors when motor is located outdoors, whether under a cover or not, or exposed to moisture. Provide protective covering for electronically commutated motors located in outdoor or wet/wash-down locations.

Z. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

AA. Adjust damper linkages for proper damper operation.

BB. Adjust belt tension.

CC. Lubricate bearings.

DD. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

EE. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

FF. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC fans. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

3.2 ROOF EXHAUST FANS

A. Secure roof exhaust fans to roof curbs with cadmium-plated hardware.

3.3 HIGH VOLUME LOW SPEED FANS

A. Minimum distance above floor is 10-feet, in accordance with OSHA guidelines.

B. Minimum distance between fan and any obstructions such as lights, cables, conduit, piping, and building structure is 2-feet.

C. Minimum distance between fan and sprinkler deflectors is 3-feet.

D. All fans are to be interlocked to shut down immediately upon receiving a water flow signal from the alarm system, in accordance with the requirements of NFPA 72.

END OF SECTION 23 34 00

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Grilles, Registers, Diffusers
2. Louvers

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size and accessories furnished.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Air Distribution Diffuser, Register, and Grille Schedule lists Basis of Design, with any specialty accessories, construction, finish or other criteria noted on schedule. Submitted air distribution must match criteria of Basis of Design:
    a. Construction materials and appearance.
    b. Frame/installation method.
    c. Isothermal throw plus or minus 5 percent at design flows shown on drawings.
    d. Noise Criteria: NC value plus or minus 1 at design flows shown on drawings.
    e. Accessories: Equal to Basis of Design.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 23, HVAC sections, where more than a single type is specified for the application, provide single selection for each product category.

B. Grilles, Registers, Diffusers:

1. Anemostat
2. Carnes
3. Environmental Air Products
4. Krueger
5. Metalaire
6. Nailor
7. Price Co.
8. Shoemaker
9. Titus
10. Tuttle & Bailey
11. Seiho
12. Or approved equivalent.

C. Louvers:

1. Ruskin Manufacturing
2. Pottorff
3. Carnes
4. Cesco
5. Greenheck
6. Or approved equivalent.

2.2 GRILLES, REGISTERS, DIFFUSERS

A. Diffuser, Register and Grille Schedule lists Basis of Design, with specialty accessories, construction, finish or other criteria noted on schedule. Submitted air distribution must match criteria of Basis of Design, including accessories and finish:

1. Matching construction materials and appearance. Equal installation method/frame.
2. Pressure drop equal to or less than Basis of Design at CFM on Drawings.
3. Throw: Isothermal jet throw plus or minus 5 percent of Basis of Design at CFM listed on Drawings.
4. Noise Criteria: Plus or minus 1 NC of Basis of Design at CFM listed on Drawings. If Basis of Design NC is below registered level, submitted must match. NC rating with 10 dB room factor or less.

B. Provide 1-, 2-, 3-, or 4-way deflection as indicated on Drawings.

C. Provide pattern controllers for linear supply air diffusers.

D. Register Dampers: Dampers utilized with grilles. Opposed blade dampers utilizing a side operated worm drive which provides external duct operation. Slot the end of the shaft to receive a screwdriver. Factory assembled side operator. Construct of the same material as the grille. Manufacturer same as grilles/diffuser.

E. Coordinate mounting frames with ceiling construction type. Verify per reflected ceiling plans.

2.3 LOUVERS

A. General: Frame and sill styles compatible with adjacent substrate, specifically manufactured to fit into construction openings with accurate fit and adequate support for weatherproof installation. Reference Drawings and Specifications for types of substrate which will contain each type of louver. Construct of aluminum extrusions, ASTM B221, Alloy 6063-T5. Weld units or use stainless steel fasteners. On inside face of exterior louvers, provide anodized aluminum wire bird screen mounted in removable extruded aluminum frames. AMCA licensed performance ratings.

B. Blades set 3 to 5-inches on center, 37.5 degree angle with rain hook on blade, minimum blade thickness 0.080-inch, drainable blade style. Minimum 57 percent free area for 48-by 48-inch unit. Maximum water penetration 0.01 ounce water psf free area at 1000 FPM. Maximum intake pressure drop of 0.10-inch wg at 750 FPM free velocity. Provide downspouts in jambs, designed to drain water from louver for minimum water cascade from blade to blade. Provide drain gutter in head frame and each blade.

C. Reference Drawings for free area required.

D. Provide access door in duct to clean birdscreen.

E. Finish: Factory Kynar 500 fluoropolymer spray finish; color to be selected by Architect. Conform to AAMA 605.2. Apply coating following cleaning, and pretreatment. Dry louvers before final finish application. 1.2 mils total dry film thickness when baked at 450 degrees F for ten minutes.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install in accordance with manufacturer's instructions. Provide seismic supports, clips, and bracing per local code. Coordinate installation of framing. Provide complete coverage of rough openings by integral device flanges or auxiliary frames. Where above ceiling location is unconditioned space, caulk rough openings; repair and re-paint locations where dust entrainment streaks develop due to unsealed openings.

B. Damp locations, such as lockers, restrooms, showers, natatoriums, whirlpool/spas, to have aluminum construction even if scheduled otherwise; mounting hardware to be stainless steel.

C. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

D. Unless otherwise shown on drawings, for ceiling mounted air outlets with adjustable airflow pattern controllers mounted at a height of 12 feet or less, adjust the air outlets for horizontal air distribution, and adjust to vertical air distribution for ceiling height above 12 feet.

E. Exterior color of grilles per Architect. White finish if not otherwise scheduled or noted by Architect. Paint ductwork visible behind air outlets and inlets matte black.

F. Ceiling Membrane: Protect ceiling membrane per code. Fire caulk around openings. Provide listed radiation damper in rated roof/ceiling or floor/ceiling assemblies as required per code.

G. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

3.2 GRILLES, REGISTERS, DIFFUSERS INSTALLATION

A. Coordinate with Architectural Reflected Ceiling Plan(s). Reflected ceiling plans determine final locations.

B. Install diffusers to ductwork with air tight connection. 18-inch straight duct section or acoustic plenum at connection. Provide square to round adapters where required for connection to round ducts.

C. Provide integral balancing dampers for diffusers, and grilles and registers where duct manual balancing dampers are not shown or specified.

D. Linear Slot Diffusers:

1. Coordinate connection plenum dimensions with linear slot final dimensions to conform with manufacturer's recommendations, or as indicated. Total and active lengths as noted on drawings. Blank off unused sections. Coordinate frame type with Architect.
2. Paint surfaces visible behind air outlets and inlets, including blank-off sections, matte black unless otherwise called for on drawings.

END OF SECTION 23 37 00

SECTION 23 52 00 - HEATING BOILERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Electric Boilers

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment
2. Section 23 09 00, Instrumentation and Control Performance Specifications
3. Section 23 21 16, Hydronic Piping Specialties

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Data: Provide data indicating general assembly, components, controls, safety controls, flue venting system, and wiring diagrams with electrical characteristics and connection requirements, and service connections.
2. Shop Drawings: Indicate general assembly, components, controls, flue venting, safety controls, and wiring diagrams with electrical characteristics and connection requirements, and service connections.
3. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.
4. Manufacturer's Field Reports: Indicate condition of equipment after start-up including control settings and performance chart of control system.
5. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
6. Provide documentation indicating compliance with local air quality management district.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this Section, with minimum three years of documented experience.
2. Installer Qualifications: Company specializing in installing and servicing the products specified in this Section, with minimum three years of documented experience and approved by manufacturer.
3. Air Quality: Provide documentation showing compliance with local Air Quality Management District.
4. Equipment must meet local air quality management district requirements. Do not bid equipment that does not comply.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Vertical Tubeless Boiler: 5-year material and workmanship on pressure vessel.
2. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Electric Boilers:

1. Bryan Steam LLC/Bryan Boiler
2. Cleaver-Brooks
3. INDEECO
4. Coates
5. Lochinvar
6. Aerco Benchmark E

2.2 ELECTRIC BOILERS

A. Manufactured Units:

1. Description: Electric hot water boiler completely packaged, factory assembled, ready for operation except for connections of piping and electrical connections.

B. Fabrication:

1. Assembly: Welded steel shell; heater support nipples or flanges; inspection handhole; necessary fittings to accept gauges, safety and operating controls; threaded or flanged inet and outlet connections; inlet diffuser; and lifting lugs, conforming to ASME (BPV IV) and ASME (BPV VIII, 1) requirements, and tested for maximum working pressure of 160 PSI.
2. Heating Elements: Threaded or flanged, incoloy sheathed, with maximum density of 75W/sq. in. suitable for operation at 160 PSIG. Attach each element to tube sheet by mechanical assembly permitting single elements to be replaced without replacing entire tube bundle.
3. Enclose in galvanized steel jacket with factory applied baked enamel, insulated with 2 inch thick fiberglass insulation.

C. Trim:

1. ASME rated pressure relief valve set at 45 PSI.
2. Assemble with pressure gauge, thermometer in brass separable well, automatic air vent, and drain valve.
3. Low water cut-off with manual reset and inlet flow switch to automatically prevent operation when water falls below safe level or on low flow through boiler.
4. Operating temperature controller with outdoor reset with remote bulb in brass separable well to control heating elements to maintain supply water temperature.
5. Electronic operating temperature controller with full cover for wall mounting, ambient temperature range minus 30 degrees F to 150 degrees F, adjustable reset ration of outside air temperature change to discharge control point change 1:2 to 100:1, integral set point adjustment 80 degrees F to 230 degrees F, electronic primary and outdoor sensors, for on-off switching of pilot duty relays.
6. High limit temperature controller with automatic reset to prevent boiler water temperature from exceeding safe system temperature.

D. Controls:

1. Provide pre-wired, factory assembled electric controls enclosed in NEMA 250, Type 1 cabinet, factory mounted integral with unit.
2. Controls include:
   a. Unfused disconnect switch with door interlock.
   b. Splitter arrangement and fused magnetic contactors for each element.
   c. Fused control circuit transformer with control circuit on/off switch.
   d. Proportioning step controller.
   e. Remote bulb operating thermostat complete with brass separable well.
   f. Remote bulb high limit thermostat complete with brass separable well.
   g. Pilot lights for each step of control.
3. Peak load control system.
   a. Pump motor starter auxiliary contact.
   b. Flow switch.
   c. Remote mounted three wire temperature controller.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install boiler in accordance with manufacturer’s instructions.

B. Provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes, and fuel oil tanks. Pipe gas vents to atmosphere.

C. Boilers Installed in Battery: Do not install boilers closer than 48-inches from each other, except boilers that operate at up to 2,000,000 BTU/hr, installed according to manufacturer's instructions.

D. Provide connection to fuel oil tanks and pumps as indicated.

E. Install boiler on concrete housekeeping base, sized minimum 4-inches larger than boiler base.

F. Provide piping connections and accessories as indicated. Reference Section 23 21 16, Hydronic Piping Specialties.

G. Pipe relief valves to nearest floor drains.

H. Pipe relief valves to outdoors.

I. Install circulator on boiler.

J. Provide for connection to electrical service.

K. Provide all wiring between control panels and devices and unit.

L. Mount thermometer in boiler breeching within 12-inches of flue nozzle.

M. Pipe boiler drains to nearest floor drains.

N. Provide boiler within pre-manufactured skid including: Outdoor enclosure, pumps, piping and appurtenances, meters and gauges, and vibration isolation devices.

O. System Start-Up:

1. Provide the services of manufacturer's field representative for starting and testing unit.
2. After installation and pipe flushing, boil out boilers using chemical and procedure as recommended and supervised by boiler manufacturer.
3. Manufacturer shall provide report verifying that boilers have been inspected, cleaned and tested according to their recommendations.

P. Closeout Activities:

1. Train operating personnel in operation and maintenance of units.
2. Provide the services of manufacturer's field representative to conduct training.

Q. Boiler Shutdown:

1. Remote switch: Install shutdown switch to disconnect power to the boiler burner controls and gas service in room. Install pushbutton under clear, impact-resistant flip lid. Provide red phenol label "Emergency Shutdown" locate label above pushbutton. Mount pushbutton by latch side of each boiler/mechanical room door within interior of the room, unless otherwise directed by AHJ. Provide electrical wiring and raceway as necessary for installation. Provide additional relays and wiring to cut power to gas solenoid valves in the room not integral to boilers. Reference Drawings for gas solenoid valve locations.
2. For gas fired boilers and/or water heaters located in a Refrigeration Machinery Room, shut down all gas fired equipment on refrigerant leakage.

END OF SECTION 23 52 00

SECTION 23 57 00 - HEAT EXCHANGERS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Plate and Frame Type Heat Exchangers

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. ASME Compliance: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels."
2. AHRI Standard 400 for liquid to liquid heat exchangers.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Data: Provide data with dimensions, locations, and size of tappings and performance data.
2. Shop Drawings: Indicate dimensions, locations, and size of tappings and performance data.
3. Design Data: Indicate in sufficient detail to verify that heat exchangers meet or exceed specified requirements.
4. Test Reports: Indicate tube bundle pressure tests.
5. Certificates - Heat Exchangers: ASME Compliance: Fabricate and label heat exchangers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels."
6. Manufacturer's Instructions: Indicate installation and support requirements.
7. Operation and Maintenance Data: Include start up and shut down instructions, assembly drawings, and spare parts lists.
8. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
9. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
10. See Division 01, General Requirements, Product Requirements, for additional provisions.
11. Plate Type Heat Exchanger Specialty Tools: One set of wrenches for disassembly.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

PART 2 - PRODUCTS

2.1 PLATE AND FRAME TYPE HEAT EXCHANGERS

A. Manufacturers:

1. Tranter
2. Alfa Laval
3. Armstrong Fluid Technology
4. Bell & Gossett
5. Taco
6. APV
7. Triangle Tube

B. General: Plate and frame heat exchanger to consist of frame, plates, piping connections, compression bolts and gaskets. Provide heat exchanger rated in accordance with ASME Section VIII, Division 01 for 150 PSIG working pressure.

C. Frames: Carbon steel with baked epoxy enamel paint, ASTM A666 Type 316 stainless steel side bolts and shroud. Provide frame sized for addition of 15 percent more plates. Piping connections suitable for grooved plate piping fittings where grooved piping is specified.

D. Plates: Titanium or Hastelloy C22.

E. Gaskets: EPDM.

F. Nozzles: Rated for 150 percent of maximum system operating pressure, rated lined flange type.

G. Piping connections to be flanged whole assembly to be rated to 150 PSIG working pressure. Connections equal to or less than 2-inches to be stainless steel NPT type.

H. Provide insulated closure panel complying with OSHA requirements.

I. Provide lifting lugs and ball bearing assemblies for tightening and untightening of unit.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer's written instructions and requirements and seismic requirements.

B. See articles below for specific requirements.

3.2 PLATE AND FRAME TYPE HEAT EXCHANGERS INSTALLATION

A. Install to permit removal of plates with minimum disturbance to installed equipment and piping. Provide unions, pipe offsets, etc. to allow for isolation of unit and repairs/replacement without cutting/welding of piping.

B. Support heat exchangers from structure.

C. Pipe drain valves to nearest floor drain.

D. Water Inlets and Outlets: Per piping diagram on Drawings. Thermometer and sensor wells, pressure gauge tappings, strainer on inlet piping.

E. Heated Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure and temperature relief valve, valved drain.

F. Clean and flush heat exchanger before final fill. After completing system installation, including outlet fitting and devices, inspect ex-posed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

G. Make piping connections so that unit does not support pipe weight and piping does not interfere with plate removal and maintenance.

END OF SECTION 23 57 00

SECTION 23 72 23 - PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Outdoor Packaged Energy Recovery Units
    a. Shipping and Handling
    b. Factory Testing
    c. Cabinet, Casing and Frame
    d. Supply and Exhaust Fans
    e. Variable Frequency Drives
    f. Electrical
    g. Fixed Plate Recovery Core
    h. Electric Heating
    i. Filters
    j. Dampers
    k. Outside Air Intake Hood
    l. Roof Curb
    m. Packaged Controls
2. Indoor Packaged Energy Recovery Ventilators
    a. Cabinet
    b. Blowers
    c. Fixed Plate Heat Exchanger
    d. Isolation Dampers
    e. Filter
    f. Electrical
    g. Controls

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment (with Addendum 1).
2. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils (with Addenda 1, 2 & 3).
3. ANSI/AHRI Standard 340/360 - Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
4. AHRI 1060 I-P - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.
5. ASHRAE Standard 84 - Method of Testing Air-to-Air Heat/Energy Exchangers.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, electrical characteristics and connection requirements.
2. Certified fan performance curves with system operating conditions indicated.
3. Certified fan sound-power ratings.
4. Filters: Data for filter media, filter performance data.
5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Interior surfaces of units meet erosion and growth resistance requirements of ASHRAE 62.1, latest edition, as well as construction requirements for equipment.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. AHRI Certification: Provide AHRI certified and listed units.
4. Sound Power Level Ratings: Comply with AHRI 270, Sound Performance Rating of Outdoor Unitary Equipment (with Addendum 1).
5. Entire unit to be ETL Certified per UL Standard 1995 and bear an ETL sticker.
6. Energy wheel to be AHRI 1060 I-P certified.
7. Performance: Scheduled capacities and face areas are minimum accepted values. Scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Provide total 5 years manufacturer's warranty for compressor(s) parts only.
2. Provide minimum 10 year manufacturer warranty on energy core.

1.7 EXTRA MATERIAL

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set for each belt-driven fan.
2. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 OUTDOOR PACKAGED ENERGY RECOVERY UNITS

A. The following manufacturers will be considered provided they comply with Contract Documents:

1. American Aldes
2. Greenheck
3. AAON
4. Semco
5. Renewaire
6. Valent ERC (ERV-2 only)

B. Shipping and Handling:

1. Provide each unit completely factory assembled and shipped in one piece.
2. Ship packaged units fully charged with refrigerant as scheduled.
3. Units to have decals and tags to indicate caution areas and aid unit service.
4. Provide unit nameplates fixed to the main control panel door.
5. Provide electrical wiring diagrams attached to the control panels.
6. Provide installation, operating and maintenance bulletins and start-up forms supplied with each unit.

C. Factory Testing:

1. The unit to undergo a complete factory run test prior to shipment. Factory test sheets to be shipped with unit.

D. Cabinet, Casing, and Frame:

1. Provide specifically designed for outdoor rooftop application with weatherproof cabinet.
2. Standard double-wall construction for sidewall access doors and floor areas to be provided with 22 gauge solid galvanized steel inner liners to protect insulation during service and maintenance. Provide a minimum of 2-inch thick, 3/4-pound density Insulation, neoprene coated glass fiber or foam injected insulation with a minimum density of 2 pounds per cu.ft. Design unit cabinet to operate at total static pressures up to 6.5-inches wg. Insulation on ceiling and end panels secured with adhesive and mechanical fasteners.
3. Exterior surfaces constructed of pre-painted galvanized steel for aesthetics and long term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat. Finished surface to withstand a minimum 1000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.
4. Provide service doors for access to all unit components. Service doors constructed of heavy gauge galvanized steel with a galvanized steel interior liner. Service doors mounted on multiple, stainless steel hinges and secured by a latch system that is operated by quarter turn handles.
5. Provide lifting brackets with lifting holes to accept cable or chain hooks.

E. Supply and Exhaust Fans:

1. Provide fan assemblies statically and dynamically balanced at the factory, including a final trim balance, prior to shipment. Provide fan assemblies to employ solid steel fan shafts. . Provide bearings sized to provide an L-50 life at 200,000 hours. Entire fan assembly to be isolated from the fan bulkhead and mounted on isolators.
2. Provide heavy-duty premium efficiency fan motors, 1800 rpm open drip-proof (ODP) type with grease lubricated ball bearings with external lubrication points.
3. Provide supply and exhaust air fans with an expanded metal belt guard if belt-driven fan.

F. Variable Frequency Drives:

1. Provide independent variable frequency drive for the supply and exhaust air fan.
2. Line reactors or DC bus choke to be factory installed for each drive.

G. Electrical:

1. Unit wiring to comply with NEC requirements and with applicable UL standards. Electrical components to be UL recognized where applicable. Wiring and electrical components provided with unit to be number and color-coded and labeled according to the electrical diagram provided for easy identification. Provide unit with a factory wired weatherproof control panel. Unit to have a single point power terminal block for main power connection. Provide terminal board for low voltage control wiring. Supply and return fan motors to have contactors and external overload protection.
2. Phase failure and under voltage protection on three-phase motors provided to prevent damage from single phasing, phase reversal, and low voltage conditions.
3. The unit manufacturer to install power and control wiring.
4. Provide ground fault protection to protect against arcing ground faults.
5. Provide the following accessories:
   a. Provide single factory wired non-fused disconnect switch for disconnecting electrical power at the unit.

H. Fixed Plate Recovery Core:

1. Fixed plate recovery coreexchanger constructed with aluminum.

I. Electric Heating:

1. Provide factory installed staged electric heating coils.
2. Safety controls to include automatic reset high temperature limit control.
3. Provide electric heat elements controlled by the factory installed main unit control system.

J. Filters:

1. Provide 2-inch thick pleated panel filters with efficiency or MERV 13 rating as scheduled. Provide filters frame mounted and to slide into galvanized steel racks contained within the unit. Provide filter racks to protect both sides of energy recovery device.
2. Provide filters with antimicrobial treatment.

K. Dampers:

1. Provide outside air dampers sized to handle 100 percent of the supply air volume. Provide low leak dampers. Provide damper blades with rubber edge and end seals. Damper leakage to be less than 0.2 percent at 1.5-inches static pressure differential. Low leak damper to be Class 2 per AMCA Standard 511.

2. Control of the dampers by a factory installed actuator.

L. Outside Air Intake Hood:

1. Provide unit with a 100 percent outdoor air hood. Factory install outdoor air hood and construct from galvanized steel finished with the same durable paint finish as the main unit. Hood to include a bird screen to prevent infiltration of foreign materials and a rain lip to drain water away from the entering air stream.

M. Roof Curb:

1. A prefabricated 12 gauge galvanized steel, mounting curb, designed and manufactured by the unit manufacturer, provided for field assembly on the roof decking prior to unit shipment. Roof curb to be a full perimeter type with complete perimeter support of the air handling section and rail support of the condensing section. Provide supply and return opening duct frames as part of the curb structure allowing duct connections to be made directly to the curb prior to unit arrival. Curb to be a minimum of 16-inch high and include a nominal 2-inch by 4-inch wood nailing strip. Provide gasket for field mounting between the unit base and roof curb.
   a. Curb to include seismic vibration isolation with 2-inch static deflection.

N. Packaged Controls:

1. Equip each unit with a complete microprocessor based control system. Unit control system to include required temperature and pressure sensors, input/output boards, unit controller and operator interface. Unit control system to perform unit control functions including scheduling, unit diagnostics and safeties. Boards to be individually replaceable for ease of service. Microprocessors, boards, and sensors to be factory mounted, wired and tested.
2. Unit controller to be capable of stand-alone operation with unit configuration, set point adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling. Unit controller to maintain existing set points and operate stand alone if the unit loses remote communication. Protect unit controller from voltage fluctuations as well as any extended power failures with UPS battery backup. Factory and user set schedules and control points maintained in nonvolatile memory.
   a. Main microprocessor to support an RS-232 direct connection to a product service tool or a modem.
   b. Provide BACnet Ethernet communications port for direct communication into the BMS network. Each unit to have the ability to accept a time schedule via BMS network communications. The independent BMS system to have access to "read only" variables and "read and write" variables.
   c. Provide integral controls to prevent frost forming on energy core.
   d. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, push button override, and occupancy scheduling to be accomplished with an interface module with LCD screen and input keypad.
   e. The display character format to be minimum 20 characters by 4 lines. Display to be liquid crystal display (LCD) providing high visibility. Display form to be in plain English coded formats.
3. Unit controller to include the following functions:
   a. Display supply, outdoor and space air temperature, current time and date.
   b. Control modes include manual on/off, auto, heat to prevent low temperature delivery, and fan only.

c. Provide occupied/unoccupied time schedules with allowances for holiday/event dates and duration.

2.2 INDOOR PACKAGED ENERGY RECOVERY VENTILATORS

A. The following manufacturers will be considered provided they comply with Contract Documents:

1. Daikin
2. Mitsubishi
3. LG
4. Renewaire

B. Unit Cabinet:

1. The cabinet will be fabricated of galvanized steel.
2. Insulated with 2-inch-thick, 3/4-pound density, neoprene-coated glass fiber or polyurethane foam insulation.

C. Blowers:

1. Furnish with direct drive centrifugal blowers for supply and exhaust.
2. Blower motors directly connected to the blower wheels and have permanently lubricated bearings.
3. Blowers and motors mounted on isolators for quiet operation.

D. Fixed Plate Heat Exchanger:

1. Heat exchanger element constructed of specially treated cellulose fiber membrane separated by corrugated layers or aluminum to allow sensible and latent energy recovery.

E. Isolation Dampers:

1. Provide low leak insulated dampers on exhaust and outside air with actuators interlocked with fan operation.

F. Filter:

1. The heat exchanger will have protective filters installed at both the supply and exhaust sides with an access cover to allow easy maintenance.
2. Provide MERV 8 filters.

G. Electrical:

1. Unit wiring to comply with NEC requirements and applicable UL standards. Unit to have single point power terminal block for main power connection.
2. The unit manufacturer to install power and control wiring.
3. Provide ground fault detection.

H. Controls:

1. Provide unit controller capable of stand-alone operation. Unit control system to perform unit control functions including scheduling, unit diagnostics and safeties. Unit controller, and sensors to be factory mounted, wired and tested.

2. Provide controller with display for unit configuration, set point adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling.
3. Provide external control from VRV centralized controller or BMS.
4. Controller provides the following functions:
    a. Heat recovery mode: Ventilation air and exhaust air pass through energy recovery core and bypasses are closed.
    b. Bypass mode: Outdoor air bypasses the core and is supplied from the unit.
    c. Auto mode; automatically changes between the bypass and heat recovery modes based on space and outside air temperature.
    d. Night purge.
    e. Adjustable fan speed control.
    f. Scheduling.

PART 3 - EXECUTION

3.1 OUTDOOR PACKAGED ENERGY RECOVERY UNITS

A. General Installation Requirements:

1. Install in accordance with manufacturer's instructions.
2. Use touch-up paint to repair scratches and minor damage to equipment prior to start-up.
3. Duct installation requirements are specified in other Division 23, HVAC sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:
    a. Install ducts to termination in roof curb.
    b. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
    c. Terminate exhaust-air duct through roof structure.
4. Supply and Exhaust Fans:
    a. Install in accordance with Construction Documents, manufacturer's written requirements and instructions.
5. Variable Frequency Drives:
    a. Install in accordance with Construction Documents, manufacturer's written requirements and instructions.
6. Electrical:
    a. Electrical System Connections: Comply with applicable requirements in Division 26, Electrical Sections for power wiring, switches, and motor controls.
    b. Ground equipment according to Division 26, Electrical.
    c. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
7. Electric Heating:
    a. Remove debris and clean heating elements.
8. Filters:
    a. Provide access for filter installation.
    b. Install in accordance with Construction Documents, manufacturer's written requirements and instructions.
9. Dampers:
    a. Install in accordance with Construction Documents, manufacturer's written requirements and instructions.
10. Outside Air Intake Hood:
    a. Install in accordance with Construction Documents, manufacturer's written requirements and instructions.

11. Roof Curb:
    a. Roof curb to be mounted level on roof in accordance to NRCA manuals and details. Secure to structure per engineered/sealed seismic installation details.
    b. Unit to be secured to curb per seismic installation details.
    c. Provide to external vibration isolation or isolation curb to prevent transmission of unit-borne sound to building structure. Provide flexible connections for electrical power and fuel piping.
    d. Seal openings between curb and building interior.
    e. Protect the roof from damage during installation.
    f. Fill void between roof and bottom of unit with 3-pound density acoustic batt.
    g. Install normal-weight, 3000 PSI (20.7 MPa), compressive strength (28-day) concrete mix inside roof curb, 4-inches thick.
12. Packaged Controls:
    a. Control wiring from roof-mounted equipment must be routed in conduit from above roof to inside building or must be routed through roof curb inside unit. Control wiring must not be exposed to weather.
    b. Install factory provided control sensors and wire to unit controller.

B. Field Quality Control:

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
2. Perform the following field quality-control tests and inspection and prepare test reports:
    a. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
    b. Inspect for and remove shipping bolts, blocks, and tie-down straps.
    c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
    d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Remove malfunctioning units, replace with new units, and retest as specified above.
4. Startup Service:
    a. Engage a factory-authorized service representative to perform startup service.
    b. Protect or remove energy recovery devices prior to starting the units to insure damage does not occur to the devices or media. Replace at no cost to Owner if devices/media get damaged.
    c. Complete installation and startup checks according to manufacturer's written instruction and do the following;
        1) Inspect for visible damage to unit casing.
        2) Inspect internal insulation.
        3) Verify that labels are clearly visible.
        4) Verify that clearances have been provided for servicing.
        5) Verify that controls are connected and operable.
        6) Verify that filters are installed.
        7) Adjust vibration isolators.
        8) Inspect operation of barometric dampers.
        9) Lubricate bearings on fan.
        10) Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
        11) Adjust fan belts to proper alignment and tension.
        12) Start unit according to manufacturer's written instructions.
            a) Start refrigeration system in summer only.

b) Complete startup sheets and attach copy with Contractor's startup report.

13) Inspect and record performance of interlocks and protective devices; verify sequences.
14) Operate unit for an initial period as recommended or required by manufacturer.
15) Adjust and inspect low-temperature limits.
16) Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
17) Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
18) After startup and performance testing, change filters, vacuum heat exchanger and cooling outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

5. Adjusting:
   a. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
6. Demonstration:
   a. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners. Reference Division 01, General Requirements.

3.2 INDOOR PACKAGED ENERGY RECOVERY VENTILATORS

A. General Installation Requirements:

1. Install in accordance with manufacturer’s instructions.
2. Use touch-up paint to repair scratches and minor damage to equipment prior to startup.
3. Provide seismic restraint, as necessary.
4. Install with required clearances and access for maintenance.
5. Install factory furnished devices for field installation.

B. Electrical:

1. Electrical System Connections: Comply with applicable requirements in Division 26, Electrical Sections for power wiring, switches, and motor controls.
2. Ground equipment according to Division 26, Electrical.
3. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

C. Controls:

1. Connect to BMS or VRV Controller.

D. Field Quality Control:

1. Inspect for and remove shipping bolts, block and tie-down straps.
2. After energizing units: Test units for proper fan rotation. Test and adjust controls and internal safeties.
3. Replace malfunctioning units and retest.
4. Thoroughly clean exposed portions of equipment. Install new filters prior to final test and balance and again prior to final acceptance.

END OF SECTION 23 72 23

SECTION 23 74 00 - ROOFTOP PACKAGED AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Materials, installation and testing of roof-mounted, packaged direct expansion air conditioning units in the following configuration:

1. Rooftop Packaged Air Conditioning Units, Constant Volume (up to 20 tons).

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
2. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment (with Addendum 1).
3. AHRI 340/360 - Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
4. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils (with Addenda 1, 2 & 3).
5. AHRI 1060 I-P - Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following

1. Interior surfaces of units to meet erosion and growth resistance requirements as well as construction requirements for equipment of ASHRAE 62.1, latest edition.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Fabricate and label refrigeration system to comply with ASHRAE 15, Safety Code for Mechanical Refrigeration.
4. Energy-Efficiency Ratio: Meet minimum requirements shown on Drawings.
5. Coefficient of Performance: Meet minimum requirements shown on Drawings.

6. Comply with NFPA 54 for gas-fired furnace section. Classified in accordance with ANSI Z 21.47.
7. AHRI Certification: Provide AHRI certified and listed units.
8. AHRI Compliance for Units with Capacities Less Than 135,000 Btuh (39.6 kW): Rate rooftop air-conditioner capacity according to AHRI 210/240, Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
9. AHRI Compliance for Units with Capacities 135,000 Btuh (39.6 kW) and More: Rate rooftop air-conditioner capacity according to AHRI 340/360, Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
10. Sound Power Level Ratings: Comply with AHRI 270, Sound Performance Rating of Outdoor Unitary Equipment (with Addendum 1).

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Provide total 5 years manufacturer's warranty for compressor(s), including parts and labor.
2. Provide 5 year manufacturer warranty on heat exchanger.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set for each belt-drive fan.
2. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 ROOFTOP PACKAGED AIR CONDITIONING UNITS, CONSTANT VOLUME (UP TO 20 TONS)

A. Manufacturers:

1. Trane Company
2. York/JCI
3. Daikin Applied
4. AAON
5. Valent
6. FloAire

B. Description: Factory assembled and tested; designed for outdoor installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, electric auxiliary heating coil, filters, dampers and other accessories/devices listed in this specification and the drawings.

C. Provide marine environment construction including cabinet and coil coatings.

D. Casing: Galvanized steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 3/4-inch thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs. Double wall construction. Finished panel surfaces to withstand a minimum 1000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance. Unit base to overhang the roof curb for positive water runoff and to seat on the roof curb gasket to provide a positive weather tight seal.

E. Indoor Fan:

1. Double width, double inlet (DWDI) forward curved or backward incline curved aluminum, centrifugal, directly driven by multispeed motor.
2. Fan assembly to have adjustable pitched sheaves on the motor. Bushings to be used on sheaves to allow for easy removal of the pulleys from the fan and motor shaft. Fixed bore pulleys fastened to the shaft by setscrews will not be allowed. Drives selected with a 1.2 service factor.
3. Fan assemblies statically and dynamically balanced at the factory, including a final trim balance, prior to shipment. Fan assemblies to employ solid steel fan shafts. Bearings sized to provide a L-50 life of 250,000 hours.
4. Provide fan motors heavy-duty, 1800 rpm, open drip-proof (ODP). Motors efficiencies to meet EPAct premium efficiencies. Motors mounted on an adjustable base that provides for proper alignment and belt tension adjustment.
5. Fan design to allow for the fan and motor assembly to slide out of the rooftop unit for ease of servicing the equipment.
6. VFD driven variable speed premium effieciency motors.

F. Outside Coil Fan: Condenser fans to be direct drive, axial type designed for low tip speed and vertical air discharge. Condenser fan rpm to be 1140 rpm maximum. Fan blades constructed of steel and riveted to a steel center hub. Condenser fan motors to be heavy-duty, non reversing type with permanently lubricated ball bearing and thermal protection. Motor design to be totally enclosed air over (TEAO).

G. Refrigerant Coils: Copper fin and seamless copper tube in steel casing with equalizing-type vertical distributor. Provide phenolic epoxy corrosion-protection coating to both coils. Coils factory leak tested with high pressure air under water. Provide condenser coils protected from incidental contact to coil fins by a coil guard.

H. Compressor: Number as scheduled. Hermetic scroll compressor with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief. Lead refrigeration circuit to use Digital Scroll compressor capable of 10:1 turndown. Lead refrigeration circuit to be provided with hot gas bypass.

I. Refrigeration System: Air conditioning and heat pump reversing primary heating.

1. Compressor with an automatic-reset control that shuts compressor off after five minutes.
2. Outside coil and fan.
3. Indoor coil and fan.
4. Four-way reversing valve and suction line accumulator.
5. Thermal expansion valve with replaceable thermostatic element and liquid line filter drier.
6. Refrigerant dryer.
7. High-pressure switch.
8. Low-pressure switch.
9. Thermostat for coil freeze-up protection during low-ambient temperature operation or loss of air.

10. Low-ambient switch.
11. Brass service valves installed in discharge and liquid lines.
12. Refrigerant gauge parts.
13. Charge of refrigerant (R-454) and oil.
14. Independent refrigerant circuits where unit has multiple compressors.
15. Variable capacity scroll type compressors.

J. Drain Pan: Stainless steel, positively sloped drain pan provided with the cooling coil. Drain pan to extend beyond the leaving side of the coil and underneath the cooling coil connections. Drain pan to have a minimum slope of 1/8-inch per foot to provide positive draining. The slope of the drain pan to be in two directions and comply with ASHRAE Standard 62.1. Drain pan to be connected to a threaded drain connection extending through the unit base.

K. Filters: 4-inch thick pleated MERV 13 and 2-inch thick pleated MERV 8.

L. Electric Heat: Helix-wound, nickel-chrome, electric-resistance elements, factory wired for single-point wiring connection; with time delay for element staging, and overcurrent and overheat protective devices. Modulating SCR electric backup heating.

M. Outdoor/Return Air Section: A return air plenum to be provided with an outdoor air hood. Hood to allow outdoor air to enter at the back of the return air plenum. Hood to include moisture eliminator filters to drain water away from the entering air stream. Return air plenum to allow return air to enter from the bottom of the unit. Upon unit shut down during unoccupied periods, the outdoor air damper to be power driven closed.

N. Outside-Air Damper: Linked damper blades, for 0 to 30 percent outside air, with fully modulating, spring return damper motor. Upon unit shut down during unoccupied periods, the outdoor air damper to be power driven closed. Damper blades to be gasketed with side seals and jamb seals to provide an air leakage rate of no more than 4 cfm/square foot of damper area at 1-inch differential pressure per ASHRAE 90.1 Energy Standard. Leakage rate to be tested tin accordance with AMCA standard 500.

O. Energy Recovery: Polymer Energy Recovery Wheel.

P. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood. Upon unit shut down during unoccupied periods, the outdoor air damper to be power driven closed. Damper blades to be gasketed with side seals and jamb seals to provide an air leakage rate of no more than 4 cfm/square foot of damper area at 1-inch differential pressure per ASHRAE 90.1 Energy Standard. Leakage rate to be tested tin accordance with AMCA standard 500.

1. Economizer + Energy Recovery + Bypass Damper.
2. Damper Motor: Fully modulating spring return with adjustable minimum position.
3. Control: Electronic-control system uses outside-air temperature or mixed-air temperature and selects beween outside-air and return-air enthalpy to adjust mixing dampers.
4. Power Exhau

Q. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.

R. Electrical: Unit wiring to comply with NEC requirements and with applicable UL standards. Electrical components to be UL recognized where applicable. Wiring and electrical components provided with the unit to be number and color coded and labeled according to the electrical diagram provided for easy identification. The unit to be provided with a factory wired weatherproof control panel. Unit to have a single point power connection for main power connection. A terminal board to be provided for low voltage control wiring. Each compressor and condenser fan motor to be furnished with contactors and thermal overload protection. Supply fan motors to have a factory installed and wired control contactor. Knockouts to be provided in the bottom of the main control panels for field wiring entrance.

S. Unit Controls: Factory Controller Makeup Air Heat Pump - CV Cool + CV Heat. Solid-state control board and components contain at least the following features:

1. Indoor fan on/off relay.
2. Default control to ensure proper operation after power interruption.
3. Service relay output.
4. Unit diagnostics and diagnostic code storage.
5. Field-adjustable control parameters.
6. Defrost control.
7. Dehumidification control with dehumidistat.
8. Economizer control.
9. Electric heat SRC modulation.
10. Indoor-air quality control with carbon dioxide sensor.
11. Low-ambient control, allowing operation down to 0 degrees F (minus 18 deg C).
12. Minimum run time.
13. Night setback mode.
14. Return-air temperature limit.
15. Smoke alarm with smoke detector installed in supply and return air.
16. Low-refrigerant pressure control.
17. Digital display of outside temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

T. DDC: Install stand-alone control module providing link between unit controls and DDC system. Control module to be compatible with temperature-control system through BACnet interface for BMS connection, monitoring, temperature adjustment, and diagnosis.

U. Accessories:

1. Service Outlets: One, 115-V, ground-fault, circuit-interrupter type.
2. Condensate drain trap.
3. Dirty-filter switch.
4. Hail guards of steel, painted to match casing with matching corrosion protection.
5. Power Exhaust Fan: Centrifugal type. Direct drive with variable frequency drive.

V. Roof Curb:

1. Refer to Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment for spring isolation curb.
2. 14 gauge galvanized steel with corrosion-protection coating, gasketing, and factory-installed wood nailer; complying with NRCA standards; minimum height of 14-inches.
3. Isolation Curb: Rigid upper and lower steel structure with vibration isolation springs having 2-inch static deflection and vertical and horizontal restraints; with elastomeric waterproof membrane.

4. Insulate interior of the curb with 2-inches of 1.5 pound neoprene coated fiberglass insulation.
5. Provide seismic restraints to secure the unit to the curb in accordance with Code.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Examine areas and conditions under which units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Roof curb to be mounted level on roof in accordance to NRCA manuals and details. Secure to structure per engineered/sealed seismic installation details.

C. Unit to be secured to curb per seismic installation details.

D. Provide external vibration isolation or isolation curb to prevent transmission of unit-borne sound and vibration to building structure. Provide flexible connections for hot water piping, electrical power and fuel piping.

E. Seal openings between curb, roof opening, ducts, electrical conduits, piping, and building interior.

F. Protect the roof from damage during installation. Secure factory touch-up paint to repair scratches and minor damage to equipment prior to start-up. Comb evaporator and condenser coils to repair any minor fin damage.

G. Control wiring from roof-mounted equipment must be routed in conduit from above roof to inside building or must be routed through roof curb inside unit. Control wiring must not be exposed to weather.

H. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

I. Perform the following field quality-control tests and inspections and prepare test reports:

1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

J. Remove malfunctioning units, replace with new units, and retest as specified above.

K. Engage a factory-authorized service representative to perform startup service.

L. Protect or remove energy recovery devices prior to starting the units to ensure damage does not occur to the devices or media. Replace at no cost to Owner if devices/media get damaged or are no longer in "as-new" condition.

M. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, air-cooled outside coil, energy recovery devices, internal coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean outside coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Adjust vibration isolators.
13. Inspect operation of barometric dampers.
14. Lubricate bearings on fan.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.
    a. Coordinate starting of refrigeration system during winter with manufacturer.
    b. Complete startup sheets and attach copy with Contractor's startup report.
18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Calibrate thermostats.
21. Adjust and inspect high-temperature limits.
22. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
23. Start refrigeration system and measure and record the following:
    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outside-air, dry-bulb temperature.
    d. Outside-air-coil, discharge-air, dry-bulb temperature.
24. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
25. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outside-air intake volume.
26. Simulate maximum cooling and heating demand and inspect the following:
    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through outside coil or from outside coil to outside-air intake.
27. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:
    a. High-limit heat exchanger.
    b. Warm-up for morning cycle.
    c. Freezestat operation.
    d. Economizer to limited outside-air changeover.
    e. Alarms.
28. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

N. Adjust initial temperature, humidity, and CO2 set points.

O. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

P. Occupancy Adjustments: Within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

Q. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop air conditioners. Reference Division 01, General Requirements.

3.2 ROOFTOP PACKAGED AIR CONDITIONING UNITS, CONSTANT VOLUME (UP TO 20 TONS) INSTALLATION

A. Duct installation requirements are specified in other Division 23, HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination in roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Terminate return-air duct through roof structure.
4. Fill void between roof and bottom of unit with 3-pound density acoustic batt.
5. Install normal-weight, 3000 PSI (20.7 MPa), compressive strength (28-day) concrete mix inside roof curb, 4-inches thick.

B. Electrical System Connections: Comply with applicable requirements in Division 26, Electrical Sections for power wiring, switches, and motor controls.

C. Ground equipment according to Division 26, Electrical.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION 23 74 00

SECTION 23 81 26 - SMALL SPLIT SYSTEM AND UNITARY HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Materials, installation, and testing of:

1. Ducted and Ductless Split Systems - Heat Pumps

1.2 RELATED SECTIONS

A. Contents of Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. Efficiency ratings, cooling/heating performance, fan performance, sound performance to meet or exceed Basis of Design as scheduled on Drawings.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Refrigeration compressor(s): 5-year warranty.
2. Furnace heat exchanger: 5-year warranty.

PART 2 - PRODUCTS

2.1 DUCTED AND DUCTLESS SPLIT SYSTEMS - HEAT PUMPS

A. Manufacturers:

1. Mitsubishi
2. Sanyo
3. Daikin Applied
4. LG
5. Fujitsu
6. Samsung

B. Description: Self-contained, matched factory-engineered and assembled. Pre-wired indoor and outdoor units. UL/ETL listed.

C. Outdoor Unit:

1. Self contained, consisting of cabinet, compressor system, condenser fan matched to indoor unit.
2. Cabinet: Fabricated of galvanized steel, bonderized, and finished with powder coated baked enamel.
3. Refrigerant System:
   a. HFC refrigerant or other refrigerant with zero ozone depletion potential (ODP).
   b. Compressor: To be inverter driven, hermetic rotary type.
4. Air System:
   a. Fan: Propeller Type with one direct drive, inverter driven, variable speed motor.
   b. Motor: Premium efficiency with inherent protection, permanently lubricated bearings and variable speed drive compatible.
   c. Coil: Copper tubes and aluminum fins, coated for corrosion protection.
5. Controls: Single source for both indoor and outdoor units, with low/high pressure switch, capable of communicating to/from the building DDC control system.

D. Indoor Unit(s):

1. Self contained ducted, wall mounted, ceiling mounted or recessed ceiling mounted evaporator unit(s) as shown on Drawings, matched to outdoor unit.
2. Cabinet:
   a. Non-flammable, high impact polymer with a white finish.
   b. Power Source: To be a single point power connection or sub-fed from outdoor condensing unit.
3. Refrigeration System: HFC refrigerant or other refrigerant with zero ozone depletion potential (ODP).
4. Air System:
   a. Fan: An assembly with one or two inline fan(s) with a single direct drive motor.
   b. Filter: Polypropylene, furnished with the unit, removable and washable.
   c. Coil: Direct expansion type with copper tubes mechanically bonded into aluminum fins.
5. Condensate Drain:
   a. Provide drain pan sloped to drain away from unit. Drain pan with a single drain connection.
   b. Condensate pump kit provided with unit.

c. Secondary drain pan; Condensate overflow shut-off float switch or integral float switch on condensate pump and external alarm.

6. Controls: Wired thermostat. Control to be integral with unit. The unit to have PID controls provided by manufacturer to perform input functions necessary to operate the system. No third party building management system to be required; however, VRV/VRF or split heat pump systems to be provided with BACnet interface with third-party BMS/BAS system. Provide central command controller with graphic interface and link to BMS/BAS graphics user interface.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install with required clearances and access for maintenance.

B. Install factory furnished devices for field installation.

C. Inspect for and remove shipping bolts, blocks and tie-down straps.

D. After energizing units: Test units for proper fan rotation. Test and adjust controls and internal safeties. Replace malfunctioning units and retest.

E. Thoroughly clean exposed portions of equipment. Install new filters prior to final test and balance and again prior to final acceptance.

F. Provide vibration isolation: As scheduled.

G. Provide seismic restraint.

H. Condensate drain per manufacturer's piping diagram.

I. Condensate piped to indirect waste connection; cleanouts at changes of direction; sized and sloped to drain per Code. Secondary drain routed to visible location.

J. Shut-off/hose kits for all hydronic connections.

END OF SECTION 23 81 26

SECTION 23 81 43 - AIR SOURCE HEAT PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Air Source Modular Heat Pump Boiler

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
2. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment (with Addendum 1).
3. NRCA: Provide roof curbs in accordance with NRCA.

1.6 WARRANTY

A. Warranty of materials and workmanship as outlined in Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Refrigeration Compressor(s) - 5-year warranty.

1.7 PACKAGED TERMINAL HEAT PUMP MOCK-UP

A. Install one unit that includes inside cabinet, wall sleeve, and wall louver.

B. Locate where directed.

C. Mock-up may remain as part of work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Air Source Modular Heat Pump Boiler:

1. ClimaCool
2. Or approved equivalent.

2.2 AIR SOURCE MODULAR HEAT PUMP BOILER

A. Features: Unit to be set-up for heating only.

1. Electrical service - 460/3/60.
2. Water isolation valves and flush ports for service or maintenance without module removal.
3. Motorized valves are provided for step-variable flow operation.
4. 300 PSI rated grooved coupling header piping connections, 6-inch.
5. Individual power supply to each module for true operational redundancy.
6. Each module is pre-charged with refrigerant R-454B and factory run tested.
7. Dual scroll compressors on each module for reliability/redundancy.
8. Dual independent refrigerant circuits per module for reliability/redundancy.
9. Highly efficient, 316 stainless steel, dual circuited, brazed plate evaporator.
10. Air cooled condenser coils with aluminum fins and copper tubes.
11. Ultra quiet, high efficient, EC condenser fan with variable speed motors and integral head pressure control.
12. Reversing valves.
13. Compressor on/off switches for maintenance.
14. Weatherproof NEMA 4 starter/control panel with compressor contactors, control transformer, relays, safety/operating controls and DDC microprocessor controller.
15. Adjustable high and low pressure cut-outs.
16. ASHRAE 90.1 energy efficiency compliance.
17. Two equally sized on/off scroll compressors each module.

B. Furnish and Install with factory representative assistance:

1. CoolLogic Touch Control System includes NEMA Type 1 enclosure, control transformer, surge protection, convenience outlet, three position selector switch, power and fault indication, 32 Bit microprocessor controller, and BACnet BAS interface.
2. Mounting hardware kit.
3. Header grooved coupling kit.
4. Sound attenuator end panel kit.
5. 4.5-inch temperature sensors, well assemblies, conduit box, two per water loop.
6. Strainers for field installation: Minimum 60 mesh first pass, one required per loop to protect heat exchangers from clogging and to maintain chiller-specified KW/ton.
7. Cooling Loop: Y strainer, 40-mesh.
8. Header Bank End Cap Kit: Two per bank.
9. 250 PSI Pressure Differential Flow Sensor: One per water loop, NOT for pump control.

C. Start-up and Warranty:

1. Provide factory authorized modular heat pump representative start-up, supervision, and training.
2. Provide one year parts warranty.
3. Provide five year compressor parts warranty.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Examine areas and conditions under which units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Verify that ceiling system is ready to receive work and opening dimensions are as indicated on shop drawings.

C. Verify that electric power is available and of the correct characteristics.

D. Install in accordance with manufacturers written instructions and guidelines.

E. Coordinate installation of unit with building components to allow adequate airflow to/from the units and for maintenance clearances. Mount outdoor units on a built-up roofing curb flashed and sealed in accordance with roofing warranty requirements.

F. Provide adequate bracing and vibration isolation in accordance with seismic code requirements and acoustical engineers requirement.

G. Provide adequate drainage connections and routing for condensate piping to indirect waste receiver.

H. Provide shut off valves, site glasses, and routing pressure gauges, and all other appurtenances required for refrigerant system maintenance and operation.

I. Set initial temperature set points. Instruct operating personnel in adjustment of setpoints and controls.

J. See Division 01, General Requirements and Section 23 00 00, HVAC Basic Requirements for additional requirements.

K. Provide service and maintenance of units for one year from date of substantial completion.

END OF SECTION 23 81 43

SECTION 23 82 00 - TERMINAL HEAT TRANSFER EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Electric Wall Heaters

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as outlined in Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 ELECTRIC WALL HEATERS

A. Manufacturers:

1. Trane
2. Markel
3. Qmark
4. Chromalox
5. Indeeco

B. Description: Wall mounted forced air unit heater, including enclosure for surface mounting, fan and motor, heating elements and wall box. UL listed and wired per NEC.

C. Cabinet: 20 gauge zinc coated steel, 16 gauge painted exterior grille.

D. Fan and Motor: Propeller type fan, totally enclosed motor with permanently lubricated bearings and thermal overload protection, vandal proof.

E. Heating Element: Sealed tubular type with finned heating elements, manual reset thermal limit safety switch, fan purge limit to dissipate residual heat on heater shutdown.

F. Control:

1. Control specified in Section 23 09 00, Instrumentation and Control Performance Specifications.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Avoid interference with structure and with work of other trades, preserving adequate headroom and clearing doors and passageways. Check each piece of equipment for defects, verifying that items function properly and that adjustments have been made.

B. Prior to acceptance, thoroughly clean exposed portions of terminal heat transfer equipment, remove shipping labels and traces of foreign substance. Touch up scratched surfaces of radiant panels with factory matching paint.

3.2 ELECTRIC WALL HEATERS INSTALLATION

A. Damaged Coils: Make every effort to prevent damage to both built-up coils and coils of packaged equipment. Comb damaged coil fins to be straight.

B. Install per manufacturer's instructions. Comply with NEC and UL listings.

C. Install heaters in place with box trim flush with finished wall.

D. Install thermostat as shown on drawings. Provide control wiring from thermostat to unit.

END OF SECTION 23 82 00

SECTION 23 84 00 - HUMIDITY CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Dehumidification Unit

1.2 RELATED SECTIONS

A. Contents of Division 23, HVAC and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment
2. Section 23 05 93, Testing, Adjusting, and Balancing for HVAC
3. Section 23 09 00, Instrumentation and Control Performance Specifications
4. Section 23 21 13, HVAC Piping
5. Section 23 21 23, Hydronic Pumps
6. Section 23 31 00, HVAC Ducts and Casings

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product Data: Provide catalog data indicating rated capacity, dimensions, duct and service connections, electric nameplate data and wiring diagrams.
2. Shop Drawings: Indicate rough-in dimensions, piping plans with details of components and steam dispersion tubes, duct and service connections, electric nameplate data and wiring diagrams.
3. Manufacturer's Instructions: Indicate assembly and installation instructions.
4. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
5. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. The unit to be ETL listed.

C. Unit to be completely factory assembled, wired, piped, and test run prior to shipping. All controls to be factory adjusted and preset to the design conditions. A factory test report to be available upon request.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 23 00 00, HVAC Basic Requirements and Division 01, General Requirements.

B. Warranty: The entire system to have a 24 month limited parts warranty from ship date.

1. 90 days from initial start-up, all parts and repairs related to factory defects or replacement parts are covered by manufacturer warranty.

PART 2 - PRODUCTS

2.1 DEHUMIDIFICATION UNIT MANUFACTURERS:

A. Desert Aire

B. Dectron

C. Or approved equivalent.

2.2

A. General: Provide self-contained, closed loop heat recovery unit, piped, wired, and factory tested.

1. Fully constructed custom system designed for natatorium environment control, including:
   a. Dehumidification.
   b. Unit mounted hot water coil for space heating.
   c. Unit mounted modulating exhaust system exhaust fan and 100% purge/economizer fans.
   d. Unit mounted outdoor air connections and dampers.
   e. Glycol heat recovery loop between the exhaust and outdoor air intake air streams.
   f. Single point factory wired power.
   g. Factory provided and sequence programmed controller with BAS interface.

B. Cabinet Construction: All cabinet 16, 20 and 24 gauge sheet metal to be galvanized G90 steel or GalvalumeTM alloy with mill-applied zinc phosphate primer followed by an exterior grade white silicone modified polyester top coat. The sheet metal is engineered to form a cabinet with maximum strength and rigidity. All seams shall be caulked with silicone to prevent air and water leakage or infiltration.

1. Base Rails: The cabinet to have a base frame comprised of 2 layers of 10 gauge mill galvanized G90 steel. Lifting lugs to be provided on the base frame for rigging the system.
2. The cabinet walls to be of double-wall construction using 20 gauge pre-painted steel with a fully painted inner metal liner and 2 inches of fiberglass insulation.
3. The cabinet floor to be comprised of a 16-gauge galvanized steel panel with a 20-gauge pre-painted steel inner liner, 2-inch double wall engineered with structural bending for maximum rigidity and be mechanically fastened to the base frame of the unit.

4. The cabinet roof to be 20-gauge pre-painted steel, 2-inch double wall engineered with structural bending for maximum rigidity and be mechanically fastened to the base walls of the unit.
5. The cabinets to be mechanically assembled with stainless steel 5/32-inch sealed blind rivets. Where bolts are required bright zinc plated bolts to be used.
6. Access doors to be supported on multiple hinges, held shut by compression latches for quick access. Doors to be provided for entrance to all sections housing components requiring routine maintenance. Full height access doors to have "hold back" latches to prevent door closure during the performance of service procedures.
7. The unit to have non-corroding protective mesh screens on all air intake openings.
8. The system to have non-corroding protective mesh screens covering internal fan blades, protective grates covering all floor access ports.

C. Outdoor Air Intake:

1. Purge /Economizer and Minimum Outdoor Air connections with motorized dampers and controls.

D. Insulation: The unit to be insulated per the following standards:

1. All exterior cabinet sections to be insulated with two (2) inch thick fiberglass inside the double walled cabinet.
2. Fire resistant rating to conform to NFPA Standard 90A and 90B.
3. Sound attenuation coefficient to not be less than 1.02 at a frequency of 1,000 Hz as per ASTM Standard C423.
4. Thermal conductivity to not exceed 0.26 Btu/hr-sqft-ft at 75°F.

E. Filters: Air filters to be standard sized, replaceable, off-the-shelf filters including:

1. Return Air: 2-inch MERV 13, 90% pleated filters with rust-free non-metallic structure on a slide-in or face-loading rack.
2. Exhaust Air: 2-inch MERV 8, 30% pleated filters with rust-free non-metallic structure.
3. Outside Air: 2-inch MERV 13, 90% pleated filters with rust-free non-metallic structure.
4. Dirty air filter switches included on the return air filter for indicating an alarm when pressure drop exceeds a set point.

F. Heating Coil: The packaged hot water coil to be sized to meet the scheduled heating capacity and have the following characteristics:

1. Modulating (0-10V) auxiliary air heat control by means of a factory mounted and wired three-way control valve.
2. Air heating coil tubes, fins, headers, casing, and end-plates to be fully protected by a polyester/enamel coating for maximum corrosion protection. The protective coating to comply with ASTM B117/D1654 and ASTM D2126 for corrosion resistance against common acids, salts, and gases.
3. Coil casing and end-plates to be made of galvanized steel.
4. Aluminum fin and copper tubes mechanically bonded to assure high heat transfer.
5. The maximum loop operating pressure to not be less than 250 psig.

G. Heat Recovery Coils:

1. The unit to have heat recovery between the minimum exhaust and outdoor air streams per specifications.
    a. The heat recovery coils to be sized for heat transfer between the two air streams.

b. The heat recovery fluid circulating between coils to be glycol. The module to be a complete package and independent circuit that includes a circulating pump, fill valves and expansion tank.

2. Coils to be fully dipped and coated with a polyester/enamel coating for maximum corrosion protection. Coating to comply with ASTM B117/D1654 and ASTM D2126 for corrosion resistance against common acids, salt, and gases.
3. Aluminum fin and copper tube joints mechanically bonded to assure high heat transfer.

H. Drain Pans:

1. Each chilled water coil to be provided with a positive draining, compound-sloped, baked powder paint coated aluminum drain pan with fully-welded corners to ensure zero water retention.

I. Blowers and Blower Motors:

1. Supply Blowers:
   a. Blower(s) to be a single width/single inlet airfoil plenum type, secured a machined, ground and polished solid steel shaft. The wheel to be G90 galvanized steel with baked powder paint coating. The shaft to be coated with a rust inhibitor.
   b. The complete blower assembly to be statically and dynamically balanced on precision electronic balancers.
   c. The blower assembly to be mounted on a 1-inch deflection spring isolated rack.
2. The fan inlets to be equipped with accidental contact protection screen.
   a. Motor(s) to be Premium Efficiency painted cast iron construction TEFC, NEMA MG1-PART 31 Inverter Duty 15:1 Constant Torque Severe Duty with a service factor 1.25. Motors to be 6 Pole 1200 RPM or 4 Pole 1800 RPM synchronous speed. Motors to have double lip seals on both ends with re-greaseable bearings 254T frame and larger with Polyurea grease.
   b. The motor(s) to be provided with a low motor noise and high starting torque VFD for air balancing purposes. The VFD to have a drive efficiency of 96 to 98% with displacement power factor of 0.98. The VFD to have protective features including: torque limit, heat sink over-temperature, current-limiting DC bus fuse, electronic motor overload with phase-to-phase and ground fault short circuit protection; current limit, over/under torque protection, over/under voltage protection, short circuit current rating of minimum 30kA rms symmetrical protected by recommended branch circuit protection devices.
3. Exhaust Blowers:
   a. The packaged exhaust blower (EF1) to be sized to maintain the negative pressure requirement in the space as set by balancer.
   b. The blower to be impeller plenum fan complete with backward curved, three-dimensional, profiled blades made of high performance composite material. The blower to be completely corrosion resistant and be maintenance free a direct drive via a direct current (DC) electronic commuted (EC) motor. The EC-Motor to have zero slippage design and have continuously variable speed control connected to the unit's controller.
   c. The fan assembly to be balanced in Class G 6.3 acc DIN ISO 1940, dynamic on two levels.
   d. The fan assembly to be suitable for ambient temperatures of -40°C to max. +70°C.
   e. Thermal contacts installed in the windings compliant with THCL 155.
   f. Drive motor in external rotor principle, sealed in protection class IP54 with moisture protection impregnation of the windings, topical protection.
   g. High corrosion resistance design with high quality and reliability.

h. The exhaust fan to be controlled from an end switch on the power open of the exhaust air damper. The exhaust dampers to be protected by louvers to divert rain from the face of the dampers.
i. To be packaged with the heat recovery module.

4. Purge Blowers:
   a. The ventilation/economizer/purge exhaust blowers (PEA) to be unit mounted and sized to provide full exhaust from the space when operating with EF1.
   b. The fans to be direct driven axial fan made of high-strength composite material in which the motor and controller are integrated. Include FE2owlet blades combined with guide vanes and EC commutated direct-current external rotor motors to provide maximum efficiency the quietest performance. The EC motor to have maintenance-free electronic circuitry, a rotor with permanent magnets, and an integral controller to provide the windings with electrical current so that, the motor rotates continuously and quietly. The fan is to be aerodynamically-optimized, sickle-blade profile, patterned with serrated trailing edge and winglets on the blade outer edge for energy and noise-optimized operation.
   c. The fan assembly to be balanced in Class G 6.3 acc DIN ISO 1940, dynamic on two levels.
   d. The fan assembly to be suitable for ambient temperatures of -40°C to max. +70°C.
   e. Thermal contacts installed in the windings compliant with THCL 155.
   f. Drive motor in external rotor principle, sealed in protection class IP54 with moisture protection impregnation of the windings, topical protection.
   g. High corrosion resistance design with high quality and reliability.
   h. The exhaust fan to be controlled from an end switch on the power open and spring return outside air damper. The gravity exhaust dampers to be protected by louvers to divert rain from the face of the dampers.
5. Dampers:
   a. Internal dampers to be made from extruded anodized aluminum with a parallel blade configuration and neoprene double-seal tips to minimize leakage. Damper blades to be mounted on steel rods which rotate on nylon bushings. All damper hardware to be corrosion resistant.
      1) The system to be provided with normally closed outside air and exhaust air dampers equipped with spring-return actuators The dampers modulate between 0% to 100% open position.
      2) The outdoor air and exhaust air dampers to be of opposed blade configuration. Dampers to have 0.750-inch insulated blades made from extruded anodized aluminum with neoprene double-seal tips to minimize leakage. Damper leakage to be less than 1% of maximum flow at 4-inch water column differential. Damper blades to be mounted on steel rods which rotate on nylon bushings. All damper hardware to be corrosion resistant.
6. Control Panel:
   a. The electrical contractor to be responsible for external power wiring and disconnect switch fusing. Power block terminals to be provided.
   b. The system to include a factory-installed fused disconnect.
   c. Main control panel to be mounted inside the service vestibule outside of the process air stream.
   d. Blower motors to be protected against overloads.
   e. The system to have a voltage monitor with phase protection.
   f. Available dry contacts to include:
      1) Alarm
      2) Blower interlock
      3) Modulating Heating
      4) Blower interlock
      5) Remote Exhaust

6) System on
7) Heat Recovery

g. All wiring to be installed in accordance with UL or CSA safety electrical code regulations and to be in accordance with the NFPA All components used in the system to be UL or CSA listed.

7. Wiring diagrams to be located near the electrical panel(s) on the system. These diagrams to provide color-coding and wire numbering for easy troubleshooting. All wires to be contained in a wire duct.
   a. An airflow switch and a dry contact for alarm(s) to be provided and factory-mounted.
   b. Convenience outlet and light included factory mounted in control cabinet, factory wired.
8. Microprocessor Control:
   a. A factory installed and programmed microprocessor controller with the following characteristics to be provided:
      1) All set points and parameter adjustments are pre-programmed at the factory during quality control testing.
      2) The microprocessor program to be stored on updatable FLASH memory.
      3) A minimum of 11 analogue inputs, 4 analogue outputs, 24 digital inputs and 16 digital outputs.
      4) Four serial interface ports including both RS232 and RS485 types.
      5) An Ethernet port with RJ-45 connector and LED activity indicator.
      6) A real time clock to time-stamp the system operation log and to enable a programmable 7-day occupation schedule.
      7) Two manual demand forced modes to allow the user to manually bypass the microprocessor in the event of controller failure.
      8) The local and remote operator panel(s) to have a backlit graphic liquid crystal display with touch controls. Mount remote panel near BAS graphic user interface. Include interface and map points for graphical display, monitoring, temperature and humidity setpoints, and timed purged exhaust controlled by user at BAS graphical interface.
      9) The system to monitor temperature and humidity and control modulations of outdoor air for cooling and dehumidification, and heating coil valve modulation for heating/reheat.
   b. The following status LEDs to be on the controller:
      1) Alarm - indicates there has been a failure requiring service.
      2) Dehumidification - indicates that the system is dehumidifying the space.
      3) Cooling - indicates that the system is operating in economizing outdoor air exchange modulation for cooling and/or dehumidifying.
      4) Reheat – indicated reheat is operating in conjunction with dehumidification.
      5) Space Heat - indicates that the space heating is operating.
      6) Maintenance - indicates whether or not maintenance is required.
      7) Manual - indicates that the system has been set to manual operation.
      8) Purge – indicates system has been manually set to purge for a specific time (3hr – adj.).
   c. The following set points to be accessible and adjustable from the operator panel, and mapped to BAS for monitoring and adjustability.
      1) Space temperature
      2) Space relative humidity
   d. The following sensors to be unit-mounted and monitored at the operator panel, remote panel, and mapped to BAS for monitoring. All information from these items to be actively used in the system control and operation strategies:
      1) Return air temperature
      2) Supply air temperature

3) Return air relative humidity
4) Outdoor air temperature
5) Outdoor air humidity

e. System Fault: To indicate via text message to the display and mapped to BAS graphic interface what systems require attention or servicing. Built-in monitoring and diagnostics to allow the user to view the following:
1) Power failure
2) Dirty air filter
3) System off

9. Roof Curb:
a. Reference Section 23 05 48, Vibration and Seismic Controls for HVAC Equipment. Coordinate fastening unit to top steel frame and lower sheet metal curb and attachment to roof structure raise mounting pad or curb.
b. Lower perimeter type curb made minimum 12-gauge galvanized steel with stiffeners, not less than 2.0 in of rigid acoustical and thermal fiberglass insulation, and all necessary hardware to be provided for field assembly of the curb on the roof structural pad prior to system shipment.

10. Factory Performance Testing:
a. The system to be thoroughly tested under factory test conditions.

2.3 SEQUENCE OF OPERATION

A. System Startup:

1. Power is turned on or the system is started.
2. After a short initial delay to allow the sensors to stabilize, the blowers start and operate continuously.
3. Based on sensor feedback, the system will begin or resume operation, based on the sequence below.

B. Airside Configuation:

1. The system continuously delivers the specified supply air volume to the natatorium to achieve minimum 6ACH.
2. The minimum exhaust air volume is set to meet the engineer's schedule, and as set by balance to achieve and maintain ASHRAE recommended 0.05-0.15-inch WC negative pressure relative to surrounding spaces. NOTE: exhaust fan dedicated to exhaust behind the spa is also operating continuously and must be operating when determining fan speed settings to maintain negative space pressure.
3. Unit microprocessor will control modulation of dampers and exhaust fan(s) to exhaust a set percentage offset more than introduced outside air to maintain a negative space pressure (as determined by balancer).

C. Dehumidification Mode:

1. The return air relative humidity is above the humidity setpoint: 50% RH (adj.).
2. Return air dewpoint is above dewpoint setpoint: 59.7°F (adj.) based on space temp set at 80°F (adj.).
3. The microprocessor sends an output signal to modulate the dampers and fan speeds to increase OA percentage based on return air temperature, relative humidity, and dewpoint.
4. The microprocessor heating output signal (0-10 volts) is sent to the heating coil controller if needed based on return air temperature, relative humidity, and dewpoint.

D. Space Cooling Mode:

1. The return air temperature is above the room temperature setpoint 82°F (adj.).
2. The microprocessor sends an output signal to modulate the dampers and fan speeds to increase OA percentage based on return air temperature.

E. Space Heating Mode:

1. The return air temperature is below the room temperature setpoint 80°F (adj.)
2. The microprocessor space heating output signal (0-10 volts) is sent to the heating coil controller. The signal output will regulate based on the return air temperature.

F. Exhaust Air Heat Recovery Mode:

1. The minimum outdoor air damper and minimum exhaust fan(s) and will operate as continuously as programmed, minimum OA occupied and setback by 50% OA unoccupied.
2. Outdoor air temperature is compared with the return air temperature, if the differential is greater or equal to 10°F (adj.), the glycol pump to circulate a glycol mixture between the exhaust air and the outdoor air heat recovery coils to precool or preheat the incoming outside air.

G. Purge Mode:

1. This mode is triggered automatically if cooling mode or dehumidification mode requires up to 100% OA; Or this mode is manually triggered by an operator when super-chlorinating the pool. It can be manually triggered at the unit-mounted, remote operator panel, through the online WebSentry interface, or by the BACnet interface controller on the BAS graphic user interface.
2. Manual triggered Purge Mode has an adjustable timed duration (3hr adj.) after which the system automatically resumes normal operation.
3. Once manually triggered by the operator:
    a. A signal from the microprocessor sets the exhaust fan(s) to their maximum CFM.
    b. The unit-mounted outdoor air dampers open fully and the return air dampers close
    c. The system stays in 100% outdoor air ventilation mode.
    d. After the timed period expires, all dampers and fans return to normal operating settings and the system resumes normal operation.
    e. During Purge Mode, the system will control heating based on supply air temperature

H. Economizer Cooling Mode:

1. Same as cooling mode above since system uses outside air as primary cooling and dehumidifying.

I. Economizer Dehumidification Mode:

1. Same as dehumidification mode above since system uses outside air as primary cooling and dehumidifying.

J. Freeze Protection:

1. The supply air temperature falls below the freeze stat setpoint.
2. Exhaust fan(s) are stopped and outdoor air damper(s) are fully closed.

3. When the freeze stat alarm is tripped, it must be manually cleared by the operator.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with manufacturer's written instructions and recommendations.

B. Connect unit to water supply. Provide isolation valves, strainer, and drain down on hydronic connections.

C. Install piping with unions or flanges for easy removal of pan for servicing.

D. Duct connections: drawings indicate the general arrangements of the ducts. Connect units to 304 stainless steel ductwork, acoustic attenuators, and chemical/corrosion proof flex connections.

E. Perform a thorough physical inspection of the system upon delivery from the shipment carrier.

F. Identify and immediately report any physical damage to manufacturer.

G. Cleaning: Prior to acceptance, thoroughly clean exposed portions of the units, remove shipping labels and traces of foreign substance.

H. Install and make connection to allow space for service and maintenance.

I. Field Quality Control:

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test and adjust field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.
2. Perform the following field quality-control tests and inspections and prepare test reports:
    a. After installing units and after electrical circuitry has been energized, test units for compliance with requirements.
    b. Inspect for and remove shipping bolts, blocks, and tie-down straps.
    c. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
    d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Remove malfunctioning units, replace with new units, and retest as specified above.

J. Startup Services:

1. Engage a factory-authorized service representative to perform startup service.
2. Complete installation and startup checks according to manufacturer's written instructions.

K. Adjusting:

1. Adjust initial temperature and humidity.
2. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
3. Within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual conditions.

L. Demonstration: Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units. Reference Division 01, General Requirements.

END OF SECTION 23 84 00

SECTION 26 00 10 – REQUIREMENTS FOR ELECTRICAL, COMMMUNICATIONS, AND ESS

PART 1 GENERAL

1.1 SUMMARY

A. Supplemental requirements generally applicable to the Work specified in Divisions 26, 27, and 28. This Section is also referenced by related Work specified in other Divisions.

B. Section Includes:

1. Electrical equipment coordination and installation
2. Sleeves for raceways and cables
3. Sleeve Seals
4. Grout
5. Common installation requirements

C. General Requirements: Conform to Contract Documents. This section is supplemental and in addition to requirements of Division 01.

D. Conditions and Requirements: Conditions and requirements of the General Provisions, Supplemental General provisions and Special Provisions are hereby made a part of the Electrical Division of this Specification. If requirements disagree, the more stringent requirement will become the contractual obligation.

E. Provide a complete working installation with all equipment called for in proper operating condition. Documents do not undertake to show or list every item to be provided. When an item not shown or specified is clearly necessary for proper operation of equipment shown or specified, provide an item which will allow the system to function at no increase in Contract Sum.

F. Work shall be of the best quality and competent and experienced electricians and subcontractors shall be employed and shall be under supervision.

G. The drawings and specifications are complimentary and what is called for (or shown) in either is required to be provided as if called for in both

1.2 REFERENCES

A. Definitions

1. Definitions of all terms shall be in accordance with applicable definitions of all applicable industry standards included but not limited to:
    a. AIA
    b. NFPA
    c. ICC
    d. IEEE

e. IES

f. NEMA

g. UL

h. BICSI

i. EIA/TIA

j. Local Jurisdiction requirements

B. Abbreviations and Acronyms for Electrical Terms and Units of Measure:

1. A: Ampere, unit of electrical current.

2. AC or ac: Alternating current.

3. AFCI: Arc-fault circuit interrupter.

4. AIC: Ampere interrupting capacity.

5. AL, Al, or ALUM: Aluminum.

6. ASD: Adjustable-speed drive.

7. ATS: Automatic transfer switch.

8. AWG: American wire gauge; see ASTM B258.

9. BIL: Basic impulse insulation level.

10. BIM: Building information modeling.

11. CAD: Computer-aided design or drafting.

12. CATV: Community antenna television.

13. CB: Circuit breaker.

14. CU or Cu: Copper.

15. dB: Decibel, a unitless logarithmic ratio of two electrical, acoustical, or optical power values.

16. dB(A-weighted) or dB(A): Decibel acoustical sound pressure level with A-weighting applied in accordance with IEC 61672-1.

17. dB(adjusted) or dBa: Decibel weighted absolute noise power with respect to 3.16 pW (minus 85 dBm).

18. dBm: Decibel absolute power with respect to 1 mW.

19. DC or dc: Direct current.

20. DDC: Direct digital control (HVAC).

21. EGC, GND: Equipment grounding conductor.
22. EMF: Electromotive force.
23. EMI: Electromagnetic interference.
24. EPM: Electrical preventive maintenance.
25. EPS: Emergency power supply.
26. EV: Electric vehicle.
27. fc: Footcandle, an internationally recognized unit of illuminance equal to one lumen per square foot or 10.76 lx. The simplified conversion 1 fc = 10 lx in the Specifications is common practice and considered adequate precision for building construction activities. When there are conflicts, lux is the primary unit; footcandle is specified for convenience.
28. FLC, FLA: Full-load current.
29. ft: Foot.
30. GEC: Grounding electrode conductor.
31. GFCI: Ground-fault circuit interrupter.
32. GFP: Ground-fault protection of equipment.
33. GND: Ground.
34. HDPE: High-density polyethylene.
35. HID: High-intensity discharge.
36. HP or hp: Horsepower.
37. HVAC: Heating, ventilating, and air conditioning.
38. Hz: Hertz.
39. IP: Ingress protection rating (enclosures); Internet protocol (communications).
40. IR: Infrared.
41. IS: Intrinsically safe.
42. kcmil or MCM: One thousand circular mils.
43. kV: Kilovolt.
44. kVA: Kilovolt-ampere.
45. kVAr or kVAR: Kilovolt-ampere reactive.
46. kW: Kilowatt.

47. kWh: Kilowatt-hour.
48. LAN: Local area network.
49. lb: Pound (weight).
50. LCD: Liquid-crystal display.
51. LED: Light-emitting diode.
52. LRC: Locked-rotor current.
53. LV: Low voltage.
54. MCC: Motor-control center.
55. MLO: Main lugs only.
56. MV: Medium voltage.
57. MVA: Megavolt-ampere.
58. mW: Milliwatt.
59. MW: Megawatt.
60. MWh: Megawatt-hour.
61. NC: Normally closed.
62. NIU: Network interface unit.
63. NO: Normally open.
64. PC: Personal computer.
65. PF or pf: Power factor.
66. PoE: Power over Ethernet.
67. PV: Photovoltaic.
68. PVC: Polyvinyl chloride.
69. RFI: (electrical) Radio-frequency interference; (contract) Request for interpretation.
70. RMS or rms: Root-mean-square.
71. RPM or rpm: Revolutions per minute.
72. SCR: Silicon-controlled rectifier.
73. SPD: Surge protective device.
74. TCP/IP: Transmission control protocol/Internet protocol.

75. TR: Tamper resistant.

76. TVSS: Transient voltage surge suppressor.

77. UL: (standards) Underwriters Laboratories, Inc.; (product categories) UL, LLC.

78. UPS: Uninterruptible power supply.

79. USB: Universal serial bus.

80. UV: Ultraviolet.

81. V: Volt, unit of electromotive force.

82. VA: Volt-ampere, unit of complex electrical power.

83. VAR: Volt-ampere reactive, unit of reactive electrical power.

84. VFC, VFD: Variable-frequency controller.

85. VPN: Virtual private network.

86. W: Watt, unit of real electrical power.

87. Wh: Watt-hour, unit of electrical energy usage.

88. WR: Weather resistant.

C. Abbreviations and Acronyms for Electrical Raceway Types:

1. EMT: Electrical metallic tubing.

2. ENT, Innerduct: Electrical nonmetallic tubing.

3. RMC, RGS: Electrical rigid metal conduit.

4. RGS-P: PVC-coated-steel electrical rigid metal conduit.

5. ERMC-SS: Stainless steel electrical rigid metal conduit.

6. FMC: Flexible metal conduit.

7. HDPE: HDPE underground conduit (thick wall).

8. IMC: Steel electrical intermediate metal conduit.

9. LFMC: Liquidtight flexible metal conduit.

10. PVC: Rigid PVC conduit.

D. Abbreviations and Acronyms for Electrical Single-Conductor and Multiple-Conductor Cable Types:

1. AC: Armored cable.

2. CATV: Coaxial general-purpose cable.

3. CL2: Class 2 cable.
4. CL3: Class 3 cable.
5. CM: Communications general-purpose cable.
6. FC: Flat cable, undercarpet cable.
7. MC: Metal-clad cable.
8. MV: Medium-voltage cable.
9. PV: Photovoltaic cable.
10. RHW: Thermoset rubber, moisture-resistant cable.
11. SE: Service-entrance cable.
12. THW: Thermoplastic, heat- and moisture-resistant cable.
13. THHN: Thermoplastic, heat-resistant cable with nylon jacket outer sheath.
14. THHW: Thermoplastic, heat- and moisture-resistant cable.
15. THWN: Thermoplastic, moisture- and heat-resistant cable with nylon jacket outer sheath.
16. TW: Thermoplastic, moisture-resistant cable.
17. XHHW: Cross-linked polyethylene, heat- and moisture-resistant cable.

1.3 CODES

A. Follow all relevant industry codes listed above. At no point shall contractor deviate from National or local codes. Specific codes as follows (local amendments not listed) but not limited to all codes adoped in local jurisdiction

1. National Electric Code – NFPA 70
2. IBC
3. IFC
4. NFPA 72
5. Energy Code

1.4 PERMITS AND INSPECTIONS

A. Obtain permits and pay fees required by governmental agencies having jurisdiction over this work. Arrange for inspections required during construction. On completion of work, furnish satisfactory evidence to show all work installed in accordance with codes.

1.5 CLEARANCES

A. Provide clearances and working clearances around all equipment as required by relevant codes including 110-26 of the NEC.

1.6 QUALITY ASSURANCE

A. Nothing in the Drawings or Specifications shall be construed to permit Work not conforming to applicable laws, ordinances, rules or regulations.

B. When Drawings or Specifications exceed requirements of applicable laws, ordinances, rules, or regulations, comply with documents establishing the more stringent requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Ship equipment in its original package to prevent damage or entrance of foreign matter. Perform all handling and shipping in accordance with manufacturer's recommendations. Provide protective coverings during construction.

B. Identify materials and equipment delivered to the Site to permit check against approved materials list, and reviewed submittals.

C. No equipment that is not approved in submittals shall be installed.

1.8 MATERIAL AND EQUIPMENT ENVIRONMENT

A. All equipment and material shall be suitable for the environment of the installation, and the installation including equipment shall satisfy the governmental agencies having jurisdiction.

1.9 DRAWINGS AND SPECIFICATIONS

A. Specifications, with drawings, are intended to cover installation of all electrical equipment. Materials shown and called for on drawings, but not mentioned in specifications, or vice versa, necessary for proper completion and operation of equipment, shall be furnished the same as if called for in both.

B. Electrical drawings do not attempt to show complete details of project construction which affect electrical installations. Refer to architectural, structural and mechanical drawings for additional details which affect installation of this work.

1.10 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right of way for piping and conduit installed at required slope.

4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Before installation Contractor shall make proper provisions for electrical work and to avoid interferences with installation of other work. Any changes caused by neglect to do so shall be made at Contractor's expense.

E. Electrical drawings and specifications shall be compared with drawings and specifications of other trades and any discrepancies between them reported to the Architect prior to installation of work.

F. Coordinate and arrange work so there is no interference between wiring outlets, lighting fixtures, and raceways with sheet metal work, insert hangers, mechanical piping, and structural members.

1.11 CUTTING AND PATCHING

A. Do all cutting and patching for installation of the work. All cutting done carefully to prevent damage to work of other trades, and all patching done by mechanics skilled in the trade affected, and subject to approval by Architect. Provide all work per Division 01. Work shall include.

1. All openings for removed equipment shall be patched or entire system replaced. No openings shall remain at completion of work.

2. Exterior cutting and patching shall be done by qualified Contractors. Patching of asphalt and concrete shall be per Division 01 and approved by Civil Engineers and Architect. Grass and earth patching, seeding, and sod work shall be per Division 01 and approved by the Landscaper, Civil Engineer, and Architect. All backfill per Division 01.

3. Painting: All exposed conduit, boxes, surface metal raceway, enclosures, multi-outlet assemblies shall be painted to match wall color. Where exact color unknown, coordinate with Architect to obtain color. All items shall be painted regardless of whether wall, ceiling, floor finish is painted.

1.12 RUBBISN AND CLEANUP

A. Contractor shall promptly remove waste material and rubbish caused by workers.

B. At completion of work, clean all fixtures, electrical panel interiors, switchboards, distribution centers, and all other equipment installed.

1.13 SUBMITTALS

A. Provide general equipment and shop drawings for each section included in the project manual.

1. General:

a. Submittals shall be in accordance with requirements of Division 01 and as specified.

b. Forward all submittals to the Architect, together, at one time. Individual or incomplete submittals are not acceptable.

c. Organize submittals in same sequence as they appear in Specification Sections.

d. Identify each submittal item by reference to Specification Section paragraph in which item is specified, or Drawing and Detail number.

e. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and review materials and equipment. Words “as specified” are not sufficient identification.

2. Shop Drawings:

a. Show physical arrangement, construction details, finishes, materials used in fabrication, provisions for conduit entrance, access requirements for installation and maintenance, physical size, electrical characteristics, foundation and support details, and weights.

3. Substitutions

a. Any substitutions from specified equipment shall include formal substitution request form in the submittal.

1.14 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Provide emergency operation, normal operation, and preventive maintenance manuals for each system, equipment, and device listed below:

2. Include the following information:

a. Manufacturer's operating specifications.

b. User's guides for software and hardware.

c. Schedule of maintenance material items recommended to be stored at Project site.

d. Detailed instructions covering operation under both normal and abnormal conditions.

e. Time-current curves for overcurrent protective devices and manufacturer's written instructions for testing and adjusting their settings.

f. List of load-current and overload-relay heaters with related motor nameplate data.

g. List of lamp types and photoelectric relays used on Project, with ANSI and manufacturers' codes.

h. Manufacturer's instructions for setting field-adjustable components.

i. Manufacturer's instructions for testing, adjusting, and reprogramming microprocessor controls.

j. EPSS: Manufacturer's system checklists, maintenance schedule, and maintenance log sheets in accordance with NFPA 110.

k. Exterior pole inspection and repair procedures.

3. Software and Firmware Operational Documentation: Provide software and firmware operational documentation, including the following:

a. Software operating and upgrade manuals.

b. Names, versions, and website addresses for locations of installed software.

c. Device address list.

d. Printout of software application and graphic screens.

e. Testing and adjusting of panic and emergency power features.

f. For lighting controls, include the following:

1) Adjustments of scene preset controls, adjustable fade rates, and fade overrides.

2) Operation of adjustable zone controls.

4. Software:

a. Provide Program Software Backup

b. Provide to Owner upgrades and unrestricted licenses for installed and backup software, including operating systems and programming tools required for operation and maintenance.

B. As- Built Drawings

1. Drawings shall be continuously maintained in the field by the Contractor. Drawings used for this purpose shall be the latest revision and shall be kept neat and clean.

2. Drawings shall include dimensions on all underground, feeder, and communications feeder conduit including location of pullboxes and handholes.

3. Drawing shall show all work changed from the original drawings

4. Deliver in Autocad or Revit, current format.

5. See Division 1 for additional requirements.

1.15 MOCKUPS

A. Provide mockups where requested of installations prior to implementing the work. Corrections shall be made based on owner. Architect, and engineer comments prior to proceeding with work.

B. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.

1.16 UTILITY COORDINATION

A. Coordinate with serving utilities and provide all provisions required by the serving utility.

1. Serving power utility is Snohomish County PUD

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials and Equipment General Requirements:

1. All items of materials in each category of equipment shall be of one manufacturer.

2. Groups of items having same or similar function shall be by single manufacturer to facilitate maintenance and service.

3. Compatible with space allocated. Modifications necessary to adjust items to space limitations shall be at Contractor's expense.

4. Conform with conditions shown and specified. Coordinate with other trades for best possible assembly of completed Work.

5. Install fully operating without objectionable noise or vibration.

B. Access Doors:

1. Furnish under this Division where shown, required by regulatory agencies, and for access to all concealed electrical items requiring access. Access doors shall be in accordance with requirements of Division 08. Doors in this Division, Division 08, and Division 15 shall be from the same manufacturer for identical appearance and keying. Furnish fire rated doors where required. Deliver access doors for installation under Division 08. Mark each access door to accurately establish its location.

C. Firestopping and Smokestopping:

1. General Penetrations

a. STI Firestop Spec Seal of appropriate type for installation

1) Provide firestopping where wiring, conduit, or cable tray penetrates fire wall or floor.

2) Provide smokestopping where wiring, conduit, or cable tray penetrates smoke barrier.

2. Outlet Boxes

a. STI Fire Stop SSP putty pads on all boxes in fire rated walls.

3. Conduits

a. Seal around conduits with STI firestop above or Provide STI EZ Path

b. EZ Path shall be sized to same size and capacity as conduits shown.

c. EZ path may be used anywhere instead of conduit.

d. All sleeves over 6 inch shall be EZ Path

2.2 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends. PVC 40 permitted where not passing through a structural opening.

B. Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.

2. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.3 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Metraflex Co.

d. Pipeline Seal and Insulator, Inc.

B. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

C. Pressure Plates: Plastic, Carbon steel. Include two for each sealing element.

D. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 EXECUTION

3.1 INSTALLATION OF WORK

A. Unless more stringent requirements are specified in the Contract Documents or manufacturers' written instructions, comply with NFPA 70 and NECA NEIS 1 for installation of Work specified in Division 26. Consult Architect for resolution of conflicting requirements.

B. Follow manufacturer’s directions in all cases where manufacturers of articles used furnish directions covering points not shown or specified.

C. Accurately set and level equipment with supports neatly placed and properly fastened. No allowance of any kind will be made for negligence on the part of the Contractor to foresee means of bringing in and installing equipment in position inside the building.

D. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

E. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

F. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

G. Right of Way: Give to piping systems installed at a required slope.

3.2 CONDUIT SYSTEM:

A. Work into complete integrated arrangement with like elements. Make Work neat and finished appearing.

B. Run concealed, except where shown otherwise. Routing for exposed conduit and wiring, not indicated clearly on plan, to be approved by Architect, Owner and Engineer team prior to install. Where exposed run parallel with walls or structural elements with vertical runs plumb, horizontal runs level and close to ceiling, concealing conduit as much as possible; groups racked together neatly with bends parallel and uniformly spaced.

C. Flash and counterflash all penetrations through roof in accordance with requirements of Division 07 and as shown.

D. Provide hangers, supports, anchors and chases as required for installation of Electrical Work.

E. Excavating and Backfilling: In accordance with requirements of Division 02. Provide all necessary shoring, sheeting, and pumping as part of Work of this Division.

F. Concrete: In accordance with requirements of Division 3.

G. Interface with other products:

1. For purposes of clarity and legibility, Drawings are essentially diagrammatic to the extent that many offsets, bends, special fittings, and exact locations of items are not indicated, unless specifically dimensioned. Exact routing of wiring, and locations of outlets, panels, and other items shall be governed by structural conditions or obstructions. Contractor shall make use of data in Contract Documents. In addition,

Architect reserves right, at no increase in Contract Sum, to make any reasonable change in location of electrical items exposed at ceilings or on partitions to group them in orderly relationships or to increase their utility. Verify requirements in this regard prior to roughing-in.

2. Take dimensions, location of doors, partitions, and similar features from Architectural Drawings. Verify at the Site under this Division. Consult Architectural Drawings for exact location of outlets, and other items to center with architectural features. Coordinate location of all ceiling mounted items with Division 09.

3.3 FIELD QUALITY CONTROL

A. Test panels and circuits for grounds and shorts with mains disconnected from feeders, branch circuits connected, and circuit breakers closed, all fixtures in place, permanently connected, grounding jumper to neutral lifted, and with all wall switches closed.

B. Contractor shall engage qualified testing agencies and contractors as defined in specification sections included in this manual

C. Run Meggar test on all feeders

D. Run meggar test on all branch circuits requested.

3.4 CLEANING

A. Properly prepare Work under this Division to be finish painted under Division 01.

3.5 EQUIPMENT IDENTIFICATION

A. Properly identify panelboards, circuit breakers in panelboards, disconnect switches, starters, and other apparatus used for operation or control of circuits, appliances or equipment.

3.6 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

I. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.7 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.8 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.9 SYSTEM STARTUP

A. Provide startup with manufacturer’s representatives on all systems requested by the owner. Provide list to owner 1 month prior to startup for owner to advise on startup training required.

3.10 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate to Owner's maintenance and clerical personnel and building occupants how to operate the following systems and equipment as defined in specifications as requested by the owner.:

B. Provide video recordings of demonstrations to Owner and provided minimum 3 copies to owner.

END OF SECTION

SECTION 26 05 19 – LOW-VOLTAGE CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Aluminum building wire.
3. Metal-clad cable, Type MC.
4. Connectors and splices.

1.2 SUBMITTALS

A. Product Data:

1. Copper building wire.
2. Aluminum building wire.
3. Metal-clad cable, Type MC.
4. Connectors and splices.

PART 2 PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Wire, Copper Conductors: Building wire will be 600V, Copper, TWHN unless noted otherwise

1. Underground wire may be RHW subject to approval from the engineer.
2. Aluminum wire is permitted for feeders sizes #2 when terminated with high pressure terminations equal to Burndy Hy-Lug or Hy-Plug
   a. Conduit size shall be increased to allow for aluminum wire
   b. Aluminum is based on THWN but XHHW is allowed if conduit size is increased.
   c. Stabloy Aluminum, complying with ASTM B800 and ASTM B801
3. Standards:
   a. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

b. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

4. Conductor Insulation:

5. Type THHN and Type THWN-2. Comply with UL 83.

2.2 METAL-CLAD CABLE, TYPE MC

A. See section 260533 for instances when MC Cable is allowed instead of conduit and building wire specified above. MC Cable shall not be installed anywhere not specifically listed.

B. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

2. Comply with UL 1569.

D. Circuits:

1. Single circuit and multicircuit with color-coded conductors.

E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors

F. Ground Conductor: [Insulated]

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2. Comply with UL 83.

H. Armor: Steel preferred, Aluminum acceptable, interlocked.

I. Jacket: PVC applied over armor.

2.3 CONNECTORS AND SPLICES

A. Splices and Terminations

1. 600 Volt

a. Splices: Solderless type only. Preinsulated "twist-on" type permitted on solid conductor size number 10 and smaller. Hydraulic compression long barrel type with application preformed insulated cover, heat shrinkable tubing or plastic insulated tape for all stranded conductors. For stranded conductors provide terminations designed for use with stranded conductors.

b. Terminations: 250 kcmil and above - two hole long barrel compression lugs. Below 250 kcmil - single hole compression lug. Conductors No. 12 and smaller: provide eye or forked tongue compression lugs at bolted or screw connections - no lugs required for compression style terminal blocks.

c. Cable Ties: Nylon or accepted, locking type. Use a torque limiting tool for installation of ties.

2. Control Cable Splices and Terminations

a. Splices: Preinsulated crimp pigtail or butt splice connectors.

b. Terminations: Locking spade, insulated, compression lugs.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.

2. Hubbell Power Systems, Inc.

3. O-Z/Gedney; EGS Electrical Group LLC.

4. 3M; Electrical Products Division.

5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Type THHN-THWN, single conductors in raceway.

B. Branch Circuits: Type THHN-THWN, single conductors in raceway.

C. Class 1 Control Circuits: Type THHN-THWN, in raceway.

D. Class 2 Control and Low Voltage Circuits: Type THHN-THWN, in raceway, or as required by manufacturer. Plenum rated where required. Cable shall not be installed in slab or under ground. All circuits shall be installed in raceway when installed in walls and non-accessible spaces.

3.2 INSTALLATION, GENERAL

A. Conceal cables in raceway in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points in accordance with Section 260533 prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least [6 inch (150 mm)] [12 inch (300 mm)] of slack.

3.4 BRANCH WIRING

A. General: Complete system of conduit required to all light outlets, receptacles, switches, etc. as shown. Conduit size as shown on drawings, except where no size is shown, conduit shall be sized per National Electrical Code. No conduit shall carry more than 8 conductors. All exposed switches, receptacles or outlet boxes for other purposes, install die cast boxes, except where specifically noted otherwise. Feeder cables shall have each phase identified according to the established code.

B. Coding: Branch circuit color code shall be: For 120/208 V. Black – Phase A, Red – Phase B, Blue – Phase C, White – Neutral, Green – Ground, Isolated Ground – Green with Yellow stripe, Purple "Travellers" on 3 and 4 way switching. For 277/480V. Brown (A), Orange (B), Yellow (C), and Gray neutral. Where colors are not available (No. 4 and larger) all terminals shall be coded, both on the wire and on the terminal. Phase and neutral wires shall appear in the same position and rotation at all appearances.

3.5 EQUIPMENT WIRING

A. General: Wiring connections for power and control for all equipment shall be complete including disconnect switches and controls unless otherwise specified or noted on drawings.

B. Control wiring for mechanical systems installed under this section of specifications shall be in accordance with mechanical drawings and specifications.

3.6 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each of the following visual and electrical tests:

a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.

b. Test bolted connections for high resistance using one of the following:

1) A low-resistance ohmmeter.

2) Calibrated torque wrench.

3) Thermographic survey.

c. Inspect compression-applied connectors for correct cable match and indentation.

d. Inspect for correct identification.

e. Inspect cable jacket and condition.

f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.

g. Continuity test on each conductor and cable.

h. Uniform resistance of parallel conductors.

B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.

2. Results that comply with requirements.

3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 GENERAL

1.1 SUMMARY

A. This section includes methods and materials for grounding

1.2 SUBMITTALS

A. Product Data:

1. For each type of product indicated.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Grounding Conductors:

1. General Characteristics: 600 V, THHN/THWN-2, copper wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

2. Isolated Equipment Grounding Conductor: same except green with continuous yellow stripe.

B. Bare Copper Grounding and Bonding Conductor:

a. Soft or Annealed Copper Wire: ASTM B3

b. Concentric-Lay Stranded Copper Conductor: ASTM B8.

c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.

d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.2 GROUNDING AND BONDING CLAMPS

A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

D. Exothermically Welded Connection

1. General Characteristics: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING AND BONDING BUSHINGS

A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures, and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

2.4 GROUNDING AND BONDING CONNECTORS

A. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

2.5 GROUNDING (EARTHING) ELECTRODES

A. Description: Grounding electrodes include rod electrodes, ring electrodes, metal underground water pipes, metal building frames, concrete-encased electrodes, and pipe and plate electrodes.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

2.6 GROUND BUS

A. Copper, 0.25 inch thick, minimum 16” x 4”, pre-drilled, 32 hole. Burndy BBB series or equal

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

3.2 BUSBARS

A. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, all MDF and IDF rooms and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inch (50 mm) minimum from wall, 6 inch (150 mm) above finished floor unless otherwise indicated.

3.3 SELECTION OF CONNECTORS

A. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.4 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Special Techniques:

1. Conductors:

a. Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

2. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

b. Make connections with clean, bare metal at points of contact.

c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.

d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.

e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

f. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1) Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate adjacent parts.

2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3) Use exothermic-welded connectors for outdoor locations and UFER; if disconnect-type connection is required, use bolted clamp.

g. Grounding and Bonding for Piping:

1) Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use bolted clamp connector or bolt lug-type connector to pipe flange by using one of lug bolts of flange. Where dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2) Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with bolted connector.

3) Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

h. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

i. Grounding for Steel Building Structure: Bond to common ground point. Where not common steel ground point is provided install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft (18 m) apart.

3. Electrodes:

a. Ground Rods: Drive rods until tops are 2 inch (50 mm) below finished floor or final grade unless otherwise indicated.

1) Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2) Use exothermic welds for below-grade connections.

b. For grounding electrode system, install at least four rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding electrode conductor.

c. Concrete-Encased Electrode (Ufer Ground):

1) Fabricate in accordance with NFPA 70; use minimum of 20 ft (6 m) of bare copper conductor not smaller than #3/0 Copper

a) If concrete foundation is less than 20 ft (6 m) long, coil excess conductor within base of foundation.

b) Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

d. Fabricate in accordance with NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 ft (6.0 m) long. If reinforcing is in multiple pieces, connect together by usual steel tie wires or exothermic welding to create required length.

4. Grounding at Service:

a. Equipment grounding conductors and grounding electrode conductors must be connected to ground bus. Install main bonding jumper between neutral and ground buses.

5. Grounding Separately Derived Systems:

    a. Bond to structural steel, main waterpipe within five feet of waterpipe entry to building, or building grounding electrode.

6. Grounding Underground Distribution System Components:

    a. Duct-Bank Grounding Conductor: Bury 12 inch (300 mm) above duct bank when indicated as part of duct-bank installation.

        1) Comply with IEEE C2 grounding requirements.

    b. Grounding Manholes and Handholes: Install driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inch (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inch (50 mm) above to 6 inch (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

    c. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields in accordance with manufacturer's published instructions with splicing and termination kits.

    d. Pad-Mounted Transformers and Switches when owner provided: Install two ground rods and ring electrode around pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than 2 AWG for ring electrode and for taps to equipment grounding terminals. Bury ring electrode not less than 6 inch (150 mm) from foundation.

7. Equipment Grounding:

    a. Install insulated equipment grounding conductors with all feeders and branch circuits.

    b. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

        1) Feeders and branch circuits.

        2) Lighting circuits.

        3) Receptacle circuits.

        4) Single-phase motor and appliance branch circuits.

        5) Three-phase motor and appliance branch circuits.

        6) Flexible raceway runs.

        7) Armored and metal-clad cable runs.

    c. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

d. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

e. Isolated Grounding Receptacle Circuits: Install insulated equipment grounding conductor connected to receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.

f. Isolated Equipment Enclosure Circuits: For designated equipment supplied by branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.

g. Metallic Fences: Comply with requirements of IEEE C2.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.

B. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 26 05 29 – HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Support, anchorage, and attachment components.

2. Fabricated metal equipment support assemblies.

1.2 SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Slotted support systems, hardware, and accessories.

b. Clamps.

c. Hangers.

d. Sockets.

e. Eye nuts.

f. Fasteners.

g. Anchors.

h. Saddles.

i. Brackets.

j. Trapeze

1.3 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.4 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive structural analysis provided by the manufacturer of support equipment. Where not available engage a qualified structural professional engineer to design hanger and support system.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

E. All supports shall comply with IBC, Washington Seismic Zone and IBC Standards

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch (10 mm) diameter holes at a maximum of 8 inch (200 mm) on center in at least one surface.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.; a division of Cooper Industries.

c. ERICO International Corporation.

d. GS Metals Corp.

e. Thomas & Betts Corporation.

f. Unistrut; Tyco International, Ltd.

g. Wesanco, Inc.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.

3. Material for Channel, Fittings, and Accessories: Hot dipped galvanized steel unless stainless steel specified.

4. Channel Width: Selected for applicable load criteria

5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Nonmetallic and Aluminum Slotted Support Systems: not permitted

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body must be made of malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Mechanical-Expansion Anchors: Insert-wedge-type, [zinc-coated] [stainless] steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325 (Grade A325M).

6. Toggle Bolts:Steel springhead type.

7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 EXECUTION

3.1 SELECTION

A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA `

2. NECA NEIS 101

3. NECA NEIS 105.

B. Provide vibration and seismic controls with hangers and supports in accordance with requirements specified in Section 260548

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERMC as required by NFPA 70. Minimum rod size must be 1/4 inch (6 mm) in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch (38 mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 INSTALLATION OF SUPPORTS

A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA NEIS 1, EMT, IMC and RMC may be supported by openings through structure members, in accordance with NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination must be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inch (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inch (100 mm) thick.

6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts

7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 6 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M. Submit welding certificates.

3.4 CONCRETE BASES

A. Provide concrete bases under Switchboards, Generators, Floor Mounted Distribution Panels, and transformers as well as where noted on the drawings.

B. Construct concrete bases of dimensions indicated, but not less than 4 inch (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

C. Use 3000 psi (20.7 MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup:

1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

SECTION 26 05 33 – RACEWAY AND BOXES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. HDPE: High Density Polyethlyene

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. RMC: Rigid Galvanized Steel

I. RNC: Rigid nonmetallic conduit.

J. RGS: Rigid galvanized steel

K. PVC: Polyvinyl Chloride

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Conduit, Raceways, and Boxes
2. Wireways and auxiliary gutters.
3. Surface metal raceways.
4. Floor boxes.
5. Cabinets and cutout boxes.

PART 2 PRODUCTS

2.1 METALLIC RACEWYAS

A. EMT

1. Performance Criteria:

    a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

    b. General Characteristics: UL 797 and UL Category Control Number FJMX.

    c. Hot dipped galvanized inside and outside

2. Steel Electrical Metal Tubing (EMT) and Elbows:

    a. Material: Steel.

3. Minimum size ½”

B. RMC (Rigid Galvanized Steel)

1. Performance Criteria:

    a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

    b. General Characteristics: UL 6 and UL Category Control Number DYIX.

2. Galvanized-Steel Electrical Rigid Metal Conduit, Elbows, Couplings, and Nipples:

    a. Exterior Coating: Zinc.

    b. Interior Coating: Zinc with organic top coating

3. Minimum Size is 1/2”

C. PVC-Coated-Steel Rigid Metal Conduit, Elbows, Couplings, and Nipples:

1. Exterior Coating: PVC complying with NEMA RN 1.

2. Interior Coating: Zinc with organic top coating

3. Minimum Trade Size: ½”.

D. IMC

1. Performance Criteria:

    a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

    b. General Characteristics: UL 1242 and UL Category Control Number DYBY.

    c. Steel Electrical Intermediate Metal Conduit (IMC):

    d. Exterior Coating: Zinc

    e. Interior Coating: Zinc with organic top coating

    f. Minimum Size: ½”

E. Flexible Metallic Conduit

1. Performance Criteria:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

   b. General Characteristics: UL 1 and UL Category Control Number DXUZ.

   c. Material: Steel preferred or Aluminum acceptable.

   d. Minimum Size: ½"

F. Liquid Tight Flexible Metallic Conduit

1. Performance Criteria:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

   b. General Characteristics: UL 360 and UL Category Control Number DXHR.

2. Material: Steel preferred or aluminum, acceptable

3. Minimum Trade Size: ½".

G. Aluminum conduit: Not permitted

2.2 NON METALLIC RACEWAYS

A. PVC

1. Performance Criteria:

   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

   b. General Characteristics: UL 651 and UL Category Control Number DZYR.

2. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

   a. Dimensional Specifications: Schedule 40.

   b. Minimum size: ½"

3. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:

   a. Dimensional Specifications: Schedule 80.

   b. Minimum size: ½"

B. ENT: Not allowed except for fiber optic innerduct

2.3 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

B. Fittings for Type RMC, Type IMC, and Type PVC Raceways:

1. General Characteristics: UL 514B and UL Category Control Number DWTT.

2. Options:

   a. Material: Steel.

   b. Coupling Method: Setscrew coupling. Setscrew couplings with only single screw per conduit are unacceptable.

   c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.

C. Fittings for Type EMT Raceways:

1. General Characteristics: UL 514B and UL Category Control Number FKAV.

2. Options:

   a. Material: Steel.

   b. Coupling Method: Setscrew coupling. Setscrew couplings with only single screw per conduit are unacceptable.

   c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.

   d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

D. Fittings for Type FMC Raceways:

1. General Characteristics: UL 514B and UL Category Control Number ILNR.

E. Fittings for Type LFMC Raceways:

1. General Characteristics: UL 514B and UL Category Control Number DXAS.

2.4 SOLVENT CEMENTS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

2. General Characteristics: As recommended by conduit manufacturer in accordance with UL 514B and UL Category Control Number DWTT.

2.5 MULTIOUTLET ASSEMBLY

A. See 262726

2.6 RACEWAYS AND AUXILIARY GUTTERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

2. General Characteristics: UL 870 and UL Category Control Number ZOYX.

B. Metal Wireways and Auxiliary Gutters:

1. Additional Characteristics:

    a. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

    b. Finish: Manufacturer's standard enamel finish.

2. Options:

    a. Degree of Protection: Type 1 (interior), Type 4 (exterior and kitchen) unless otherwise indicated.

    b. Wireway Covers: Hinged type unless otherwise indicated.

2.7 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

2. General Characteristics: UL 514A and UL Category Control Number QCIT.

B. Metallic Outlet Boxes:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.

    a. Material: Sheet steel.

    b. Sheet Metal Depth: Minimum 1.5 inch (38 mm) for power 2.5 inch (65 mm) for ESS and Communications

2. Exposed Exterior: Diecast FS and FD type

    a. Cast-Metal Depth: Minimum 1.8 inch (44.5 mm) for power and 2.4 inch (60.3 mm) for communications.

3. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb (23 kg).

    a. Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb (32 kg).

4. Surface boxes interior

    a. In finished areas provide Wiremold outlet boxes

        1) Power: 4-5/8” x 2-7/8” by 1-3/4” deep similar to WH2048 box. Dual gang WH2048-2

        2) Communications: Same but extra deep at 2-3/4”

5. Device Boxes: Same but with provision for mounting outlet directly to box

C. Metallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.

D. Floorboxes

1. Standard

a. Description: Floor box with provisions for mounting wiring devices below floor surface and floor box cover with provisions for passage of cords to recessed wiring devices mounted within floor box.

b. Six gang with scrubproof cover

c. Wiremold EFB6S in all floor types

1) Diecast cover of color selected by architect.

2) Provide Wiremold EFB6S when on grade.

d. Install devices with brackets shown on the drawings.

2. Wet Locations (Kitchen and areas near kitchen)

a. Full waterproof, with diecast lid

b. Cole Lighting #TLS-351-W (-C when in concrete)

c. Device mounting area is 4”x 9.5” (4 gang). Provide brackets for mounting

3. Performance Spaces (Stage)

a. Cast Iron non–skid lid

b. Cole Lighting #TLS-354 (-C when in concrete)

c. Device mounting area is 6”x 12”. Provide brackets for mounting

2.8 CABINETS, CUTOUT BOXES, JUNCTION BOXES, AND PULL BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

2. General Characteristics:

a. Non-Environmental Characteristics: UL 50.

b. Environmental Characteristics: UL 50E.

c. Outdoor products labeled Nema 4

B. Sheet Metal Cabinets and Boxes

1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.

2. Additional Characteristics: UL Category Control Number CYIV.

C. Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Additional Characteristics: UL Category Control Number BGUZ.

D. Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.

2. Additional Characteristics: UL Category Control Number BGUZ.

E. Cover Plates: Provide blank stainless steel covers for all junction or pull through boxes. See other sections for device plates

2.9 UNDERGROUND VAULTS

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

B. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

C. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

D. Where not shown handholes are Utility Vault#444LA with 44-332P H20 rated cover

PART 3 EXECUTION

3.1 SELECTION OF RACEWAYS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.

B. Outdoors:

1. Exposed: Rigid Galvanized Steel Conduit

2. Concealed Aboveground: Rigid Galvanized Steel or PVC where acceptable to AHJ and not subject to damage. Provide expansion fittings

3. Underground: PVC-40 unless noted PVC-80. Elbows to be fiberglass or plastic coated rigid steel in sizes 1.5” and larger

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors:

1. Exposed in non-finished spaces: Rigid Steel, IMC, or EMT

2. Exposed Finished Spaces: Surface Metal Raceway

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.

   a. MC Cable is permitted for branch circuitry only within the same room. All homeruns and connections between rooms are EMT

4. Damp or Wet Locations: RGS

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC and FMC.

D. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

3.2 SELECTION OF BOXES AND ENCLOSURES

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Outdoors: Nema 4 unless noted. Indoors: Type 1 unless noted. At exposed boxes provide cast metal or wiremold

3.3 INSTALLATION OF RACEWAYS

A. Raceway Sizes: When raceway is used all homeruns shall be minimum 1”, branch circuitry ¾” minimum, runs that end in a single device may be ½”. Note: where MC cable is acceptable these minimums do not apply

B. Comply with Neca 1 and NFPA 70 for installation of raceways.

C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

D. Comply with NECA NEIS 101 for installation of steel raceways.

E. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.

F. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts.

G. Raceway Terminations at Locations Subject to Moisture or Vibration: Provide insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

H. General Requirements for Installation of Raceways:

1. Complete raceway installation before starting conductor installation.

2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft (0.6 m) above finished floor.

3. Install no more than equivalent of three 90-degree bends in conduit run except for communications conduits, for which no more than equivalent of two 90-degree fewer bends are permitted . Support within 12 inch (300 mm) of changes in direction.

4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.

5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

6. Support conduit within 12 inch (300 mm) of enclosures to which attached.

7. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.

8. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:

    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

    b. Where an underground service raceway enters a building or structure.

    c. Conduit extending from interior to exterior of building.

    d. Conduit extending into pressurized duct and equipment.

    e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.

    f. Where otherwise required by NFPA 70.

9. Do not install conduits within 2 inch (50 mm) of the bottom side of a metal deck roof.

10. Keep raceways at least 6 inch (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

11. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2”) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.

12. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb (90 kg) tensile strength. Leave at least 12 inch (300 mm) of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

I. Requirements for Installation of Specific Raceway Types:

1. Types RMC and IMC: Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

2. Plastic Coated RMC: Follow manufacturer's installation instructions for clamping, cutting, threading, bending, and assembly. Provide PVC-coated sealing locknut for exposed male threads transitioning into female NPT threads that do not have sealing sleeves, including transitions from PVC couplings/female adapters to Type ERMC-S-PVC elbows in direct-burial applications. PVC-coated sealing locknuts must not be

used in place of conduit hub. PVC-coated sealing locknut must cover exposed threads on Type ERMC-S-PVC raceway. Coat field-cut threads on PVC-coated raceway with manufacturer-approved corrosion-preventing conductive compound prior to assembly.

3. Types FMC and LFMC: Comply with NEMA RV 3. Provide a maximum of 72 inch (1830 mm) equipment subject to vibration, noise transmission, or movement; and for transformers and motors and if used for fixture whips.

4. Type PVC:: Do not install Type PVC conduit where ambient temperature exceeds 122 deg F (50 deg C). Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted. Comply with manufacturer's written instructions for solvent welding and fittings.

J. Raceways Embedded in Slabs: Run raceways larger than metric designator 27 (trade size 1) below concrete slab. Run raceways larger than metric designator 27 (trade size 1) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place raceway close to slab support. Secure raceways to reinforcement at maximum 10 ft (3 m) intervals]. Arrange raceways to cross building expansion joints with expansion fittings at right angles to the joint. Arrange raceways to ensure that each is surrounded by a minimum of 2 inch (50 mm) of concrete without voids. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.

K. Stub-ups to Above Recessed Ceilings: Provide EMT, IMC, or RMC for raceways. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

L. Expansion-Joint Fittings: Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F (17 deg C) and that have straight-run length that exceeds 25 ft (7.6 m). Install in runs of aboveground RMC conduit that are located where environmental temperature change may exceed 100 deg F (55 deg C) and that have straight-run length that exceeds 100 ft (30 m).

M. Raceways Penetrating Rooms or Walls with Acoustical Requirements: Seal raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.

3.4 INSTALLATION OF SURFACE RACEWAYS

A. Install surface raceway with a minimum 2 inch (50 mm) radius control at bend points. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch (1200) mm) and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's written instructions. Tape and glue are unacceptable support methods.

3.5 INSTALLATION OF BOXES AND ENCLOSURES

A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.

B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured as follows:

1. Receptacle, AV, and Data: 18” to center of box, 20” to top

2. Light, Control Switches, Fire Alarm Pull Stations, and Access control panic/lockdown buttons: 48” to top of box

3. Fire Alarm Evacuation Device: 96” to top

4. Speakers and Clocks: 8’ to top or 6” below ceiling

5. Monitor Power, Data, and AV Boxes: 66” unless noted on the drawings

C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.

D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

E. Locate boxes so that cover or plate will not span different building finishes.

F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.

G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.

H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.

I. Set metal floor boxes level and flush with finished floor surface.

J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

M. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:

1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.

2. Provide gaskets for wallplates and covers.

N. Handholes and Vaults: Install level and true on minimum 24” of pea gravel. Lids shall be completely flush with grade and be labeled.

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements 260100.

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING

A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION

SECTION 26 05 34 – RACEWAY AND BOXES FOR COMMUNICATIONS AND ESS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes requirements for raceways, fittings, and boxes specific to communications circuits for fire alarm, security, CCTV, sound, television, voice, and data which are additional to 260533

B. This section applies to all conduit and boxes installed for all Division 27 and 28 systems.

1.2 REFERENCES

A. The applicable portions of the following specifications, standards, codes and regulations (latest editions and/or amendments) shall be incorporated by reference into these specifications.

B. General:

1. National Electrical Code (NEC)

2. National Electrical Safety Code (NESC)

3. Washington Industrial Safety and Health Act (WISHA)

4. Occupational Safety and Health Act (OSHA)

5. Communications:

6. TIA/EIA - 568A: Commercial Building Telecommunications Cabling Standard

7. TIA/EIA - 568A2: Corrections and Additions to TIA/EIA 568A

8. TIA/EIA - 569A: Commercial Building Standard for Telecommunication Pathways and Spaces

9. TIA/EIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

10. TIA/EIA - 607: Commercial Building Grounding and Bonding Requirements for Telecommunications

11. TIA/EIA -TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems

12. ISO/IEC IS 11801: Generic Cabling for Customer Premises

13. BICSI: BICSI Cabling Installation Manual

PART 2 PRODUCTS

2.1 RACEWAYS AND BOXES

A. Cable Tray

1. Basket (Wire Mesh) Cable Tray is 4” high with IEC 61537 BlacK Class C8 coating

a. Chastworth 60283450-003, 18” wide in MDF and IDF Rooms

b. Other areas of the building shall use size noted and 12 where not noted

c. Chatsworth #60283300-003

2. Include the following and all additional accessories for a complete system as shown on drawings

   a. Wall mount: Medium Duty Cantilever: Chatsworth RPlus#62085X03-004 of width required for tray

   b. Ceiling Mount: Omega SPLUS#62082X04 or width required

   c. Joint Clamps: Chatsworth#604800061-50

   d. Accessory Clamp (for joining waterfalls). Chatsworth #4080158-050

   e. Splice Plate: Chatsworth 67080053-010

   f. Radius Drop: CPI #60500-701 and 67020139-010

   g. Conduit Bracket: CPI#67080040-010

   h. Bend Radius: CPI #34742-706

   i. Ground Kit: CPI #68000032-020/68000033-020 with 680000370929 strap

   j. Cable Tie Clip and Hook and Loop: CPI#68000110-20 and 89011000-001

   k. Wire Cutter: CPI # 68000058-001

B. Raceway

1. Provide per 260533

   a. Minimum size for ESS systems is 1”

   b. Minimum size for Data and AV Systems is 1.25”

   c. Minimum size for other Communications Systems is 1”

   d. Elbows and sweeps: Bend radius is minimum 8x conduit radius up to 2” and 10x bending radius above 2”.

C. Boxes

1. Randl 5” x 5” x 2.875” deep box with single and double gang mudrings. Randl R-55014 for electronic safety and security and signal systems and Randl T-55017 for communications systems

   a. Exception: When in fire rated wall, Randl box exceeds allowable area, provide 4” x 4” by 2-1/2” box.

   b. Alternate approved box Hubbell HBL260 or HBL263 extra deep 4-11/16” box.

2. Surface mounted outlets – Not allowed except where shown. Wiremold 2.5” deep box:

D. Pull Boxes:

1. Provide pull boxes (junction boxes) as shown on the Drawings and as required. 90 degree condulets (LB’s) are not acceptable.

2. Increase size of pull boxes

Conduit	Width	Length	Depth
1”	4”	16”	4”
1.25”	6”	20”	5”

1.5”	8”	27”	6”
2”	8”	36”	6”
2.5”	8”	43”	8”
3”	12”	48”	8”
3.5”	12”	54”	10”
4”	12”	60”	10”

2.2 ACCESSORIES

A. Backboards: Provide backboards which are 5/8” A-C fire treated plywood, void free, 8-ft high unless otherwise noted, capable of supporting attached equipment, and painted with a minimum of two coats of fire retardant light gray semi gloss paint

B. Grounding Conductor: Provide #6 AWG insulated solid copper conductor (green) to bond all metallic raceway to the nearest grounding bus bar, cable tray or structural steel as required by the AHJ

C. Labels: Provide labels as recommended in TIA/EIA 606. Labels shall be permanent/legible typed and created by a Brady LS-2000 label maker or equivalent system. Handwritten labels are not acceptable. Labels are required for all raceway and pull boxes.

D. Pull Strings: Provide pull strings in all conduit per 260533

PART 3 EXECUTION

3.1 SELECTION OF RACEWAYS

A. All work shall comply with 260533

B. Cable shall not be run underground except between the MDF and IDF unless specifically approved by the engineer.

C. Outdoors:

1. Exposed: Rigid Galvanized Steel Conduit

2. Concealed Aboveground: Rigid Galvanized Steel or PVC where acceptable to AHJ and not subject to damage. Provide expansion fittings

3. Underground: PVC-40 unless noted PVC-80. Elbows to be fiberglass or plastic coated rigid steel in sizes 1.5” and larger.

D. Indoors:

1. Exposed in non-finished spaces: Rigid Steel, IMC, or EMT

2. Exposed Finished Spaces: Surface Metal Raceway Boxes

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.

4. Damp or Wet Locations: RGS

3.2 INSTALLATION OF RACEWAYS

A. Comply with all requirements identified in 260533.

B. Install the raceway system in a manner ensuring that communications circuits, when installed, are able to fully comply with the TIA/EIA, ISO/IEC and BICSI references listed in Part 1 — References, above.

C. Run conduit in the most direct route possible, parallel to building lines. Do not route conduit through areas in which flammable material may be stored, or over or adjacent to boilers, incinerators, hot water lines, or steam lines.

D. Conduit bends: A conduit bend shall not exceed 90 degrees.

E. For conduit up to 2”, the bend must be at least 8 times the internal diameter of the conduit. For conduit greater than 2”, the bend must be at least 10 times the internal diameter of the conduit.

F. The sum total of conduit bends for a section of conduit shall not exceed 180 degrees, except one additional bend of up to 90 degrees is acceptable if the bend is located within 12 inches of the cable feed end.

G. 90 degree condulets (LB’s) are not acceptable.

H. Ream conduits to eliminate sharp edges and terminate with metallic insulated grounded throat bushings. Cap each conduit with a mechanical-type seal for protection. Equip all conduits with a plastic or nylon pull string with a minimum test rating of 200 lb.

I. Terminate conduits that protrude through a floor 1” to 3” above the surface of the floor. Conduits stubbed to ceiling shall be clear of all casework and obstacles on floor below. Also conduits shall be located to be easily accessible and not blocked by structural members, ductwork, piping, equipment, etc.

J. Label each conduit end in a clear manner by designating the location of the other conduit end (i.e. room name, communications closet name, junction box number, etc.). Indicate conduit length on the label.

K. Pull Boxes: Install pull boxes in an exposed location, readily accessible both at time of construction and after building occupation. Pull boxes shall not be installed in interstitial building space.

L. Do not exceed one pull box per total conduit run between device box and termination point in a communications closet.

M. If mounting pull box on ceiling structure above ceiling grid, do not mount higher than 4’ above grid (mount on wall instead).

N. Install pull boxes such that conduit enters and exits at opposite ends of the box as follows:

END OF SECTION

SECTION 26 05 43 – UNDERGROUND RACEWAY AND BOXES

PART 1 GENERAL

1.1 SUMMARY

A. This Section provides additional requirements to Section 260533

B. Provide all materials and labor for the installation of a pathway system underground circuits. Work in this section includes excavation and trenching, duct (raceway) construction, cutting and patching, concrete, underground cable vault construction, and landscaping.

C. This Section includes requirements for the above work which specifically pertain to outside plant communications and which are more stringent, additional to, or different from that of the Division 2, Division 3, Division 26, Division 27 and Division 28 sections.

D. Primary voltage (over 600 Volts) shall be encapsulated by red CDF. RED CDF – Allow 3000psi concrete

1.2 REFERENCES

A. The applicable portions of the following specifications, standards, codes and regulations (latest editions and/or amendments) shall be incorporated by reference into these specifications.

1. National Electrical Code (NEC)

2. National Electrical Safety Code (NESC)

3. Washington Industrial Safety and Health Act (WISHA)

4. Occupational Safety and Health Act (OSHA)

5. WSDOT/APWA 1998 Standards Specifications for Road, Bridge and Municipal Construction (APWA Standard Specifications)

6. TIA/EIA - 758: Customer-owned Outside Plant Telecommunications Cabling Standard

7. TIA/EIA - 568A: Commercial Building Telecommunications Cabling Standard

8. TIA/EIA - 569: Commercial Building Standard for Telecommunication Pathways and Spaces

9. TIA/EIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

10. TIA/EIA - 607: Commercial Building Grounding and Bonding Requirements for Telecommunications

11. ISO/IEC IS 11801: Generic Cabling for Customer Premises

1.3 SUBMITTALS

A. Product Data: Raceways, fittings, elbows, manholes, handoles, supports

PART 2 PRODUCTS

2.1 RACEWAYS AND FITTINGS

A. Comply with all requirements of 260533 except per below.

2.2 DUCTS AND DUCTBANKS

A. Ducts: Provide in locations as shown on the drawings. All conduit, fittings, and adhesives shall be provided by the same manufacturer.

B. Types:

1. Rigid Non-Metallic Conduit (RNC):

a. RNC shall be NEMA TC 2 schedule 40 rigid polyvinyl chloride (PVC) approved for direct burial without concrete encasement. RNC shall be UL listed.

b. Fittings shall be NEMA TC3, matched to conduit and material.

c. Bends shall be Fiberglass, Plastic Coated Rigid Galvanized Steel, or Taped Rigid Galvanized steel in sizes 1.5” and larger

d. Minimum burial depth is 24”

e. Use Schedule 80 PVC where directed on the drawings.

C. Fittings:

1. Bends/Sweeps:

a. Unless otherwise noted on the Drawings, bends/sweeps shall be factory manufactured.

b. Unless otherwise shown on the Drawings, bends of a bend radius shall not be less than 10 times the internal diameter of the conduit for communications circuits.

c. Unless otherwise shown on the Drawings, the use of 90 degree elbows, LB’s, condulets, or the use of a UCV in place of a bend/sweep is not acceptable for communications circuits.

2. End Caps (Plugs): Provide pre-manufactured water-tight end caps for all ducts during construction. Tape is not an acceptable end cap or cover.

3. End Bells: Provide end bells for terminating conduit in UCVs. Do not provide for conduit ends terminating in UCVs which are equipped with TERM-A-DUCT.

D. Pull Cords: Provide nylon pull cord indicating length measurement for each duct. Pull cord strength shall be a minimum of 130 pounds.

E. Ductbanks:

1. Duct Spacers/Supports: Provide high-density plastic interlocking spacers/supports to maintain uniformity of multiple ducts within a ductbank. Spacers shall be:

2. Underground Devices Inc.: WUNPEECE

F. Warning Tape: Provide metallic warning tape above each ductbank. Tape shall be 6” wide and orange in color.

G. Grounding/Bonding: Provide #2 bare ground along length of ductbank.

H. Concrete Warning Planks: At buried conduit for future locations. Mark each plank with "ELECTRIC" or “Communications” in 2 inch (50 mm) high, 3/8 inch (10 mm) deep letters.

2.3 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover must form top of enclosure and must have load rating consistent with that of handhole or box with closed bottom and H20 fully rated lid

1. Utility Vault #444LA with 44-332P Cover for power. Label Electric

2. Utility Vault #253T with 38/25-TA cover (253TA Vault). Label Communications

3. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at installation location with ground-water level at grade.

4. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus additional 12 inch (300 mm) vertically and horizontally to accommodate alignment variations.

PART 3 EXECUTION

3.1 EARTHWORK

A. Backfill

1. Provide 4” of sand bedding under all underground conduit

2. Embed conduits with sand shading around duct bank

3. Provide 12” of sand shading above conduits after compaction.

4. Top of trench may be native backfill with no rocks over 6”

B. Depth of excavation

1. For handholes and vaults: Depth shall allow for the overall assembled height of the vault plus the added height of risers, covers and bedding material.

2. For trenches: 24 inch minimum depth but 36” depth for all trenches with over 600 volt power

C. Width of excavation: Minimum 24” to maintain

1. 24” clearance from gas or water lines

2. 12” clearance between communications and over 600 volt lines

3. 12” clearance between under and over 600 volt lines.

D. Trench grade shall be sloped to fall 3 inches per 100 feet in general and ¼” per foot where possible. Slope shall fall toward lower handholes.

E. All conduits entering the building slabe shall slope up minimum ¼” per foot.

F. Waste Disposal: The Contractor shall remove all materials and other construction debris from the site in a timely manner. Materials shall be disposed of legally.

G. Restoration:

1. Restore area immediately after backfilling is completed.

2. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

3. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.

4. Cut and patch existing pavement in path of underground duct, duct bank, and underground structures in accordance with "Cutting and Patching" Article in Section 017300 "Execution."

3.2 INSTALLATION OF DUCTS

A. Reference Standards: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NEMA TCB 2 for installation of underground ducts and duct banks.

B. Duct Terminators for Entrances to Cast-in-Place Manholes and Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inch (150 mm) o.c. for 4 inch (100 mm) duct, and vary proportionately for other duct sizes.

C. Building Wall Penetrations: Make transition from underground duct to steel raceway at least 10 ft (3 m) outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed. Install steel raceway penetrations of building walls

D. Install manufactured steel raceway elbows for stub-ups at poles unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow. Couple steel elbows to ducts with adapters designed for this purpose, and encase coupling with minimum 3 inch (75 mm) of concrete for minimum of 12 inch (300 mm) on each side of coupling.

E. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15 psig (1.03 MPa) hydrostatic pressure.

F. Pulling Cord: Install 200 lbf (1000 N) test nylon cord in empty ducts.

G. Duct and Duct Bank:

1. Excavate and backfill per earthwork above

2. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

a. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 ft (6 m) of duct. Place spacers within 24 inch (600 mm) of duct ends. Stagger spacers approximately 6 inch (150 mm) between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

3. Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

a. Install manufactured steel elbows for stub-ups, at building entrances, and at changes of direction in duct. Couple RNC duct to steel raceway with adapters designed for this purpose, and encase coupling with minimum 3 inch (75 mm) of concrete.

b. Stub-ups to Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inch (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment. Stub-ups must terminate in coupling installed flush with finished base and minimum 3 inch (75 mm) from conduit side to edge of base.

4. Underground-Line Warning Tape: Bury nonconducting underground line no less than 12 inch (300 mm) above. Align tape parallel to and within 3 inch (75 mm) of centerline of duct bank. Provide additional warning tape for each 12 inch (300 mm) increment of duct-bank width over nominal 18 inch (450 mm). Space additional tapes 12 inch (300 mm) apart, horizontally across width of ducts.

5. Ground ducts and duct banks in accordance with Section 260526."

H. Concrete Encasement

1. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

2. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms. Remove all forms

3. Concrete Cover: Install minimum of 3 inch (75 mm) of concrete cover between edge of duct to exterior envelope wall, 2 inch (50 mm) between duct of like services, and 4 inch (100 mm) between power and communications ducts.

4. Place minimum 6 inch (150 mm) of engineered fill above concrete encasement of duct.

5. Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

3.3 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handholes and Manholes:

1. Install units level and plumb and with orientation and depth coordinated with connecting duct to minimize bends and deflections required for proper entrances.

2. Unless otherwise indicated, support units on level bed of crushed stone or gravel graded from 1 inch (25 mm) sieve to No. 4 (4.75 mm) sieve and compacted to same density as adjacent undisturbed earth.

3. Field-cut openings for conduits in accordance with enclosure manufacturer's published instructions. Cut wall of enclosure with tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

B. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

C. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars.

3.4 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump, and building interiors affected by Work.

1. Sweep floor, removing dirt and debris.

2. Remove foreign material.

END OF SECTION

SECTION 26 05 48 – VIBRATION AND SEISMIC CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Restraints - rigid type.
3. Restraints - cable type.
4. Restraint accessories.
5. Post-Installed concrete anchors.
6. Concrete inserts.

1.2 SUBMITTALS

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Use manufacturer’s structural engineer approved details or engage qualified structural professional engineer to design seismic control system.

B. Seismic-Restraint Device Load Ratings: Devices to be tested and rated in accordance with applicable code requirements and authorities having jurisdiction. Devices to be listed by a nationally recognized third party that requires periodic follow-up inspections and has a listing directory available to the public. Provide third-party listing by one or more of the following: ICC-ES product listing or UL product listing

C. Consequential Damage: Provide additional seismic restraints for suspended electrical components or anchorage of floor-, roof-, or wall-mounted components so that failure of a non-essential or essential component will not cause failure of any other essential building component.

D. Fire/Smoke Resistance: Seismic restraint devices that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.

E. Component Supports:

1. Load ratings, features, and applications of reinforcement components must be based on testing standards of a nationally recognized testing agency.

2.2 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.

2. Size: Factory or field cut to match requirements of supported equipment.

3. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.

4. Surface Pattern: Smooth, ribbed, or waffle pattern.

5. Infused nonwoven cotton or synthetic fibers.

6. Load-bearing metal plates adhered to pads.

7. Sandwich-Core Material: Resilient.

   a. Surface Pattern: Smooth, ribbed, or waffle pattern.

   b. Infused nonwoven cotton or synthetic fibers.

2.3 RESTRAINTS - RIGID TYPE

A. Description: Shop- or field-fabricated bracing assembly made of ANSI/AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe, or other rigid steel brace member. Includes accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.4 RESTRAINTS - CABLE TYPE

A. Seismic-Restraint Cables: ASTM A603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for seismic-restraining cable service; with fittings attached by means of poured socket, swaged socket, or mechanical (Flemish eye) loop.

B. Restraint cable assembly and cable fittings must comply with ASCE/SEI 19. Cable fittings and complete cable assembly must maintain the minimum cable breaking force. U-shaped cable clips and wedge-type end fittings do not comply and are unacceptable.

2.5 RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped]to hanger rod. Non-metallic stiffeners are unacceptable.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.6 POST-INSTALLED CONCRETE ANCHORS

A. Mechanical Anchor Bolts:

1. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488/E488M.

B. Provide post-installed concrete anchors that have been prequalified for use in seismic and wind-load applications.

1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.

2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.

2.7 CONCRETE INSERTS

A. Provide preset concrete inserts that are seismically prequalified in accordance with ICC-ES AC446 testing.

B. Comply with MSS SP-58.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application.

3.3 INSTALLATION OF SEISMIC-RESTRAINT DEVICES

A. Provide seismic restraint devices for systems and equipment where indicated in Equipment Schedules or Seismic and Wind-Load Controls Schedule, where indicated on Drawings, where the Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.

1. Install equipment and devices to withstand the effects of earthquake motions.

B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

C. Installation of seismic restraints must not cause any stresses, misalignment, or change of position of equipment or conduits.

D. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).

2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

E. Raceway, Cable, Wireway, Cable Tray, and Busway Support and Hanger Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).

2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).

F. Install cables so they do not bend across edges of adjacent equipment or building structure.

G. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

H. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

I. Post-Installed Concrete Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Mechanical-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors must be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque using a torque wrench.

5. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

END OF SECTION

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes label requirements for Divisions 26,27,28:

1.2 SUBMITTALS

A. Product Data

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

1.3 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13..

B. Comply with 29 CFR 1910.144 for color identification of hazards; 29 CFR 1910.145 for danger, caution, warning, and safety instruction signs and tags; and the following:

1. Fire- -alarm equipment, including boxes, must be finished, painted, or suitably marked safety red or as required by AHJ

2. finished floor.

C. Signs, labels, and tags required for personnel safety must comply with the following standards:

1. Safety Colors: NEMA Z535.1.

2. Facility Safety Signs: NEMA Z535.2.

3. Safety Symbols: NEMA Z535.3.

4. Product Safety Signs and Labels: NEMA Z535.4.

5. Safety Tags and Barricade Tapes for Temporary Hazards: NEMA Z535.5.

D. Comply with NFPA 70E and Section 260573 requirements for arc-flash warning labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, must comply with UL 969.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

2.2 COLOR REQUIREMENTS

A. Raceways, equipment, and boxes Carrying Circuits at 1000 V or Less:

1. 120/208 Volt Power: White letters on a black field.
2. 277/480 Volt Power – White letters on blue
3. 120/208 Volt emergency Power: Black letters on a red field (Use dark orange if AHJ objects)
4. 277/480 Volt Power – Blue letters on red field (Use dark orange if AHJ objects)
5. Fire Alarm: White on red.
6. Legend: Indicate system or service and voltage, if applicable.

B. Cable Colors

1. Color must be factory applied and field applied tape for sizes larger than 4 AWG.
2. Colors for 208Y/120 V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
   d. Neutral: White
   e. Ground: Green
   f. Isolated Ground: Green with yellow stripe
3. Colors for 480Y/277 V Circuits:
   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Neutral: Gray
   e. Ground: Green
   f. Isolated Ground: Green with yellow stripe
4. Travellers: Purple

C. Raceways and Cables Carrying Circuits at More Than 1000 V:

1. Black letters on orange field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

D. Junction Box Colors. Paint all junction boxes

1. 277 Volt Normal: Brown
2. 120 Volt Normal: Black
3. 277 Volt emergency: Darkest Orange or Red as allowed by code authority
4. 120 Volt Normal: Dark Orange or Red as allowed by code authority
5. Fire Alarm: Red
6. Intercom/Clock: Gray
7. Data/Phone: Blue
8. Television: White
9. Sound: Purple
10. Security: Yellow
11. In addition indicate with pen the system type, circuit, and voltage for power junction boxes

2.3 LABELS, TAGS, BANDS, SIGNS, AND WARNING LABELS

A. Comply with NFPA 70 and 29 CFR 1910.145

B. Labels

1. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
2. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.
3. Self-Adhesive Wraparound Labels: Write-on, 3 mil (0.08 mm) thick, polyester or vinyl flexible label with acrylic pressure-sensitive adhesive.
4. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over legend. Labels sized such that clear shield overlaps entire printed legend.
5. Marker for Labels:
    a. Permanent, waterproof, black ink marker recommended by tag manufacturer.
    b. manufacturer.
6. Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3 mil (0.08 mm) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
7. Minimum Nominal Size:
    a. 1-1/2 by 6 inch (37 by 150 mm) for raceway and conductors.
    b. 3-1/2 by 5 inch (76 by 127 mm) for equipment.
    c. As required by authorities having jurisdiction.

C. Bands and Tubes

1. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inch (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.

2. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at maximum of 200 deg F (93 deg C). Comply with UL 224.

D. Tapes and Stencils

1. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mil (0.08 mm) thick by 1 to 2 inch (25 to 50 mm) wide; compounded for outdoor use.

3. Tape and Stencil: 4 inch (100 mm) wide black stripes on 10 inch (250 mm) centers placed diagonally over orange background and are 12 inch (300 mm) wide. Stop stripes at legends.

4. Underground-Line Warning Tape:

a. Tape:

1) Recommended by manufacturer for method of installation and suitable to identify and locate underground electrical and communications utility lines.

2) Printing on tape must be permanent and may not be damaged by burial operations.

3) Tape material and ink must be chemically inert and not be subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

4) Color and Printing:

a) Comply with APWA Uniform Color Code using NEMA Z535.1 safety colors.

b) Inscriptions for Red Tapes: "CAUTION BURIED ELECTRIC LINE BELOW" or for over 600V. "CAUTION BURIED HIGH VOLTAGE ELECTRIC LINE BELOW"

c) Inscriptions for Orange Tapes: CAUTION BURIED FIBER OPTIC LINE BELOW" OR "CAUTION BURIED COMMUNICATION LINE BELOW".

5. Tape:

a. Pigmented polyolefin, bright colored, [continuous-printed on one side with inscription of utility,]compounded for direct-burial service.

b. Width: 3 inch (75 mm).

c. Thickness: 4 mil (0.1 mm).

d. Weight: 18.5 lb/1000 sq. ft (9.0 kg/100 sq. m).

e. Tensile in accordance with ASTM D882: 30 lbf (133.4 N) and 2500 psi (17.2 MPa).

E. Tags

1. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

F. Signs

1. Baked-Enamel Signs:

a. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.

b. 1/4 inch (6.4 mm) grommets in corners for mounting.

c. Nominal Size: 7 by 10 inch (180 by 250 mm).

2. Metal-Backed Butyrate Signs:

a. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396 inch (1 mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.

b. 1/4 inch (6.4 mm) grommets in corners for mounting.

c. Nominal Size: 10 by 14 inch (250 by 360 mm).

3. Laminated Acrylic or Melamine Plastic Signs:

a. Engraved legend.

b. Thickness:

1) For signs up to 20 sq. inch (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.

2) For signs larger than 20 sq. inch (129 sq. cm), 1/8 inch (3.2 mm) thick.

3) Punched or drilled for mechanical fasteners with 1/4 inch (6.4 mm) grommets in corners for mounting

4) Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

G. Cable Ties

1. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

a. Minimum Width: 3/16 inch (5 mm).

b. Tensile Strength at 73 deg F (23 deg C) in accordance with ASTM D638: 12,000 psi (82.7 MPa).

c. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).

d. Color: Black, except where used for color-coding.

2. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

a. Minimum Width: 3/16 inch (5 mm).

b. Tensile Strength at 73 deg F (23 deg C) in accordance with ASTM D638: 12,000 psi (82.7 MPa).

c. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).

d. Color: Black.

3. Plenum-Rated Cable Ties in all plenums: Self-extinguishing, UV stabilized, one piece, and self-locking.

a. Minimum Width: 3/16 inch (5 mm).

b. Tensile Strength at 73 deg F (23 deg C) in accordance with ASTM D638: 7000 psi (48.2 MPa).

c. UL 94 Flame Rating: 94V-0.

d. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).

e. Color: Black.

2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Wiring Device Labels

1. Label all wiring devices with panel and circuit number with clear dymo label with black letters for normal power, red letters for emergency power.

2. At Wiring devices in black pen on inside of box indicated panel, voltage, and circuit numbers in the box.

B. Panel Directory

1. Directory: Provide typewritten circuit directory on the inside of each panel door under plastic cover, identifying the type and location of every load. At lighting and receptacle circuits, indicate room numbers and names. All room numbers shall be as furnished by the Owner. All replaced or modified panels shall be provided with new directories.

2. Identification: Spare circuits will be identified as such in pencil. Permanent room numbers, as furnished by owner, shall be used for location identification.

3. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

4. Fasteners for Labels and Signs: Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

C. Ceiling Tile Labels

1. Where equipment is above an accessible ceiling label the ceiling T or ceiling panel if T is not available.

a. Label shall be clear dymo label indicating equipment description

PART 3 EXECUTION

3.1 IDENTIFICATION SCHEDULE

A. Label the following equipment

1. Panelboards: Typewritten directory of circuits in location provided by panelboard manufacturer. Panelboard identification must be in form of self-adhesive, engraved, laminated acrylic or melamine label.

2. Enclosures and electrical cabinets.
3. Access doors and panels for concealed electrical items.
4. Switchboards.
5. Transformers: Label that includes tag designation indicated on Drawings for transformer, feeder, and panelboards or equipment supplied by secondary.
6. Emergency system boxes and enclosures.
7. Motor-control
8. Enclosed switches.
9. Enclosed circuit breakers.
10. Enclosed controllers and starters.
11. Variable-speed controllers.
12. Push-button stations.
13. Power-transfer equipment.
14. Generator
15. Contactors.
16. Lighting Control Devices
17. Remote-controlled switches, dimmer modules, and control devices.
18. Battery-inverter units.
19. Monitoring and control equipment.
20. UPS equipment.
21. Label the following Division 27 and 28 equipment per their specifications
    a. Communications/Intercom Equipment
    b. Communications/Data and Telephone
    c. Communications/Emergency Responder
    d. Communications/Audio Visual
    e. Other communications systems
    f. Access Control Equipment
    g. Security Systems equipment
    h. Fire alarm equipment
    i. Video Surveillance Equipment

B. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

C. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

D. Specific Label Types

1. Cable Identification: For cables in vaults, pull and junction boxes, and handholes, use vinyl wraparound labels or self-adhesive vinyl tape to identify cable type and voltage where appropriate

2. Cable Identification at Lighting Control, Communications, and ESS: Provide vinyl wraparound labels or self-adhesive vinyl tape to identify cable type, destination, and circuit where appropriate at all control devices

3. Future Boxes, Conduits, and Circuits: Attach write-on tags or hand mark cable, conduit, or box as the stub location and future purpose

4. Spare Boxes, Conduits, and Circuits: Attach write-on tags or hand mark cable, conduit, or box as the stub location and future purpose

5. Conduit Stubs (Used, Spare, and Future): Attach write-on tags or hand mark cable, conduit, or box as the stub location and future purpose

6. Future Stub out locations underground: Mark with 20” x 4” concrete marker block labeled with size, destination and purpose of stub

7. Conduits in Handholes: Label all conduits with destination with hand marker

8. Concealed and Accessible Raceways, Duct Banks, More Than 600V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3 inch (75 mm) high, black letters on 20 inch (500 mm) centers. Locate identification at changes in direction, at penetrations of walls and floors, and at 10 ft (3 m)

9. Accessible Raceways and Metal-Clad Cables, 600V or Less, for Service, Feeder, and Branch Circuits, More Than 30A: Identify with self-adhesive raceway labels. Locate identification at changes in direction, at penetrations of walls and floors, at 50 ft (15 m) maximum intervals in straight runs, and at 25 ft (7.6 m) maximum intervals in congested areas.

10. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

11. Instructional Signs: Baked-enamel warning signs or Metal-backed, butyrate

12. Warning Labels for Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs or Metal-backed, butyrate warning signs.

    a. Apply to exterior of door, cover, or other access.

    b. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

        1) Power-transfer switches.

        2) Controls with external control power connections.

13. Arc Flash Warning Labeling: Self-adhesive labels.

14. Instruction Signs: Baked-enamel warning signs, Metal-backed, butyrate warning signs, or Laminated acrylic or melamine plastic signs

15. Emergency Operating Instruction Signs: Baked-enamel warning signs, Metal-backed, butyrate warning signs, or Laminated acrylic or melamine plastic signs with white legend on red background with minimum 3/8 inch (10 mm) high letters

E. Equipment Identification Labels: Equipment: Self-adhesive label

3.2 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.3 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 1000 V: Identification must completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 1000 V: Identification must completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at location with high visibility and accessibility.

2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to location and substrate.

K. Snap-Around Labels: Secure tight to surface at location with high visibility and accessibility.

L. Self-Adhesive Wraparound Labels: Secure tight to surface at location with high visibility and accessibility.

M. Self-Adhesive Labels:

1. Install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.

2. Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on 1-1/2 inch (38 mm) high label; where two lines of text are required, use labels 2 inch (50 mm) high.

N. Snap-Around Color-Coding Bands: Secure tight to surface at location with high visibility and accessibility.

O. Heat-Shrink, Preprinted Tubes: Secure tight to surface at location with high visibility and accessibility.

P. Marker Tapes: Secure tight to surface at location with high visibility and accessibility.

Q. Self-Adhesive Vinyl Tape: Secure tight to surface at location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for minimum distance of 6 inch (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

R. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

S. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inch (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in common trench [or concrete envelope]exceeds 16 inch (400 mm) overall.

2. Install underground-line warning tape for direct-buried cables and cables in raceways.

T. Metal Tags:

1. Place in location with high visibility and accessibility.

U. Write-on Tags:

1. Place in location with high visibility and accessibility.

V. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

2. Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on minimum 1-1/2 inch (38 mm) high sign; where two lines of text are required, use signs minimum 2 inch (50 mm) high.

W. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

2. Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on 1-1/2 inch (38 mm) high sign; where two lines of text are required, use labels 2 inch (50 mm) high.

X. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to location and substrate.

2. Unless otherwise indicated, provide single line of text with 1/2 inch (13 mm) high letters on 1-1/2 inch (38 mm) high sign; where two lines of text are required, use labels 2 inch (50 mm) high.

Y. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.

2. In Spaces Handling Environmental Air: Plenum rated.

END OF SECTION

SECTION 26 05 73 – POWER SYSTEMS PROTECTIVE DEVICE STUDY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. System coordination study for normal systems.

2. Short circuit study for normal and emergency systems.

3. Protective device calibration and setting to achieve coordination.

4. Arc fault study per NEC 70E or entire system. Provide an Arc Flash Hazard Study for the electrical distribution system shown on the one-line drawings. The intent of the Arc Flash Hazard Study is to determine hazards that exist at each major piece of electrical equipment shown on the one-line drawings. This includes switchgear, switchboards, panelboards, motor control centers, automatic transfer switches, VFD's, and transformers. The study will include creation of Arc Flash Hazard warning labels. These labels serve as a guide to assist technicians and others in the selection of proper personal protective equipment when working around exposed and energized conductors. Electrical contractor shall install the labels.

5. The system coordination engineer must include a statement in the front of the study stating that Selective Coordination has been provided to meet NEC 700.27. The report shall have the coordination engineer's stamp on the cover page.

6. Contractor shall provide all changes including transformers, fuses, wire size and conduit size changes required by the coordination engineer.

1.2 SCOPE

A. It is the intent of these tests to assure that protective devices are operational, correctly applied, within industry and manufacturer's tolerances, and installed in accordance with the specifications. This effort should minimize the damage caused by any electrical failure. The testing agency shall verify that the electrical system and electrical equipment configuration matches the contract documents, vendor shop drawings, and the electric system coordination study recommended settings.

B. Prepare a coordination study for the specific electrical overcurrent devices and feeder lengths, to be installed under this project, from the primary overcurrent protective device to the branch circuit breaker panels to assure proper equipment and personnel protection.

C. The study shall present an organized time-current analysis of each protective device in series from the individual device back to the source at Puget Sound Energy. The study shall reflect the operation of each device during normal and abnormal current conditions, and confirm that devices are coordinated.

D. The study shall coordinate the emergency system to meet NEC 700, 701, and 702. The system shall selectively coordinate to comply with all requirements of 700.27 and 701.18. all equipment provided under Panels, Switchboards, Circuit Breakers, Fusing, Controllers, etc. shall be designed and provided by the contractor to comply with the selective coordination requirements of the code. Study shall be completed and accepted by the engineer prior to ordering any equipment.

E. Provide arc fault/flash study per NFPA 70E.

F. Study shall be stamped by the coordination study engineer with a Professional Engineer's stamp from the State of Washington

G. Report shall not be submitted until complete compliance with NEC 700.27 is complete. Contractor shall provide all devices as directed in the coordination study.

H. Coordination Study Engineer report and stamp states that the coordination engineer is stating that the system complies with NEC 700.27 and 701.18.

1.3 APPLICABLE CODES, STANDARDS AND REFERENCES

A. Inspection and tests shall be in accordance with the following codes and standards except as provided otherwise herein:

1. American National Standards Institute ANSI C2: National Electrical Safety Code

2. American Society for Testing and Materials – ASTM

3. Association of Edison Illuminating Companies – AEIC

4. Institute of Electrical and Electronic Engineers – IEEE

5. Insulated Cable Engineers Association – ICEA

6. International Electrical Testing Association NETA Maintenance Testing Specifications MTS- 1989

7. National Electrical Manufacturer's Association – NEMA

8. National Fire Protection Association – NFPA

a. ANSI/NFPA 70: National Electrical Code

b. ANSI/NFPA 70B: Electrical Equipment Maintenance

c. NFPA 70E: Electrical Safety Requirements for Employee Workplaces

d. ANSI/NFPA 78: Lightning Protection Code

e. ANSI/NFPA 101: Life Safety Code

f. NFPA 70E

9. Occupational Safety and Health Administration – OSHA

10. State and local codes and ordinances

1.4 SUBMITTALS

A. Submit the following in accordance with Division 01:

1. Protective equipment shop drawings with the protective device study. The one-line diagram showing available fault currents and timing of devices shall be submitted both as hard copies and as two electronic copies of Autocad drawings on Compact Disc. Two electronic copies of both the Dapper and Captor software files shall be provided on Compact Disc. An index shall be provided which cross references the file names on these disks to the specific pieces of equipment or system.

2. Certifications: Two weeks prior to final inspection, the Contractor shall deliver four copies of the following certifications to the Owner's representative:

a. That the protective devices have been adjusted and set in accordance with the approved protective device study.

b. That tests and settings have been witnessed by the Owner.

c. Report of results.

3. Short circuit study in conjunction with, and at the same time as, the submittal for Panelboards. The study shall show fault currents available at key points in the system down to a fault current of 7000A. The purpose of this submittal is to verify the fault current ratings of the panelboards.

1.5 QUALIFICATIONS

A. The coordination study shall be prepared by qualified engineers of the switchgear manufacturer or an approved consultant. Provide pertinent information required by the preparers to complete the study.

B. The short circuit study and coordination study shall be performed on the Dapper and Captor computer software packages. No substitutions.

C. Preapproved: Electrotest, Power Systems Engineering, Siemens Engineering Service Division, Square D, GE.

PART 2 EXECUTION

2.1 REQUIREMENTS

A. The complete study shall include a system one line diagram, short circuit and ground fault analysis, and protective coordination plots.

B. One-Line Diagram:

1. Show, on the one line diagram, electrical equipment wiring to be protected by the overcurrent devices installed under this project. Clearly show, on the one line, the schematic wiring of the electrical distribution system.

2. Show reference nodes on the one line diagram referring to a formal report, to include the following specific information:

a. X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at the bus of the main switchboard, and all downstream equipment containing overcurrent devices.

b. Breaker and fuse ratings.

c. Transformer KVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.

d. Voltage at each bus.

e. Identifications of each bus.

f. Conduit material, feeder sizes, and length.

g. Calculated short circuit current.

C. Short Circuit Study:

1. Determine the available 3 phase short circuit and ground fault currents at each bus. Incorporate the motor contribution in determining the momentary and interrupting ratings of the protective devices.

2. The study shall be calculated by means of the Dapper computer software package. Pertinent data and the rationale employed in developing the calculations shall be incorporated in the introductory remarks of the study.

3. Present the data determined by the short circuit study in a table or report format. Include:

a. Device identification.

b. Operating voltage.

c. Protective device.

d. Device rating.

e. Calculated 3 phase short circuit current (asymmetrical and symmetrical), and ground fault current.

D. Coordination Curves:

1. Prepare the coordinations curves to determine the required settings of protective devices to assure selective coordination. Graphically illustrate on log-log paper that adequate time separation exists between existing and supplied series devices. Plot the specific time-current characteristics of each protective device in such a manner that all upstream devices will be clearly depicted on one sheet.

2. The following specific information shall also be shown on the coordination curves:

a. Device identifications.

b. Time and current ratio for curves.

c. ANSI damage points for each transformer.

d. Complete fuse curves.

e. Cable damage curves.

f. Transformer inrush points.

g. Maximum short circuit cutoff point.

3. Develop a table to summarize the settings selected for the protective devices. Include in the table the following:

a. Device identification.

b. Tap, time delay, and instantaneous pickup.

c. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.

d. Fuse rating and type.

e. Ground fault pickup and time delay.

4. Provide electronic copies of the Captor Data files on two Compact Discs. Provide a cross reference between the data file names and the hard copy tables and reports.

2.2 ANALYSIS

A. Analyze the short circuit calculations, and highlight any equipment that is determined to be underrated as specified or not coordinated. Propose approaches to effectively protect the underrated equipment. Proposed major corrective modifications will be taken under advisement by the Owner and further instructions will be given.

B. After developing the coordination curves, highlight areas lacking coordination. Present a technical evaluation with a discussion of the logical compromises for best coordination.

2.3 ADJUSTMENTS, SETTINGS AND MODIFICATIONS

A. Accomplish necessary field settings, adjustments and minor modifications to conform with the study without additional cost to the Owner. (Examples of minor modifications are trip sizes within the same frame, the time curve characteristics of induction relays, ranges etc.)

2.4 FIELD INFORMATION

A. Gather field information needed for the protective device study.

END OF SECTION

SECTION 26 09 23 – LIGHTING CONTROL SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. System Software Interfaces.

2. System Backbone and Integration Equipment.

3. Wired Networked Devices for relay panels or only where shown on drawings.

4. Wireless Networked Devices provided with power for all instances except noted..

B. Hybrid wireless system, power to all devices, no batteries allowed

C. System shall be fixture based wireless controls in 90% of fixtures to meet Washington State Energy Code

1.2 DEFINITIONS

A. Data Bus: A wired interface used to communicate with connected devices.

B. Device: A collective term for bus or wireless connected devices, including fluorescent ballasts, LED drivers, incandescent luminaires, manual switches, switching relays, sensors, and similar.

C. Global: Communication between devices in otherwise separate spaces using a bridging device or system controller.

D. Group: A set of devices that communicate together.

E. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

F. Scene: Digital light level associated with a preset.

G. System Backbone: Devices used to connect and manage otherwise separate spaces, including bridging devices and gateways or system controllers. Used to expose devices to software configuration via TCP/IP.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site

B. Preinstallation Coordination Meeting(s): For digital-network lighting controls. Conduct meeting(s) at Project site

1. Attendees: Installers, fabricators, representatives of manufacturers, and administrants for field tests and inspections. Notify Architect of scheduled meeting dates.

2. Engage factory-authorized service representative to attend preinstallation conference and review the submittal drawing, sequence of operation, and device installation best practices with Project team.

1.4 SUBMITTALS

A. Product Data:

1. Bill of Materials necessary to install the networked lighting control system.

2. Product Specification Sheets indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature.

3. Information Technology (IT) connection information pertaining to interconnection with facility IT networking equipment and third-party systems.

4. Other Diagrams and Operational Descriptions - as needed to indicate system operation or interaction with other system(s).

B. Shop Drawings:

1. Riser Diagrams showing device wiring connections of system backbone and typical per room/area type.

C. Contractor Startup/Commissioning Worksheet.

D. Service Specification Sheets indicating general service descriptions, including startup, training, post-startup support, and service contract terms.

E. Field quality-control reports.

F. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Contracts:

1. Hardware and Software Operation Manuals

2. Maintenance service agreement.

3. Software service agreement.

B. Warranty documentation.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Phone Support: Toll-free technical support available from manufacturer through an online tool to schedule a technical support appointment and provide 24/7 emergency support.

2. Remote Support: Manufacturer capable of providing remote support and ability to virtually connect with customers to address issues with visual guidance overlaid on images of real-world objects.

3. Cellular Connectivity: Manufacturer capable of cellular connectivity to a networked lighting control systems available to provide remote support within the continental United States.

4. On-Site Support: Manufacturer capable of providing a 72-hour, on-site response time within the continental United States.

5. Service Contracts: Manufacturer capable of providing service contracts for continued on-site and remote support of the lighting control system post-installation for terms up to 10 years from substantial completion, including:

    a. Remote and on-site emergency response.

    b. Remote system performance checks.

    c. Remote diagnostics.

    d. Replacement parts.

1.7 WARRANTY

A. Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.

1. Failures include, but are not limited to, the following:

    a. Faulty operation of lighting control hardware.

    b. Faulty operation of lighting control firmware.

2. Minimum Warranty Period: Five years from date of shipment.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Specification is based on Nlight or equal by Avi-On, Cooper Lighting Controls, or Wattstopper/Encelium

2.2 SYSTEM COMPLIANCE

A. System components manufactured in accordance with UL 916 and UL 924 standards where applicable.

B. System components manufactured in accordance with CFR Title 47, Part 15 standards where applicable.

C. System components manufactured in accordance with ISED Canada RSS-247 standards where applicable.

D. System components manufactured in accordance with IFT-008-2015 and NOM-208-SCFI-2016 standards where applicable.

E. System listed as qualified under DesignLights Consortium Networked Lighting Control System Specification v5.0.

F. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.3 SYSTEM PERFORMANCE REQUIREMENTS

A. System Architecture:

1. System architecture based upon the following concepts:

a. Networkable intelligent lighting control devices.

2. Intelligent lighting control devices with individually addressable network communication capability and having one or more basic lighting control components including: occupancy sensor, photosensor, relay, dimming output, contact closure input, analog 0-10 V(dc) input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure permissible to minimize overall system device count.

3. System capable of interfacing directly with networked luminaires such that either low-voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches, and system backbone.

4. Networked luminaires and intelligent lighting control devices support individual (unique) configuration of device settings and properties, with such configuration residing within the networked luminaires and intelligent control devices.

5. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices capable of providing automatic control from sensors (occupancy and/or photosensor) and manual control from local wall stations without requiring connection to a higher-level system backbone.

a. Lighting control zones (wired and wireless) support at least 128 devices per zone.

b. Capable of being networked with a higher-level system backbone to provide time-based control, control from inputs or systems external to control zone, and remote configuration and monitoring through a software interface.

6. Networked luminaires and intelligent lighting control devices with distributed intelligence programming stored in non-volatile memory, such that following any loss of power the lighting control zones operate according to their defined default settings and sequence of operations.

7. System to include one or more system controllers that provide time-based control.

8. System controller provides means of connecting the lighting control system to a system software interface and building management systems via BACnet/IP or BACnet MS/TP protocol.

9. System controller supports both low-voltage wired and wireless RF communication within a single controller device.

10. System devices support firmware update, either remotely or from within the application space, for purposes of upgrading functionality at a later date.

11. System capable of reporting lighting system events and performance data to management software for display and analysis.

B. Wired Networked Control Zone Characteristics:

1. Connections to devices within a wired networked lighting control zone and to backbone components accomplished with a single type of low-voltage network cable

2. Devices connected in "daisy-chain" topology. "Hub-and-spoke" topology, requiring all individual networked devices to be connected to a central component, is unacceptable, to reduce the total amount of network cable required for each control zone.

3. Following proper installation and provision of power, all networked devices connected with low-voltage network cable must automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g. software application, handheld remote, pushbutton).

   a. The "out of box" default sequence of operation is intended to provide typical sequence of operation to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.

4. System software capable of automatic discovery of all connected devices without requiring any provisioning of system or zone addresses.

5. Networked devices capable of detecting improper communication wiring and LED notification to alert installation/startup personnel.

6. Networked control devices suitable for control of egress or emergency light sources without additional, externally mounted UL 924 shunting or 0-10 V(dc) disconnect devices, to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. Capable of supporting the following sequence of operation:

   a. Low-Voltage Power Sensing: Devices automatically provide 100 percent light level upon detection of loss of power sensed via low-voltage network cable connection where applicable.

   b. Line-Voltage Power Sensing: Devices listed as UL 924 emergency relays which automatically close load-control relay and provide 100 percent light output upon detection of loss of power sensed via line voltage connection to normal power.

7. Global Control Zones: Networked luminaires and intelligent lighting control devices located in different areas able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span multiple areas. Occupancy, photosensor inhibit, and switch commands available across multiple controllers.

8. Wired Networked Wall Station Scene-Control Capabilities:

   a. Preset Scenes that activate a specific combination of light levels across multiple local and global channels.

   b. Local Profile Support: Profile Scenes that modify the sequence of operation for devices in the area (group) in response to a button press to dynamically optimize occupant experience and lighting energy usage.

1) Wall stations able to manually start and stop local profiles, or local profile capable of ending after a specific duration of time between five minutes and 12 hours.

2) Configurable Parameters:

a) Fixture light level.

b) Occupancy time delay.

c) Response to occupancy sensors (including enabling/disabling response).

d) Response to daylight sensors (including enabling/disabling response).

e) Enabling/disabling wall stations.

a. Three-Way or Multi-Way Control: Multiple wall stations capable of controlling the same local and global control zones, to support "multi-way" preset scene and profile scene control.

C. Wireless Networked Control Zone Characteristics:

1. No wired connections between networked devices required for the purposes of system communications.

2. Multiple wireless networking protocols supported:

a. Standards-based, distributed star topology type of protocol for 900 MHz communication, to support lighting control applications and IoT applications.

b. Bluetooth standard protocol for 2.4 GHz communication that supports direct connection to smartphone or tablet, to support device configuration, control applications, and IoT without requiring the use of a system backbone.

3. Wireless network must be self-healing, such that the loss of backbone or local communication between devices does not result in the loss of local control of lights in the space.

4. Wireless network communication must support uniform and instant response such that all luminaires in a lighting control zone respond immediately and synchronously in response to a sensor or wall station signal.

5. Communication of control signals from sensors and wall stations to networked luminaires and wireless load-control devices occur directly, without any communication, interpretation, or translation of information through a backbone device such as a wireless access point, communication bridge, or gateway.

6. All wireless communication between lighting control components supports the following five tiers of security measures.

a. Data encryption.

b. Firmware protection.

c. Tamper-proof hardware.

d. Authenticated user access.

e. Mutual device authentication.

7. Wireless devices use AES encryption to secure communication with a unique encryption key generated for each programmed site.

8. Wireless devices use signed firmware to ensure that unmodified, authentic software is always installed.

9. Wireless networked devices capable of communicating a minimum distance of 150 ft. (45 m) between devices under typical site conditions accounting for typical environmental conditions and building construction materials encountered within commercial indoor lighting environments.

10. Minimum Line-of-Sight Communication Range: 1000 ft. (304 m) under ideal environmental conditions.

11. Wireless devices self-identify when communication to system controller cannot be accomplished or when communication to the system controller is lost.

    a. Self-identification not required for wireless switches or battery-powered devices.

12. Wireless devices self-establish connection to system controller through other devices if direct communication cannot be accomplished or when communication to system controller is lost.

    a. Communication path formation to utilize existing, wireless networked devices located between system controller and respective end devices.

    b. No additional hardware for formation of networked communication path between a system controller and end devices required.

    c. Automatic connection not required for wireless switches or battery-powered devices.

13. Networked control devices suitable for control of egress or emergency light sources without additional, externally mounted UL 924 shunting or 0-10 V(dc) disconnect devices, to provide a compliant sequence of operation while reducing the overall installation and wiring costs of the system. Capable of supporting the following sequence of operation:

    a. Line-Voltage Power Sensing: Devices listed as UL 924 emergency relays that automatically close load-control relay and provide 100 percent light output upon detection of loss of power sensed via line voltage connection to normal power.

    b. Normal-Power-Broadcast Sensing: Devices listed as UL 924 emergency relays that automatically close load-control relay and provide 100 percent light output upon loss of a wireless normal-power broadcast from devices connected to normal power.

D. System Integration Capabilities:

1. Capable of interface with third-party building management systems (BMS) to support two-way communication using BACnet/IP protocol, BACnet MS/TP protocol, and RESTful API including the following system integration capabilities:

    a. "Write" messages for control of individual devices, including control of relay and dimming output.

b. "Write" messages for control of groups of devices through a single command, including control of relay and dimming output of all devices.

c. "Read" messages for individual device status information.

1) Available status will vary based on device type and capabilities, which may include relay state, dimming output, power measurement, occupancy sensor status, and photosensor light measurement.

d. "Read" messages for group status information for occupancy, relay state, and dimming output.

e. Activation of pre-defined system Global Profiles.

E. Supported Sequence of Operations:

1. Control Zones:

a. Local Control Zones: Networked luminaires and intelligent lighting control devices installed in an area (also referred to as a group of devices) capable of transmitting and tracking occupancy sensor, photosensor, and manual switch information within at least 48 unique control zones to support different and reconfigurable sequences of operation within area. These will also be referred to as local control zones.

b. Adjacent Control Zones: Networked luminaires and intelligent lighting control devices capable of tracking occupancy broadcasts from adjacent zones. When this feature is enabled, luminaire output for a vacant zone will reduce to a configurable dimmed state if one or more adjacent zones are occupied. Luminaires will turn off when both primary and adjacent zones are vacant.

c. Global Control Zones: Networked luminaires and intelligent lighting control devices located in different areas able to transmit and track information within at least 128 system-wide control zones to support required sequences of operation that may span across multiple areas. Occupancy, photosensor inhibit, and switch commands available across multiple controllers.

2. Wall Station Capabilities:

a. Wall stations support the following capabilities:

1) On/Off of a local or global control zone.

2) Continuous dimming control of light level of a local or global control zone.

b. Multi-Way Control: Multiple wall stations capable of controlling the same local or global control zones, to support "multi-way" switching and dimming control.

3. Occupancy Sensing Capabilities:

a. Occupancy sensors configurable to control a local or global zone.

b. Multiple occupancy sensors capable of controlling the same local or global zones. This capability combines occupancy sensing coverage from multiple sensors without consuming multiple control zones.

c. Occupancy sensing sequence of operation modes:

1) On/Off Occupancy Sensing.

2) Partial-On Occupancy Sensing.

3) Partial-Off Occupancy Sensing.

4) Vacancy Sensing (Manual-On / Automatic-Off).

d. On/Off, Partial-On, and Partial-Off Occupancy Sensing Modes Sequence of Operation:

1) Occupancy automatically turn lights on to a designated level when occupancy is detected. Designated occupied light level support at least 100 dimming levels.

2) Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.

3) System capable of combining Partial-Off and Full-Off operation by dimming lights to a designated level when vacant and turning the lights off completely after an additional time delay.

4) Photosensor readings, if enabled in occupancy sensing control zone, automatically adjust light levels during occupied or unoccupied conditions as necessary.

5) Wall station activation changes the dimming level or turn lights off as selected by the occupant. Lights optionally remain in this manually specified light level until the zone becomes vacant. Upon vacancy, normal sequence of operation resumes.

e. Vacancy Sensing or Manual-On/Automatic-Off Mode Sequence of Operation:

1) Activation of a wall station is required turn lights on. System capable of programming the zone to turn on to either a designated light level or previous user-set light level. Initially occupying the space without using a wall station must not result in lights turning on.

2) Occupancy sensors automatically turn lights off or to a dimmed state (Partial-Off) when vacancy occurs or if sufficient daylight is detected. Designated unoccupied dim level support at least 100 dimming levels.

3) System capable of dimming the lights when vacant and then turning the lights off completely after an additional time delay.

4) System capable of an "automatic grace period" immediately following detection of vacancy, during which time any detected occupancy results in the lights reverting to the previous level. After the grace period has expired, the use of a wall station is required to turn lights on.

5) Photosensor readings, if enabled in the Occupancy Sensing control zone, capable of automatically adjusting the light level during occupied or unoccupied conditions as necessary.

6) Wall station interaction changes the dimming level or turn lights off as selected by occupant. Lights remain at manually specified light level until

zone becomes vacant; normal sequence of operation resumes upon vacancy.

f. Occupancy time delays before dimming or shutting off lights separately programmable for all control zones from 15 seconds to 2 hours.

4. Photosensor Sensing Capabilities (Automatic Daylight Sensing):

a. Photosensor devices configurable to control a local zone.

b. Photosensor-Based Control:

1) Continuous Dimming: Control zone automatically adjusts dimming output in response to photosenor readings, to maintain a minimum light level consisting of both electric light and daylight sources. Photosensor response configurable to adjust set point and dimming rates.

5. Schedule Capabilities:

a. System capable of time schedules for time-of-day to override devices including offsets from dusk and dawn.

b. System capable of providing a visible "blink warning" five minutes prior to the end of the schedule.

c. Wall stations may be programmed to provide timed extensions/overrides that turn the lights on for an additional time period.

1) Timed override/extension duration programmable for each individual device, zone of devices, or customized group of devices, from five minutes to 12 hours.

6. Global Profile Capabilities:

a. System capable of automatically modifying the sequence of operation for selected devices in response to any of the following:

1) Time-of-day schedule.

2) Contact closure input state.

3) Manually triggered wired wall station input.

4) RS-232/RS-485 command to wired input device.

5) BACnet input command.

b. Global Profile Capabilities:

1) Global Profiles stored within and executed from the system controller (via internal timeclock). Dedicated software host or server is not required to be online to support automatic scheduling and/or operation of Global Profiles.

2) Global Profile time-of-day schedules capable of recurrence settings including daily, specific days of week, every "n" number of days, weekly, monthly, and yearly. Lighting control global profile schedules support definition of start date, end date, end after "n" recurrences, or never ending.

3) Daylight savings time adjustments capable of being performed automatically, if desired.

4) Global Profile holiday schedules follow recurrent settings for specific U.S. holiday dates regardless if they always occur on a specific date or are determined by day/week of the month.

5) Global Profiles capable of being scheduled to run according to timed offsets relative to sunrise or sunset. Sunrise/sunset times automatically derived from location information using an astronomical clock.

6) Software management interface capable of displaying a graphic calendar view of profile schedules for each control zone.

7) Global Profiles capable of manual activation directly from system controller, specially programmed wired input devices, scene-capable wired wall stations, and software management interface.

8) Global Profiles selectable to apply to a single device, zone of devices, or customized group of devices.

9) Global Profile Configurable Parameters:

a) Fixture light level.

b) Occupancy time delay.

c) Response to occupancy sensors (including enabling/disabling response).

d) Response to daylight sensors (including enabling/disabling response).

e) Enabling/disabling of wall stations.

c. Local and Global Profiles backed up and stored on software's host server such that Profile backup can be applied to a replacement system controller or wired wall station.

7. System supports automated demand response capabilities with automatic reduction of light level to at least three levels of demand response, configurable for each output device.

2.4 SYSTEMS SOFTWARE INTERFACES

A. Management Interface:

1. Web-based management interface for remote system control, live status monitoring, and configuration of lighting control settings and schedules.

2. Compatible with industry-standard web browser clients.

3. Minimum of 100 unique password-protected user accounts.

4. Minimum of three user permission levels: read-only, read and change settings, and full administrative system access.

5. Capable of restricting access for user accounts to specific devices within the system.

6. All system devices capable of being given user-defined names.

7. Device identification information displayed in the Management interface including:

    a. Model number.

    b. Model description.

    c. Serial number or network ID.

    d. Manufacturing date code.

    e. Custom label.

    f. Parent network device.

8. Management interface capable of displaying live status of a networked luminaire or intelligent control device including:

    a. Luminaire on/off status.

    b. Dim level.

    c. Power consumption.

    d. Device temperature.

    e. PIR occupancy sensor status.

    f. Microphonic occupancy sensor status.

    g. Remaining occupancy time delay.

    h. Photosensor reading.

    i. Active Profiles.

9. Management interface capable of displaying and modifying the current active settings of a networked luminaire or intelligent control device including:

    a. Dimming trim levels.

    b. Occupancy sensor and photosensor enable/disable.

    c. Occupancy sensor time delay and light level settings.

    d. Occupancy sensor response (normal or vacancy).

    e. Photosensor setpoints and transition time delays.

10. Management interface capable of applying settings changes for a zone of devices or a group of selected devices using a single action that does not require the user to apply settings changes for each individual device.

11. Management interface capable of compiling a printable network inventory report.

12. Management interface capable of compiling a printable report detailing all system profiles.

13. All sensitive information stored encrypted.

14. System software updates available for automatic download and installation via the Internet.

B. System Energy Analysis and Reporting:

1. Intuitive graphical screens to facilitate simple viewing of system energy performance.

2. Energy Scorecard: Summarized display that indicates calculated energy savings in dollars or KWh.

3. Software calculates allocation of energy savings by control measures including occupancy sensors, photosensors, and manual switching.

4. Energy savings data calculated for the system as a whole.

5. Time-scaled graph showing all relay transitions.

6. Time-scaled graph showing zone occupancy time delays.

7. Time-scaled graph showing the total light level.

8. Software capable of storing information remotely onto an open-source, object-relational database, such as PostgreSQL.

9. Data stored in the database will be accessed utilizing an open standard, application programming interface, such as Open Database Connectivity (ODBC).

C. Visualization and Programming Interfaces:

1. System provides an optional web-based visualization interface that displays a graphical floorplan.

2. Graphical floorplan will offer the following types of system visualization:

a. Full Device Option: Master graphic of entire building, by floor, showing each control device installed with zones outlined including:

1) Controls embedded light fixtures.

2) Controls devices not embedded in light fixtures.

3) Daylight sensors.

4) Occupancy sensors.

5) Wall switches and dimmers.

6) Scene controllers.

7) Networked relays.

8) Wired bridges.

9) System Controllers.

10) Wired relay panels.

11) Group outlines.

b. Group-Only Option: Master graphic of the entire building, by floor, showing only control groups outlined.

c. Pan and zoom commands supported to allow smaller areas to be displayed on a larger scale simply by panning and zooming each floor's master graphic.

d. Selecting any control device displays the following as applicable:

1) Device catalog number.

2) Device name and custom label.

3) Device diagnostic information.

4) Link to further information on device including status or current configuration.

3. Programming capabilities through the application will include the following:

a. Switch, occupancy sensor, and photosensor zone configuration.

b. Manual-on or automatic-on modes.

c. Turn-on and dim to dimming levels.

d. Occupancy sensor time delays and PIR sensitivity.

e. Dual technology occupancy sensors sensitivity.

f. Photosensor calibration adjustment and auto-setpoint.

g. Multiple photosensor zone offset.

h. Trim level settings.

i. Preset scene creation and copy for scene-capable devices.

j. Application of custom device labels to the Bluetooth Low-Energy Programming Devices and individual connected lighting control devices.

k. Fade rate settings.

D. Smartphone Programming Interface for Wired and Wireless Devices:

1. Interface provided for both Apple iOS and Android operating systems that allows configuration of lighting control settings.

2. Application supports configuration of wireless networked control devices.

a. Application access granted with valid user name and password.

b. Access to program information governed by permission system that allows users to share access with other users and restrict access to those who should not be able to reconfigure the equipment.

c. Indication of signal strength where multiple Bluetooth Low-Energy Programming Devices are available for configuration.

3. Application supports configuration or wired networked control devices.

    a. Connected device access granted through user-defined passcode at initial install.

    b. Indication of signal strength where multiple Bluetooth Low-Energy Programming Devices are available for configuration.

4. Programming Capabilities:

    a. Switch, occupancy sensor, and photosensor group configuration.

    b. Manual-on or automatic-on modes.

    c. Turn-on and dim to dimming levels.

    d. Occupancy sensor time delays and PIR sensitivity.

    e. Dual technology occupancy sensors sensitivity.

    f. Photosensor calibration adjustment and auto-setpoint.

    g. Multiple photosensor zone offset.

    h. Trim level settings.

    i. Preset scene creation.

    j. Application of custom device labels for individual connected lighting control devices.

    k. Fade rate settings.

2.5 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT

A. System Controller: Multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.

1. System Controller Processor: 32-bit microprocessor operating at a minimum of 1 GHz.

2. System Controller Memory: Minimum of 512MB memory, with a minimum of 4GB non-volatile flash, to support operating system and databases.

3. System Controller Functions:

    a. Time-based control of downstream wired and wireless network devices.

    b. Linking into an Ethernet network.

    c. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.

    d. Connection to various software interfaces, including management interface, historical database and analytics interface, and visualization interface.

4. Integral web server to support system controller configuration and diagnostics

    a. Web Server Control Interface:

        1) Display associated devices within the context of a graphical floorplan.

2) Provide control of output-capable devices through virtual sliders, toggle buttons, preset level widgets, and transparent layers on floorplan.

3) Control Capabilities:

a) Control of individual output devices, including control of relay state and analog dimming level where applicable.

b) Control of local lighting control zones, including control of relay state and analog dimming level where applicable.

c) Control of global lighting control zones, including control of relay state and analog dimming level where applicable.

d) Control of Global Profiles.

5. Minimum of three RJ-45 networked lighting control ports for connection to any of the following:

6. Device will automatically detect all network-connected devices.

7. Capable of managing and operating a minimum of 750 networked devices (wired or wireless) per system controller.

8. Multiple System Controllers capable of connection via LAN for scalability to a minimum of 20,000 networked devices.

9. Supports BACnet/IP and BACnet MS/TP protocols to directly interface with BMS and HVAC equipment without additional protocol translation gateways.

a. BACnet MS/TP Connection Speed: 9600 to 115200 baud rate.

b. BACnet Testing Laboratory (BTL listed) using Device Profile BACnet Building Controller (B-BC) with outlined enhanced features.

10. Integral FIPS 140-2, Level 1 cryptographic module.

11. Supports RESTful API for control of BACnet objects, user management, date and time, and file management.

12. NEMA 1 enclosure with Class 1 and Class 2 separation.

a. Power Supply Voltage: 120 to 277V(ac).

13. Automatic algorithm to eliminate redundant, wireless networked paths to streamline communication between the system controller and end devices.

14. System Controller Security Provisions:

a. Disallow the use of default passwords and require passwords to be updated prior to use.

b. Support user role-based access, such as administrator, user, and viewer.

c. Signed firmware to ensure that unmodified, authentic software is always installed.

d. IP-based communication protected with strong encryption algorithms such as AES or TLS1.2+.

e. Prevent rollback of firmware to firmware versions with known, critical vulnerabilities.

f. Valid cybersecurity listing through a third party.

2.6 WIRED NETWORKED DEVICES

A. Wired Networked Wall Switches

1. Mounting: Suitable for installation in single-gang switch box.

2. Communication and low-voltage power delivered via standard low-voltage network cabling with RJ-45 connectors.

3. All switches detect valid communication and blink a unique LED pattern to visually indicate a potential wiring issue.

4. Devices with mechanical push buttons provide tactile and LED user feedback.

5. Devices with mechanical push buttons manufactured with custom button labeling.

6. Wall switch and dimmer options:

a. Control Types Supported:

1) On/Off.

2) On/Off/Dimming.

3) On/Off/Dimming/Correlated Color Temperature Control for specific luminaire types.

b. Color: Per 262726

B. Wall Switch Occupancy Sensor: WSXA or equal

C. Exterior photocell input to relay panel

D. Wired Networked Relay Panel:

1. Outputs: 16 Individual relays per pane

2. Field Configurable Relays (FCR):

a. Field configurable to operate in single-, double-, or triple-pole relay groupings.

b. Field configurable to operate as normally closed or normally open.

c. Provides visual status of current state and manual override control of each relay.

d. Minimum Relay Contact Ratings:

1) 40 A at 120-480 V(ac) Ballast.

2) 16 A at 120-277 V(ac) Electronic.

3) 20 A at 120-277 V(ac) Tungsten.

4) 20 A at 48V (dc) Resistive.

5) 2 HP at 120 V(ac).

6) 3 HP at 240-277 V(ac).

7) 65kA SCCR at 480 V(ac).

3. Dimming Output Rating: Minimum of 100 mA sink current per dimming output.

4. Relay and dimming outputs individually programmable.

5. Listing: UL 924 for control of emergency lighting circuits.

6. Low-Voltage Sensor Input:

a. Configurable to support any of the following input types:

1) Indoor Photosensor.

2) Outdoor Photosensor.

3) Occupancy Sensor.

4) Contact Closure.

b. Low-voltage sensor input provides 24 V(dc) power for sensor so additional auxiliary power supplies are not required.

c. Sensor input supports all standard sequence of operations.

7. Integrated Digital Time Clock for local schedule control.

8. Panel supplies current limited low-voltage power to other networked devices connected via low-voltage network cable.

9. Enclosure:

a. Enclosure Rating: NEMA 1. Divide emergency circuits

b. Surface mount with switch adjacent

2.7 WIRELESS NETWORKED DEVICES

A. Wireless Networked Wall Switches, Dimmers:

1. Mounting: Suitable for installation in single-gang switch box.

2. Wireless Communication:

a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.

b. Security: AES-128 bit.

3. Power Supply: [120 to 277 V(ac)

4. Mechanical push buttons provide tactile and LED user feedback during button press.

5. Mechanical push buttons available with custom button labeling.

6. Wall Switches and Dimmer Options:

   a. Control Types Supported: On/Off and On/Off/Dimming.

7. Scene Switch Options:

   a. Control Types Supported: On/Off, On/Off/Dimming, and Preset Level Scene Type.

8. Color: Pe 262726

B. Wireless Networked Embedded Fixture Control Devices:

1. Wireless Communication:

   a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.

   b. Security: AES-128 bit.

2. Power Supply: Standard low-voltage wiring typically associated with an LED driver.

3. Suitable for installation within a luminaire such that the control device is not visible on the luminaire face.

4. Devices available with integrated and remote antennas such that devices can be installed within sealed container without detriment to wireless strength.

5. Power loss detection, where unit powers and controls the emergency circuit. Loss of wireless broadcasts from a dedicated normal-power-connected device forces unit to shunt closed, go to full bright, and ignore all system commands until main power is restored.

C. Wireless Networked Indoor Load Controllers with Occupancy and Photosensors:

1. Wireless Communication:

   a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.

   b. Security: AES-128 bit.

2. Detect the presence of human activity within space and fully control the on/off function of lights.

3. Utilizes passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic and Microwave-based sensing technologies are unacceptable.

4. Dual technology sensors used in locations where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions).

5. Dual technology sensors must have one sensing technology not motion dependent to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT), which detects both occupant motion and sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) are unacceptable.

6. All sensing technologies are acoustically passive, meaning they do not transmit sound waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers and hearing devices). Acceptable detection technologies include Passive Infrared (PIR) and/or Microphonic technology. Ultrasonic and Microwave-based sensing technologies are unacceptable.

7. Sensor programming parameters available and configurable remotely.

8. Ceiling, fixture, and junction box mounted sensors available, with multiple lens options available customized for specific applications.

9. Integral daylight photosensor for programmable daylight harvesting.

10. Photosensor includes adjustable illumination set-point and dead band to prevent the artificial light from cycling. Set-point and dead band capable of automatically calibrating through an "Automatic Set-Point Programming" procedure. Min and max dimming settings and set-point may be manually entered or modified.

11. Dead band setting verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

12. Power loss detection, where unit powers and controls the emergency circuit. Loss of wireless broadcasts from a dedicated normal-power-connected device forces unit to shunt closed, go to full bright, and ignore all system commands until main power is restored.

13. Power Monitoring: Integral current measurements on output with 3 percent accuracy when measuring loads 225 mA or greater.

D. Wireless Networked Indoor Occupancy and Photosensors:

1. Wireless Communication:

   a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.

   b. Security: AES-128 bit.

2. Detect the presence of human activity within space and fully control the on/off function of lights.

3. Utilizes passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic and Microwave-based sensing technologies are unacceptable.

4. Dual technology sensors used in locations where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions).

5. Dual technology sensors must have one sensing technology not motion dependent to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT), which detects both occupant motion and sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) are unacceptable.

6. All sensing technologies acoustically passive, meaning they do not transmit sound waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers and hearing devices). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonic technology. Ultrasonic and Microwave-based sensing technologies are unacceptable.

7. Sensor programming parameters available and configurable remotely.

8. Ceiling, fixture, and junction box mounted sensors available, with multiple lens options available customized for specific applications.

9. Dry Contact Output: One integrated dry contact switching relay, capable of switching 100 mA at 24 V, resistive only.

10. Integral daylight photosensor for programmable daylight harvesting.

11. Photosensor includes adjustable illumination set-point and dead band to prevent the artificial light from cycling. Set-point and dead band capable of automatically calibrating through an "Automatic Set-Point Programming" procedure. Min and max dimming settings and set-point may be manually entered or modified.

12. Dead band setting verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).

E. Wireless Networked Indoor Embedded Sensors:

1. Wireless Communication:

   a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.

   b. Security: AES-128 bit.

2. Sensors consisting of occupancy sensors and dimming photosensor suitable for installation within a luminaire such that only the lens is visible on luminaire face.

3. Power Supply: Standard low-voltage wiring typically associated with an LED driver.

4. Devices available with integrated and remote antennas such that devices can be installed within sealed container without detriment to wireless strength.

5. Detect the presence of human activity within space and fully control the on/off function of lights.

6. Dual Technology Sensor, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions.

7. Sensors detect valid communication and blink a unique LED pattern to visually indicate a potential issue.

8. Sensor programming parameters available and configurable remotely.

9. Available with multiple lens options available for various mounting heights.

10. Integral daylight photosensor for programmable daylight harvesting.

11. Photosensor includes adjustable illumination set-point and dead band to prevent artificial light from cycling. Set-point and dead band capable of automatically calibrating through an "Automatic Set-Point Programming" procedure. Min and max dimming settings and set-point may be manually entered or modified.

12. Dead band setting verified and modified by sensor automatically every time lights cycle to accommodate physical changes in space (i.e., furniture layouts, lamp depreciation, or lamp outages).

13. Power loss detection, where unit powers and controls the emergency circuit. Loss of wireless broadcasts from a dedicated normal-power-connected device forces unit to shunt closed, go to full bright, and ignore all system commands until main power is restored.

F. Wireless Networked Power Packs:

1. Wireless Communication:

a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.

b. Security: AES-128 bit.

2. Plenum rated.

3. Supply Voltage: 120 to 277V(ac).

4. Relay Output: Class 1 relay rated for 20 A and 1.5 HP at 120 to 277 V(ac) and 5 A and 0.5 HP at 480 V(ac).

5. Dimming Output: 0-10 V(dc).

6. Sink Current: 150 mA at 0-10 V(dc).

7. Antenna Type: Integrated

8. Programming parameters available and configurable remotely.

9. Mounting: Integral 1/2-inch (16-mm) chase nipple. Plastic clips into junction box are unacceptable.

10. Power Packs Options:

a. Power Pack capable of full 20-Amp switching of all normal power lighting load types, with optional 0-10V dimming output capable of up to 150 mA of sink current.

b. Power Packs capable of full 20-Amp switching of general purpose receptacle (plug-load) control.

c. Listing: UL 924 for control of emergency lighting circuits, field configurable for two distinct sequence of operation:

1) Power sense of normal power feed, where unit powers and controls emergency circuit, and loss of the normal power sense circuit forces the power pack to shunt closed, go to full bright, and ignore all system commands until normal power is restored.

2) Power loss detection, where unit powers and controls the emergency circuit. Loss of wireless broadcasts from a dedicated normal-power-connected device forces unit to shunt closed, go to full bright, and ignore all system commands until main power is restored.

d. Power Monitoring: Integral current measurements on output with 3 percent accuracy when measuring loads 425] mA or greater.

G. Wireless Networked Communication Adapter:

1. Wireless Communication:

a. Dual 900 MHz IEEE 802.15.4 based and 2.4 GHz, Version 4.0+ Bluetooth.

b. Security: AES-128 bit.

2. Capable of supporting a minimum of 750 networked wireless devices per adapter.

3. Interface: USB connection.

4. Ingress Protection: Minimum IP66.

5. Mounting: Integral 1/2-inch (16-mm) chase nipple. Minimum 16 ft. (4.8 m) USB cable and optional cable extenders for remote mounting.

H. Spare Parts

1. Fixture Embedded Sensors – 2 per type

2. Wall Switches, 2, 4 button and 2, 6 button

3. Plug load Controller: 2

4. Fixture Controller: 2

PART 3 EXECUTION

3.1 INSTALLATION OF WIRING

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260523 "Control-Voltage Electrical Power Cables." Minimum conduit size is 1/2 inch (13 mm).

1. Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems."

2. Comply with requirements for raceways and boxes specified in Section 260533.13 "Conduits for Electrical Systems," and Section 260533.16 "Boxes and Covers for Electrical Systems,"

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, boxes, cabinets, and terminals. Comply with identification requirements specified in Section 260553 "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with Section 260553 "Identification for Electrical Systems."

C. Identify all controls with device address.

D. Label each device cable within 6 inch (152 mm) of connection to bus power supply or termination block.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test continuity of each circuit.

B. Tests and Inspections: Engage a factory-authorized service representative to perform test inspections.

1. Test each zone using local and remote control hardware.

2. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.

C. Nonconforming Work:

1. Lighting controls will be considered defective if they do not pass tests and inspections.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Field Test Reports: Prepare field test reports.

1. Prepare functionality and inspection reports, including a certified report that identifies controls included and describes test results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

2. Include list of all points created from actual tests of all addressed control points for lamps, ballasts, manual controls, and sensors.

3.4 REMOTE ACCESS

A. Digital network lighting control system capable of remote access by manufacturer with the following features:

1. System diagnostics including detection of fault condition in hardware or connected devices.

2. Access to all connected devices for complete programming including scheduling of time-of-day events and device parameters necessary to meet required sequence of operations.

3. Browser-based interface to verify system functionality.

4. On-demand access to manufacturer technical support for remote troubleshooting, diagnostics, configuration, and programming.

5. Owner training on the digital network lighting control system available remotely.

B. Remote access system fully functional over commercial cellular connection or Internet-connected ethernet network.

C. All hardware associated with remote access including cellular modem and cellular antenna are to remain on-site regardless of warranty or cellular contract status.

3.5 SYSTEM STARTUP

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's published instructions.

2. Activate luminaires and verify that all maximum output levels match output levels detailed in an Owner-approved sequence of operations.

3. Confirm correct communications wiring, initiate communications between control devices and controller/gateways, and program the lighting control system in accordance with approved configuration schedules, time-of-day schedules, and input override assignments.

4. Program network devices to meet required sequence of operations.

5. Program and verify all sequence of operations.

6. Create backup of system programming.

7. Assist in installation of system software on customer-provided workstation or server.

8. Verify bidirectional communication of manufacturer-provided cellular router with manufacturer-managed remote access portal.

B. Commissioning Walkthrough: Collaborate with third-party commissioning agent to demonstrate lighting control system functionality and verify the system meets the specified Project requirements.

3.6 CLOSEOUT ACTIVITIES

A. Enhanced Documentation: Engage lighting system manufacturer to provide comprehensive system documentation including detailed programming, sequence of operation data per Project specifications, and related code requirements.

B. Training: Engage lighting system manufacturer to provide comprehensive system overview, software overview, and documentation relating to system operation and maintenance.

3.7 PROTECTION

A. After installation, protect digital network lighting controls from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

3.8 MAINTENANCE

A. Engage a factory-authorized service representative to perform on-site system adjustments.

1. On-Site Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site settings adjustments to suit actual occupied

conditions. Provide up to 2 visits to Project during other-than-normal occupancy hours for this purpose.

2. Prepare and submit report after each visit that details activities performed.

3. Prepare and submit report after each session that details activities performed.

END OF SECTION

SECTION 26 22 00 – LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Distribution, dry-type transformers with nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.2 SUBMITTALS

Action submittals are submittals requiring responsive action and return of reviewed documents to Contractor.

A. Product Data:

1.3 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note shipping damage to packaging and transformer.

1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in warm, dry, and temperature-stable location in original shipping packaging.

C. Temporary Heating: Apply temporary heat in accordance with manufacturer's published instructions within enclosure of ventilated-type units, throughout periods during which equipment is not energized and when transformer is not in space that is continuously under normal control of temperature and humidity.

D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Federal Pacific or alternate approved equal

1. Schneider Electric, Eaton, ABB/GE, and Siemens are approved if they can meet the nosie levels specified below.

B. Source Limitations: Obtain each type of transformer from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60 Hz service.

B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

C. Comply with 10 CFR 431 (DOE 2016) efficiency levels.

D. Marked as compliant with DOE 2016 efficiency levels by qualified electrical testing laboratory recognized by authorities having jurisdiction.

E. Comply with all Washington State Energy Code requirements. Chart below indicates minimum but not limted to current energy code requirements. Transformer shall meet current energy code requirements if they exceed standards below.

MINIMUM NOMINAL EFFICIENCY LEVELS FOR 10 CFR 431 LOW VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS		Three Phase Transformers	
Single Phase Transformers			
kVAa	Efficiency (%)b	kVAa	Efficiency (%)b
15	97.70	15	97.89
25	98.00	30	98.23
37.5	98.20	45	98.40
50	98.30	75	98.60
75	98.50	112.5	98.74
100	98.60	150	98.83
167	98.70	225	98.94
250	98.80	300	99.02
333	98.90	500	99.14
750		99.23	
1000		99.28	

2.3 TRANSFORMERS

A. Manufacturer: Federal Pacific or alternate approved equal

B. Comply with NFPA 70 and list and label as complying with UL 1561

C. Low-Sound-Level Requirements: Maximum sound levels when factory tested in accordance with IEEE C57.12.91, as follows:

1. Up to 300 KVA: 36 dB(A-weighted)
2. Over 300 KVA: 42 dB(A-weighted)

D. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses. One leg per phase.

E. Coils: Continuous windings without splices except for taps.

1. Coil Material: Aluminum or Copper.

2. Internal Coil Connections: Brazed or pressure type.

3. Terminal Connections: Welded or bolted.

F. Enclosure: Ventilated with no other openings to not require 1 hour rating of room per NEC.

1. Core and coil must be encapsulated within resin compound to seal out moisture and air. One leg per phase. Fungus proof

2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.

3. Wiring Compartment: Sized for conduit entry and wiring installation.

4. Environmental Protection:

   a. Indoor: UL 50E, Type 2

   b. Outdoor: UL 50E, Type 3R

5. Finish Color: Gray weather-resistant enamel.

G. Taps for Transformers Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

H. Insulation Class,

1. Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with maximum of 115 deg C rise above 40 deg C ambient temperature.

2. 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with maximum of 150 deg C rise above 40 deg C ambient temperature.

I. Load Rating: Transformers shall be capable of operating at 100% of nameplate rating continuously while in an ambient temperature not exceeding 40°C. Transformers 5 kVA and larger shall be capable of meeting the daily overload requirements of ANSI Standard C57.12.

J. Vibration Isolation: Each transformer core and coil shall be mounted in the transformer enclosure on rubber vibration isolators. Vibration isolators shall limit the transmission of sound from the 120 Hz harmonic to 10% of its unisolated level, and shall certified as such on the Shop Drawings.

K. Grounding: Provide ground-bar kit or ground bar installed on inside of transformer enclosure. Provide isolated ground bar where shown. Bond neutral to ground per NEC separately derived system

L. K-Factor Rating: Transformers shall be K13 rated and must comply with UL 1561 requirements for non-sinusoidal load current-handling capability to degree defined by designated K-factor.

1. Unit may not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor, without exceeding indicated insulation class in 40 deg C maximum ambient and 24-hour average ambient of 30 deg C.

2. Indicate value of K-factor on transformer nameplate.

3. Unit must comply with requirements of DOE 2016 efficiency levels when tested in accordance with NEMA TP 2 with K-factor equal to one.

M. Mounting

1. Provide Korfund VMC Type NRC isolators on all transformers unless more stringent requirements shown in 260548.

2. Wall Brackets where shown: Manufacturer's standard brackets

2.4 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for distribution transformers, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553"

2.5 SOURCE QUALITY CONTROL

A. Factory Tests and Inspections: Test and inspect assembled system, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, in accordance with IEEE C57.12.01 and IEEE C57.12.91 before delivering to site. Affix label with name and date of manufacturer's or qualified electrical testing laboratory's certification of system compliance on control units.

1. Resistance measurements of windings at rated voltage connections and at tap connections.

2. Ratio tests at rated voltage connections and at tap connections.

3. Phase relation and polarity tests at rated voltage connections.

4. No load losses, and excitation current and rated voltage at rated voltage connections.

5. Impedance and load losses at rated current and rated frequency at rated voltage connections.

6. Applied and induced tensile tests.

7. Regulation and efficiency at rated load and voltage.

8. Insulation-Resistance Tests:

a. Line-side to ground.

b. Load-side to ground.

c. Line-side to load-side.

9. Temperature tests.

10. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project and confirm ratings

B. Nonconforming Work:

1. System equipment that does not pass tests and inspections will be considered defective.

C. Prepare test and inspection reports.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for transformers.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's published instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 have been met. Maximum ground resistance must be 5 Ω at location of transformer.

E. Environment: Enclosures must be rated for environment in which they are located. Covers for UL 50E, Type 4X enclosures may not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounted transformers level and plumb with wall bracket. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided. Brace wall-mounted transformers as specified in Section 260548

B. Install transformers level and plumb on concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

C. Construct concrete bases and anchor floor-mounted transformers over 45 KVA in accordance with manufacturer's published instructions, seismic requirements applicable to Project, and requirements in Section 260529

1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Secure transformer to concrete base in accordance with manufacturer's published instructions.

E. Secure covers to enclosure and tighten bolts to manufacturer-recommended torques to reduce noise generation.

F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment in accordance with Section 260526 "

B. Bond neutral to ground per NEC separately derived system

C. Connect wiring in accordance with Section

D. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

E. Provide flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to building structure.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Dry-Type Transformer Field Tests:

a. Visual and Mechanical Inspection.

1) Inspect physical and mechanical condition.

2) Inspect anchorage, alignment, and grounding.

3) Verify that resilient mounts are free and that shipping brackets have been removed.

4) Verify that unit is clean.

5) Perform specific inspections and mechanical tests recommended by manufacturer.

6) Verify that as-left tap connections are as specified.

7) Verify presence of surge arresters and that their ratings are as specified.

b. Electrical Tests:

1) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

3.5 ADJUSTING

A. Record transformer secondary voltage at unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 24 13 – SWITCHBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration and installation for low voltage switchboards (SWBDs) as required for the complete performance of the Work, as shown on the Drawings, as specified herein

B. Section Includes:

1. Switchboards.
2. Surge protection devices.
3. Overcurrent protective devices.
4. Metering
5. Control power.
6. Accessory components and features.

1.2 SELECTIVE COORDINATION

A. See section 260573 for protective device coordination study requirements. All equipment specified herein shall comply with the requirements of 260573. All equipment shall be increased in size, electronic trip added, wire and conduit size increased as require to provide a complete selectively coordinated system. Nothing in the following specification relieves the contractor from providing a complete selectively coordinated system. Fuses shall not be used to provide selective coordination

1.3 REFERENCES

A. General, Publications: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

1. ASTM (ASTM): ASTM E 329 "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction."
2. Federal Specifications (FS): FS W C 375 "Circuit Breakers, Molded Case, Branch Circuit and Service."
3. International Electrotechnical Commission (IEC): IEC 60364-6 Low voltage Electrical Installations - Part 6: Verification
4. Institute of Electrical and Electronics Engineers, Inc. (IEEE): ANSI/IEEE C57.13 "Standard Requirements for Instrument Transformers".
5. International Electrical Testing Association (NETA): NETA ATS "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems."
6. International Organization for Standardization (ISO)

a. ISO 9001 “Quality Management Systems - Requirements”

b. ISO 14001 “Environmental Management Systems – Requirements”

7. National Electrical Contractors Association (NECA): NECA 400 “Standard for Installing and Maintaining Switchboards"

8. National Electrical Manufacturers Association (NEMA):

a. NEMA EI 21.1 "Instrument Transformers for Revenue Metering (110 kV BIL and Less).”

b. NEMA KS 1 "Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)"

c. NEMA PB 2 "Deadfront Distribution Switchboards."

d. NEMA PB 2.1 "General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less."

9. National Fire Protection Agency (NFPA)

a. NFPA 70 “National Electrical Code (NEC)”

b. NFPA 70B “Electrical Equipment Maintenance”

c. NFPA 70E “Standard for Electrical Safety in the Workplace”

10. Underwriters Laboratories, Inc. (UL)

a. UL 98 "Enclosed and Dead Front Switches"

b. UL 489 "Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures."

c. UL 891 "Switchboards"

d. UL 943 "Ground Fault Circuit-Interrupters"

e. UL 1008 ”Transfer Switch Equipment”

f. UL 1283 “Standard for Electro Magnetic Interference Filters"

g. UL 1449 "Surge Protective Devices"

1.4 LAYOUT AND COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.5 SUBMITTALS

A. Submit sufficient information to determine compliance with the Contract Documents. Identify submittal data with the specific equipment tags and/or service descriptions to which they pertain. Submittal data shall be clearly marked to identify the specific model numbers, options, and features of equipment and work proposed

B. Product Data:

1. Switchboards.

2. Overcurrent protective devices.

3. Surge protection devices.

4. Ground-fault protection devices.

5. Metering

6. Accessories.

7. Other components.

8. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

C. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types for types other than UL 50E, Type 1.

3. Detail bus configuration, current, and voltage ratings.

4. Detail short-circuit current rating of switchboards and overcurrent protective devices.

5. Detail utility company's metering provisions with indication of approval by utility company.

6. Include evidence of listing, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for series rating of installed devices.

7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Submit required Operations & Maintenance data specific to each product and accessory proposed. In addition, include the following information:

1. Manufacturer, supplier, support, and repair center specific contact information.

2. Manufacturer’s standard operation and maintenance data assembled for each size and type of equipment furnished.

3. All construction, installation, schematic, and wiring diagrams updated to an as-installed and commissioned state

4. All configured settings/parameters for adjustable components updated to an as-installed and commissioned stated if different from the factory default. Electronic copies of configuration files shall be provided, on media acceptable to the Owner (e.g., CD, USB stick, etc.), where these configurations can be saved as an electronic file for future upload into replaced or repaired components.

5. List of furnished and recommended spare parts.

6. Statement of standard Warranty.

7. Final Assembly and Testing Report

8. Spare parts list

1.7 SPARE PARTS

A. Spare Parts: Furnish to Owner spare parts, for repairing switchboards, that are packaged with protective covering for storage on-site and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than two of each size and type.

2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

3. Special Tools: Furnish to Owner proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to switchboards, that are packaged with protective covering for storage on-site and identified with labels describing contents.

a. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of twenty years.

1. The manufacturer shall have a valid ISO 9001 certification and an applicable quality assurance system that is regularly reviewed and audited by a third-party registrar. Manufacturing, inspection, and testing procedures shall be developed and controlled under the guidelines of the quality assurance system.

2. The manufacturer or their representative shall have service, repair, and technical support services available 24 hours 7 days a week basis.

3. The manufacturer shall have the ISO 14001 Environment Certification and shall supply the Product Environmental Profile (P.E.P.) upon request of the Engineer.

B. Installer Qualifications: Installer shall be a firm that shall have a minimum of 5 years of successful installation experience with projects utilizing equipment similar in type and scope to that required for this Project [and shall be approved by the manufacturer’s representative].

C. All work performed and all materials used shall be in accordance with the National Electrical Code and with applicable local regulations and ordinances. Equipment assemblies, materials, and equipment shall be listed and labeled by Underwriter's Laboratories or by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.9 DELIVERY, STORAGE AND HANDLING

A. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. In addition, protect electronics from all forms of electrical and magnetic energy that could reasonably cause damage.

B. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.

C. Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

1. Handle and prepare switchboards for installation in accordance with NECA 400 and NEMA PB 2.1.

1.10 WARRANTY

A. The manufacturer shall warrant products against defects in material and workmanship for [12 months from the date of final completion

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Product: Subject to compliance with requirements, provide Square D QED-2 Switchboards by Schneider Electric

B. Equal products by ABB/GE are acceptable.

C. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

2.2 GENERAL

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

C. Comply with NEMA PB 2.

D. Comply with NFPA 70.

E. Comply with UL 891.

2.3 SWITCHBOARD – GENERAL

A. Switchboard voltage, amperage and fault current rating as shown on the drawings. Breakers provided as shown on the drawings

B. Utility Metering Compartment: Provide EUSERC metering compartment or as required by the serving utility

C. Service Entrance Rating: Switchboards intended for use as service entrance equipment may contain from one to six service disconnecting means with overcurrent protection, neutral bus with disconnecting link, grounding electrode conductor terminal, and main bonding jumper.

D. Connection ahead of main: Where shown provide separate vertical section and bus for connection

E. Enclosures shall be NEMA Type 1 unless shown otherwise on drawings] and provide front access. Switchboard sections shall all be front and rear aligned with the adjacent sections. Removable steel base channels (1.5 inch floor sills) shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting

F. Enclosure shall be steel with a factory applied finish in the manufacturer's standard paint color over a rust inhibiting primer on treated metal surface. Bus transition and incoming pull sections shall match and align with adjacent sections. Barriers shall be provided between adjacent switchboard sections. Front covers shall be removable with a single tool. All doors shall be hinged with removable hinge pins.

G. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

H. All front covers shall be screw removable with a single tool and all doors shall be hinged with removable hinge pins.

I. Top and bottom conduit areas shall be clearly indicated on shop drawings.

J. Nameplates: See 260553

K. Bus Composition: Shall be shall be of sufficient cross-sectional area to meet UL 891 temperature rise requirements. Bus shall be constructed of hard drawn silver plated copper of 98 percent conductivity or tin plated, high strength, electrical grade aluminum alloy. Plating shall be applied over all bus surface except cut edges, bus plating on contact surfaces only shall not be acceptable.

1. The phase and neutral (if present) horizontal bus shall have an ampacity equal to or greater than the switchboard system rating. Tapered bus shall not be permitted. Full provisions for the addition of future sections shall be provided. Bussing shall include, but shall not be limited to, necessary hardware to accommodate splicing for future additions..

2. Group Mounted Feeder Vertical Bus Stack:

a. Bus stack shall be capable of mounting feeder breakers with different frame sizes and number of poles across from one another on the bus stack.

b. Non-conducting surface films shall be removed during circuit breaker installation by a wiping action of the circuit breaker jaws.

c. The design of the circuit breaker jaws and bus stack shall create blow on forces under fault conditions.

d. To minimize maintenance concerns, Bolted connections for feeder breakers shall not be allowed for group mounted feeders.

3. Ground Bus: Ground bus shall be sized per current NEC and UL 891 Tables 28.1 and 28.2, hard drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch circuit ground conductors. For busway feeders, insulated equipment grounding cable shall be extended to busway ground connection and the cable supported at intervals in vertical run.

L. Future Devices: Compartments shall be equipped with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit breaker compartment

2.4 SWITCHBOARD – INCOMING MAIN SECTION

A. Incoming section shall allow for top and bottom entry of incoming conductors.

B. Provisions for incoming connections shall be suitable for landing cables as shown on drawings

C. Incoming connections shall allow for direct connection to the line terminals of main overcurrent device via direct connection or via the Utility metering compartment

D. Where cable terminations are provided for incoming conductors, provide crimp type compression lugs in quantity and size for conductors shown on drawings. Lugs shall be suitable for use with copper and aluminum conductors and shall be rated for minimum 75 degree C.

E. Utility Metering Compartment where specified (see above) shall consist of fabricated compartment and section complying with utility company's requirements. EUSERC

F. Main Circuit Breaker(s)

1. Electronic Trip Circuit Breaker, trip units shall be Micrologic

2. Micrologic electronic trip unit shall be true RMS sensing.

3. Air core current transformers shall be used to ensure accurate measurements from low currents up to high currents.

4. Electronic trip unit shall be fitted with thermal imaging to protect intermittent short circuits or ground-faults.

5. The following monitoring functions shall be integral parts of electronic trip units:

a. A test connector shall be installed for checks on electronic and tripping mechanism operation using an external device.

b. LED for load indication at 105 percent.

c. LED for load indication at 90 percent of load for applications 600 amperes and smaller

d. LED for visual verification of protection circuit functionality for applications 600 amperes or smaller.

e. Micrologic trip unit functions shall consist of adjustable protection settings with the capability to be set and read locally by rotating a switch.

f. Long-time pickup shall allow for adjustment to nine long-time pickup settings. This adjustment must be at least from 0.4 to 1 times the sensor plug (In), with finer adjustments available for more precise settings to match the application.

g. Adjustable long-time delay shall be in nine bands. At six times Ir, from 0.5 to 24 seconds above 600 amperes, and 0.5 to 16 seconds for 600 amperes and below.

h. Short-time pickup shall allow for nine settings from 1.5 to 10 times Ir.

i. Short-time delay shall be in nine bands from 0.1–0.4 I^2t ON and 0–0.4 I^2t OFF.

j. Instantaneous settings on the trip units with LSI protection shall be available in nine bands.

1) Above 600 amperes, from 2 to 15 times In

2) 600 amperes, from 1.5 to 11 times In

3) 400 amperes from 1.5 to 12 times In

4) 250 amperes and below, from 1.5 to 15 times In

k. Four-pole devices shall be equipped for neutral protection with a three-position setting; neutral not protected, neutral tripping threshold equal to half the phase value, and neutral threshold equal to the phase value.

l. Ground fault settings for circuit breaker sensor sizes 1200 amperes or below shall be in nine bands from 0.2 to 1.0 times In. The ground fault settings for circuit breakers above 1200 amperes shall be nine bands from 500 to 1200 amperes.

6. It shall be possible to fit the trip unit with a seal to prevent unauthorized access to the settings in accordance with NEC Section 240-6(b).

7. Trip unit shall provide local trip indication and capability to locally and remotely indicate reason for trip, i.e., overload, short circuit, or ground fault.

8. Neutral current transformers shall be available for four-wire systems.

9. Trip units shall have the capability to electronically adjust the settings locally and remotely to fine increments below the switch settings. Fine increments for pickup adjustments shall be 1 ampere. Fine increments for delay adjustments shall be one second

10. Trip units shall be available to provide real time metering. Metering functions shall include, but shall not be limited to, the following:

a. Current (phases, neutral, average, maximum)

b. Voltage (phase-to-phase, phase-to-neutral, average, unbalance)

c. Power (active [kW], reactive [kVAR], apparent [kVA], power factor)

d. Energy (active [kWh], reactive [kVAR], apparent [kVA])

e. Frequency

f. Total harmonic distortion (current, voltage)

g. Metering accuracy shall be 1.5 percent current (above 600 amperes), 1.0 percent current (600 amperes and below), 0.5 percent voltage, and 2 percent energy. This accuracy shall be total system, including, but not limited to, CT and meter.

11. Measurement chain shall be independent from the protection chain.

12. The measurements shall be displayed on the breaker itself and/or on a remote display and/or on a remote system via Modbus communication.

13. Connections from circuit breaker to remote display and/or communication module shall be plug-n-play via RJ45 connector. No special tools or programming shall be required.

14. Provide Arc Energy Reduction Device

2.5 SWITCHBOARD – DISTRIBUTION

A. Section shall connect to main section above via bus. Bus size same as main size

B. Provisions for connections shall be suitable for landing cables as shown on drawings

C. Where cable terminations are provided for incoming conductors, provide crimp type compression lugs in quantity and size for conductors shown on drawings. Lugs shall be suitable for use with copper and aluminum conductors and shall be rated for minimum 75 degree C.

D. All breakers to be provided per the selective coordination study, including using electronic trip to match specifications above.

E. Circuit breaker(s) shall be group mounted with mechanical restraint on a common pan or rail assembly.

F. Circuit breaker(s) shall not require additional external mounting hardware. Circuit breaker(s) shall be held in mounted position by aself-contained bracket secured to the mounting pan by fasteners. Circuit breaker(s) of different frame sizes shall be capable of being mounted across from each other.

G. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.

H. Group mounted circuit breakers through 1200A, individual compartmentalized above 1200 amp.

1. Molded Case Circuit Breakers (MCCBs):

a. MCCBs shall be of standard frame sizes, trip ratings, and number of poles.

b. Lugs shall be Compression style, suitable for number, size, trip ratings, and conductor material.

c. Application Listing shall be appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air conditioning, and refrigerating equipment.

d. Ground Fault Protection shall be integral to circuit breaker with adjustable pickup and time delay settings, push to test feature, and ground fault indicator when specified.

e. Shunt Trip when specified shall be 277 volt trip coil energized from separate circuit.

2. Electronic Trip ET 1.0 Trip System (300 to 800 Amperes):

a. The circuit breaker trip system shall be a microprocessor-based true RMS sensing design.

b. Sensor ampere ratings shall be as indicated on the drawings or schedules.

c. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.

d. Trip unit shall not be field-replaced.

e. ET 1.0 trip unit functions shall consist of adjustable instantaneous pickup with no intentional time delay.

f. The long time trip point setting shall be fixed and cannot be adjusted.

g. The instantaneous settings on the trip unit shall allow 2 to 10 times the sensor rating (In).

h. The trip unit shall have the capability for the adjustment to be set and read locally by a rotating switch.

3. Electronic Trip over 800 amps – same as main breaker above

I. Barriers: Between adjacent switchboard sections.

J. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

2.6 SURGE PROTECTION DEVICES

A. TPS TK-ST240-3Y480-L or equal

1. Modes of Protection: All Modes. L-N, L-L, L-G, & N-G

2. Input Power Frequency: 40-68Hz

3. Response Time: < 1 nanosecond

4. Standard Monitoring: Status indicator lights (one per phase & one service LED); Form C dry relay contacts for suppressor status; Audible alarm with silence button

5. Short Circuit Current Rating: 200 kAIC on all units.

6. No upstream over-current protection required.

7. Enclosure: Steel. Weather-proof. NEMA 4 (IP 56)

8. Connection: Hardwired via internal lugs #10 AWG-#2 AWG

B. Mounting: Multi-point mounting feet.

C. If a dedicated breaker for the surge protective device is not provided, the surge protective device shall include an UL recognized disconnect switch.

D. Mount within 12” of switchboard breaker and busing.

2.7 METERING

A. Main Switchboard Meter

1. Provide a Square D PM2230 meter with LCD display

2. Output readings via module to DDC via Bacnet or Modbus

B. Feeders Meters:

1. Feeder meters shall provide categories as shown on drawings and to meet Washington State Energy Code

2. Feeder meters shall run circuits to exterior j-box at switchboard to allow for connection building BAS/DDC system via Bacnet or Modbus as shown on the drawings.

3. Meter shall Be Veris E50H series

a.	Accuracy	+/- 0.2%
b.	Communication	BACnet (MS/TP) or Mobus per DDC Contractor
c.	Display Type	LCD
d.	Frequency Rating	50 - 60 Hz
e.	Metering Product Family	E50 Power Meter
f.	Monitored Voltage Rang	90 - 600 VAC
g.	Mounting	Din-Rail
h.	Operating Temperature	-22 - 158 °F

C. Instrument Transformers shall adhere to requirements of NEMA EI 21.1, ANSI/IEEE C57.13.

2.8 CONTROL POWER

A. Provide control power for meters from the switchboard with any transformers required. Include breaker.

PART 3 EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards in accordance with NECA 400 and NEMA PB 2.1.

1. Lift or move switchboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's published instructions.

2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.

3. Protect from moisture, dust, dirt, and debris during storage and installation.

4. Install temporary heating during storage in accordance with manufacturer's published instructions.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect performance of equipment.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

E. to provide pathway for moving switchboards into place.

3.2 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Special Techniques:

1. Equipment Mounting: Install switchboards on concrete base, 4 inch (100 mm) nominal thickness.

a. Install conduits entering underneath switchboard, entering under vertical section where conductors will terminate. Install with couplings flush with concrete base. Extend 2 inch (50 mm) above concrete base after switchboard is anchored in place.

b. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18 inch (450 mm) centers around full perimeter of concrete base.

c. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

d. Place and secure anchorage devices. Use setting drawings, templates, diagrams, published instructions, and directions furnished with items to be embedded.

e. Install anchor bolts to elevations required for proper attachment to switchboards.

f. Anchor switchboard to building structure at top of switchboard if required or recommended by manufacturer.

2. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

3. Comply with mounting and anchoring requirements specified in Section 260548

4. Operating Instructions: Frame and mount printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

5. Install filler plates in unused spaces of panel-mounted sections.

6. Install overcurrent protective devices, surge protection devices, and instrumentation.

    a. Set field-adjustable switches and circuit-breaker trip ranges.

7. Install spare-fuse cabinet.

3.3 CONNECTIONS

A. Bond conduits entering underneath switchboard to equipment ground bus with bonding conductor sized in accordance with NFPA 70.

B. Support and secure conductors within switchboard in accordance with NFPA 70.

C. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with nameplate complying with requirements for identification specified in Section

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with nameplate complying with requirements for identification specified in Section 260553

D. Service Equipment Label: Labeled, by qualified electrical testing laboratory recognized by authorities having jurisdiction, for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Acceptance Testing:

2. Test ground-fault protection of equipment for service equipment in accordance with NFPA 70.

3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

4. Check and record torque settings on all breaker terminations and field bus connections. Post list of torque settings at the switchboard.

5. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

B. Nonconforming Work:

1. Switchboard will be considered defective if it does not pass tests and inspections.

2. Remove and replace defective units and retest.

C. Collect, assemble, and submit test and inspection reports, including certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

SECTION 26 24 16 – PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, configuration and installation for as required for the complete performance of the Work, as shown on the Drawings, as specified herein, and as specified elsewhere for the assemblies or systems comprised of the components specified herein.

B. Contractor shall note that drawings show shared neutrals for circuits. Contractor shall comply with NEC 210.4B, which requires either separate neutrals or a disconnecting means that disconnects all ungrounded conductors at the point where the circuit originates. This requires the contractor to provide breaker ties or 3 pole breakers for all groups of 3 circuits run with shared neutral in the field as grouping is frequently changed. Contractor shall include this in the contract. No additional payments will be made for this code requirement.

C. See section 260573 for protective device coordination study requirements. All equipment specified herein shall comply with the requirements of 260573. All equipment shall be increased in size, electronic trip added, wire and conduit size increased as require to provide a complete selectively coordinated system. Nothing in the following specification relieves the contractor from providing a complete selectively coordinated system. Fuses shall not be used to provide selective coordination

D. Section Includes:

1. Power panelboards (Distribution Panels)

    a. Including Combination Power Panelboards

2. Lighting and appliance branch-circuit panelboards.

3. Disconnecting and overcurrent protective devices.

1.2 REFERENCES

A. General, Publications: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

1. American Society of Civil Engineers (ASCE):

    a. ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

2. California Office of Statewide Health Planning and Development (OSHPD)

3. USA Federal Specifications (FS):

    a. FS W-C-375, "Circuit Breakers, Molded Case, Branch Circuit and Service."

    b. FS W-P-115, "Panel, Power Distribution."

4. International Code Council (ICC):

    a. ICC IBC, "International Building Code."

b. ICC IBC Section 1621, “Architectural, Mechanical, and Electrical Component Seismic Design Requirements.”

c. ICC ES AC156, “International Code Council Evaluation Services Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems”

5. National Electrical Manufacturers Association (NEMA):

a. NEMA AB 1, "Molded Case Circuit Breakers and Molded Case Switches."

b. NEMA PB 1, "Panelboards."

c. NEMA PB 1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less."

6. National Fire Protection Agency (NFPA)

a. NFPA 70, "National Electrical Code," hereinafter referred to as NEC.

b. NFPA 5000, “Building Construction and Safety Code.”

7. Underwriter Laboratories (UL):

a. UL 50, "Enclosures for Electrical Equipment, Non-Environmental Considerations.”

b. UL50E, “Enclosures for Electrical Equipment, Environmental Considerations.”

c. UL 67, "Standard for Panelboards."

d. UL 489, "Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.”

8. International Electrotechnical Commission (IEC)

a. IEC 60529: 1989+AMD1:1999+AMD2:2013 CSV Consolidated version. - Degrees of Protection Provided by Enclosures (IP Code).

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 20 years.

1. The manufacturer shall have a valid ISO 9001 certification and an applicable quality assurance system that is regularly reviewed and audited by a third-party registrar. Manufacturing, inspection, and testing procedures shall be developed and controlled under the guidelines of the quality assurance system.

2. The manufacturer or their representative shall have service, repair, and technical support services available 24 hours 7 days a week basis.

B. All work performed and all materials used shall be in accordance with the National Electrical Code, and with applicable local regulations and ordinances. Process controllers, assemblies, materials, and equipment shall be listed and labeled by Underwriter’s Laboratories or by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Installing contractor shall have minimum 5 years experience installing similar equipment

1.4 SUBMITTALS

A. Product Data:

1. Power and Distribution panelboards.

2. Lighting and appliance branch-circuit panelboards.

3. Load centers.

4. Disconnecting and overcurrent protective devices.

5. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.

6. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Submit sufficient information to determine compliance with the Contract Documents. Identify submittal data with the specific equipment tags and/or service descriptions to which they pertain. Submittal data shall be clearly marked to identify the specific model numbers, options, and features of equipment and work proposed.

C. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.

2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.

4. Detail bus configuration, current, and voltage ratings.

5. Short-circuit current rating of panelboards and overcurrent protective devices.

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

7. Include wiring diagrams for power, signal, and control wiring.

8. Key interlock scheme drawing and sequence of operations.

D. Closeout and Maintenance Materials

1. Manufacturer shall provide installation instructions and NEMA Standards Publication PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

2. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts: Furnish to Owner spare parts, for repairing panelboards, that are packaged with protective covering for storage on-site and identified with labels describing contents. Include the following:

1. Keys: Two spares for each type of panelboard cabinet lock.

B. Special Tools: Furnish to Owner proprietary equipment, keys, and software required to operate, maintain, repair, adjust, or implement future changes to panelboards, that are packaged with protective covering for storage on-site and identified with labels describing contents.[Include the following:]

1. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prior to delivery to the Project site, ensure that suitable storage space is available to store materials in a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres. Materials shall be protected during delivery and storage and shall not exceed the manufacturer stated storage requirements. As a minimum, store indoors in clean, dry space with uniform temperature to prevent condensation. In addition, protect electronics from all forms of electrical and magnetic energy that could reasonably cause damage.

B. Deliver materials to the Project site in supplier’s or manufacturer’s original wrappings and containers, labeled with supplier’s or manufacturer’s name, material or product brand name, and equipment tag number or service name as identified within the Contract Documents.

C. Inspect and report any concealed damage or violation of delivery storage, and handling requirements to the Engineer.

1.7 WARRANTY

A. Manufacturer shall warrant specified equipment free from defects in materials and workmanship for the lesser of 1 year from final completion.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Manufacturer

1. Basis-of-Design Product: Subject to compliance with requirements, provide Square D brand NQ Panelboard, NF Panelboard, and I-Line Power(Distribution) panels

2. Alternative Products by ABB/GE are acceptable

B. Acceptable Products: Panelboards specified herein shall be the product of a single manufacturer. Products and manufacturers specified are to establish a standard of quality for design, function, materials, and appearance.

2.2 PANELBOARDS COMMON REQUIREMENTS

A. Fabricate and test panelboards in accordance with IEEE 344 to withstand seismic forces

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing agency recognized by authorities having jurisdiction, and marked for intended location and application.

1. Comply with NEMA PB 1.

2. Comply with NFPA 70.

2.3 PANELBOARDS

A. Interiors:

1. Panelboards shall be rated for:

a. Type NQ: 240Vac maximum, with continuous main current ratings, as indicated on associated schedules and the Drawings

b. Type NF: 480Y/277Vac maximum, with continuous main AC current ratings, as indicated on associated schedules and the Drawings.

c. Panelboard ratings (bus ratings, heat rise, etc.) shall be conducted in accordance with, and certified by UL, as per UL67.

d. Main lug interiors up to 600 amperes shall be field convertible to main breaker.

2. Provide UL-listed short circuit current ratings (SCCR) as indicated on the associated schedules and the Drawings, not to exceed the lowest interrupting capacity rating of any circuit breaker installed with a maximum of 200,000 RMS symmetrical amperes. The panelboard shall be rated for the minimum short circuit current rating in rms symmetrical amperes:

a. Type NQ panelboards shall be Fully rated to 10,000 minimum or as shown on the drawings

b. Type NF panelboards shall be to 14,000 minimum or as shown on the drawings

3. Each bus bar shall have sequentially phased branch circuit connectors.

a. The bussing shall be fully rated, with one (1) continuous bus bar per phase, unless a Split Bus or Separated Distribution panel is specified:

1) Up to 84 circuits for 240 Vac maximum panelboards,

2) Up to 54 circuits for 480Y/277 Vac max panelboards up to 54 circuit spaces.

3) Where Split Bus and Separated Distribution panelboards are shown – provide one (1) continuous bus bar per phase for each branch distribution section.

a) Split Bus panelboard sections shall be connected from upstream lugs or branch breaker to one (1) back-fed main breaker in downstream section.

b) Separated Distribution panelboard sections shall be connected via removable, stranded copper cables, secured via mechanical lugs on each section.

b. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67.

c. Bussing rated 100-400 amperes shall be plated copper or aluminum. Bussing rated at or above 600 amperes shall be plated copper as standard construction. Bus bar plating shall run the entire length of the bus bar.

d. Interior phase bus shall be pre-drilled to accommodate field installable options i.e., Sub-Feed Lugs, Sub-Feed Breakers, Thru-Feed Lugs.

e. 240 Vac maximum panelboards shall have branch circuit connectors suitable for both plug-on and bolt-on branch circuit breakers. All breakers shall be bolt on

4. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.

5. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided where shown on the panel schedule

6. Neutral shall be plated, solid, and split for 20” nominal and wider panelboards. 14” wide and column width panelboards shall have a plated solid neutral.

7. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have filler plates covering unused mounting spaces.

8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, CSA and UL Listed label and short circuit current rating shall be displayed on the interior or in a booklet format.

9. Interiors in NEMA 1 or 2 enclosures shall be field convertible for top or bottom incoming feed. Interior leveling provisions shall be provided for flush mounted applications.

10. Main circuit breakers in 240 Vac max panelboards shall be vertically mounted. Sub-feed circuit breakers may be vertically or horizontally mounted.

11. Main circuit breakers in 480Y/347 max panelboards shall be vertically mounted. Sub-feed circuit breakers shall be vertically or horizontally mounted.

B. Enclosures

1. Type 1 Boxes

a. Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 and UL50E requirements. Unpainted galvannealed steel is not acceptable.

b. Boxes shall have removable end walls with knockouts located on [one end] [both ends] [neither end]. Standard 5.75” deep NEMA 1 enclosures shall have permanently affixed interior mounting studs. Interior mounting brackets shall be provided as required.

2. Nominal box width shall be 20”

3. Type 1 Fronts

a. Front shall meet strength and rigidity requirements per UL 50 standards. Front shall have ANSI 49 gray enamel baked onto cleaned phosphatized steel.

b. Fronts shall be hinged 1-piece with door. Panel cover shall include dual hinges to allow access to breaker compartment and entire panel enclosure (Door in Door).

1) Mounting shall be flush or surface as indicated on panel schedules.

c. Doors on front shall have rounded corners and edges shall be free of burrs.

d. Front shall have cylindrical tumbler type lock with catch and spring-loaded steel door pull, quarter-turn fasteners, or three-point latch. All lock assemblies shall be keyed alike. One key shall be provided with each lock. A clear plastic directory cardholder, or welded metal frame directory cardholder, shall be mounted on the inside of door.

4. Type 3R, 5, and 12

a. Enclosures shall be constructed in accordance with UL 50 and UL50E requirements. Enclosures shall be painted with ANSI 49 gray enamel baked onto cleaned phosphatized steel.

b. All doors shall be equipped with at least one L-Handle lock mechanisms. Enclosures 59 inches or more in height shall have additional L-Handle mechanisms or two (2) additional quarter turn fasteners. All lock assemblies shall be keyed alike. One key shall be provided with each lock. A clear plastic directory cardholder, or welded metal frame directory cardholder, shall be mounted on the inside of door. Doors in enclosures which may configured for NEMA 5 or 12 service shall be gasketed.

c. Nominal enclosure dimensions shall be:

1) 21” wide and 6.75” deep, not counting the handle, for standard Type 3R, 5, 12.

2) 21” wide and 8.75” deep, not counting the handle, for Door-in-door Type 12.

3) 27” wide and 8.75” deep, not counting the handle, for vented NEMA Type 3R.

5. Type 4, 4X

a. Enclosures shall be constructed in accordance with UL 50 and UL 50E requirements.

b. All doors shall be gasketed and equipped with a L-Handle mechanism with additional clamps or fasteners on the top, bottom, and/or side to ensure tight closure. All lock assemblies shall be keyed alike. One key shall be provided with each lock. A clear plastic directory cardholder, or welded metal frame directory cardholder, shall be mounted on the inside of door.

c. Nominal enclosure dimensions shall be 20.13” wide and 7.25” deep, not counting the handle.

C. Main Circuit Breakers

1. Main circuit breakers shall have an over center, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Main circuit breakers shall have

Thermal Magnetic trip units unless electronic trip required by the coordination study or shown on the drawings..

a. Thermal Magnetic circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true rms sensing and be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.

b. Electronic trip units shall have Long time, Instantaneous, & Short time (LSI) functionality, Electronic trip units shall use current transformers combining “iron-core” sensors for self-powered electronics and “air-core”, Rogowski coil sensors for measurement accuracy.

1) Basic Electronic trip units shall allow adjustment of Trip Current.

2) Adjustable electronic trip units shall provide adjustable protection settings for [Long time & Instantaneous (LI)] [Long time, Short time, & Instantaneous (LSI)] for flexible system coordination.

2. Two- and three-pole circuit breakers shall have common tripping of all poles. Vertically mounted molded case circuit breaker frame sizes above 125 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker that allows the user to simultaneously select the desired trip level of all poles. Molded case circuit breakers shall have a push-to-trip button for maintenance and testing purposes.

3. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL Listed for reverse connection without restrictive line or load markings.

4. Vertically mounted main circuit breaker escutcheon shall have international I/O markings, in addition to standard ON/OFF markings. Circuit breaker handle accessories shall provide provisions for locking handle in the ON or OFF position.

5. Lugs shall be CSA and UL Listed to accept solid or stranded [copper and aluminum conductors] [copper conductors only]. Lugs shall be suitable for [75° C rated wire] [90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16]. Lug body shall be bolted in place; snap-in designs are not acceptable.

6. The circuit breakers shall be CSA and UL Listed for use with the following accessories: Shunt Trip, Under Voltage Trip, Ground Fault Shunt Trip, Auxiliary Switch, Alarm Switch, Mechanical Lug Kits, and Compression Lug Kits.

D. Branch Circuit Breakers

1. Circuit breakers shall be CSA and UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the associated schedules.

2. Molded case branch circuit breakers in 240 Vac maximum panelboards shall bolt-on to the bus, and shall not require additional external mounting hardware, except when installed into IP2X enhanced fingersafe interiors.

a. Branch circuit breakers shall be available with the following nominal interrupting ratings:

1) 1 pole: 10A - 70A

2) 2 poles: 15 - 125A [(up to 200A in a single phase. panelboard)]

3) 3 poles: 15 –150A

4) Larger breakers may be subfeed type or use Power/Distribution Panel board

3. Molded case branch circuit breakers in 480Y/277 Vac maximum panelboards shall bolt-on to the bus and shall not require additional external mounting hardware.

a. Branch circuit breakers shall be available with the following nominal interrupting ratings:

1) 1 pole: 10A - 70A

2) 2 poles: 15 - 125A

3) 3 poles: 15 – 125A

b. Larger breakers may be subfeed type or use a Power/Distribution Panelboard

4. Circuit breakers shall have an over center toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole. Each thermal element shall be true RMS sensing and shall be factory-calibrated to operate in a 40 degrees C ambient environment. Circuit breakers shall have an operating range from – 10 degrees C to + 60 degrees. Thermal elements shall be ambient compensating above 40 degrees C.

5. Two- and three-pole circuit breakers shall have common tripping of all poles.

6. There shall be two forms of visible trip indication. The breaker handle shall reside in a position between ON and OFF. In addition, there shall be a red, Visi-Trip indicator appearing in the clear window of the circuit breaker housing.

7. Lugs shall be UL Listed to accept solid or stranded [copper and aluminum conductors] [copper conductors only]. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16.

8. Circuit Breakers shall be CSA and UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch. See schedule

2.4 POWER (DISTRIBTUION) PANELBOARDS

A. Panelboard interior

1. Shall be rated a shown on the drawing. Continuous main current ratings as indicated on associated schedules not to exceed 1200 amperes maximum main lugs or main circuit breaker. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67.

2. Provide UL Listed short circuit current ratings (SCCR) as indicated on the associated schedules not to exceed the lowest interrupting capacity rating of any circuit breaker installed with a maximum of 200,000 RMS symmetrical amperes. Main lug and main breaker panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NFPA70 National Electric Code.

3. The panelboard interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.

4. The bussing shall be fully rated with sequentially phased branch distribution. Panelboard bussing rated 100 through 600 amperes shall be plated copper or aluminum. Bussing rated 800 amperes and above shall be plated copper. Bus bar plating shall run the entire length of the bus bar. The entire interleaved assembly shall be contained between two (2) U-shaped steel channels, permanently secured to a galvanized steel-mounting pan by fasteners.

5. Interior trim shall be of dead-front construction to shield user from all energized parts. Main circuit breaker and main lug interiors shall be field convertible for top or bottom incoming feed.

6. A solidly bonded copper equipment ground bar shall be provided. An additional copper isolated/insulated ground bar shall also be provided where scheduled.

7. Solid neutral shall be equipped with a full capacity bonding strap for service entrance applications. Gutter-mounted neutral will not be acceptable.

8. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL Listed label, and Short Circuit Current Rating shall be displayed on the interior or in a booklet format. Leveling provisions shall be provided for flush mounted applications.

9. Group mounted circuit breakers through 1200A

    a. Molded case or electronic trip if scheduled or required by the coordination study.

    b. Circuit breaker(s) shall be group mounted with plug-on electrical connection, bolted to common pan or rail assembly.

    c. The interior shall have three flat bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus.

    d. Circuit breakers equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breakers shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Circuit breakers of different frame sizes shall be capable of being mounted across from each other.

    e. Line-side circuit breaker connections are to be jaw type.

    f. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate breaker connectors and mounting hardware.

10. Molded Case Circuit Breaker Characteristics - General

    a. Circuit breakers shall be I-LINE - up to 1200 Amp maximum construction with factory installed mechanical lugs. All circuit breakers shall be UL Listed to accept field installable/removable mechanical type lugs. All lugs shall be UL Listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors,. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating in the National Electrical Code.

b. All circuit breakers with permanent trip units shall be UL Listed for reverse connection without restrictive line and load markings and be suitable for mounting in any position.

B. Panelboard Enclosures

1. Type 1 Boxes

a. Boxes shall be hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements. Unpainted galvannealed steel is not acceptable.

b. Boxes shall have removable blank end walls and interior mounting studs. Interior support bracket shall be provided for ease of interior installation.

c. Standard enclosure widths shall be 26”, 32”,42”, and 44” depending on application.

2. Type 1 Trim Fronts

a. Trim front steel shall meet strength and rigidity requirements per UL 50 standards. Shall have an ANSI 49 medium gray enamel electrodeposited over cleaned phosphatized steel.

b. Trim front shall be hinged 1-piece with door available in flush or surface mount as schedukled. Trim front door shall have rounded corners and edges free of burrs. A clear plastic directory cardholder shall be mounted on the inside of the door.

c. Locks shall be cylindrical tumbler type with larger enclosures requiring sliding vault locks with 3-point latching. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock.

3. Type 3R, 5, and 12

a. Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.

4. Metering (only where shown on the one line diagram)

a. Feeder meters shall provide categories as shown on drawings and to meet Washington State Energy Code

b. Feeder meters shall run circuits to exterior j-box at switchboard to allow for connection building BAS/DDC system via Bacnet or Modbus as shown on the drawings.

c. Meter shall be Veris E50H series

1)	Accuracy	+/- 0.2%
2)	Communication	BACnet (MS/TP) or Mobus per DDC Contractor
3)	Display Type	LCD
4)	Frequency Rating	50 - 60 Hz
5)	Metering Product Family	E50 Power Meter

6) Monitored Voltage Rang 90 - 600 VAC

7) Mounting Din-Rail

8) Operating Temperature -22 - 158 °F

d. Instrument Transformers shall adhere to requirements of NEMA EI 21.1, ANSI/IEEE C57.13.

e. Provide control power for meters from the Distribution Panel with any transformers required. Include breaker.

2.5 SURGE PROTECTORS

A. Surge Protectors basis of design is the TPS LP series for 208 volt panels and Transtack 2 for 480 volt panels. Alternative projects must meet performance criteria below

1. 208/120 Volt Panelboards.. Provide at all 120/208 volt panels

a. Total Protection Solutions#TK-LP080-3Y208-L

1) Maximum Rated Surge Current: 80kA per phase; 40kA per mode

2) Application: ANSI/IEEE C62.41 Location A, B & C. Ideal for flush mount in-wall and adjacent panelboards

3) Design: Fusing for safety and hybrid suppression design provides lowest let-through voltage protection for mission critical loads

4) Warranty: 30-Year Unlimited Free Replacement

5) Safety Listing: UL 1449 4th Ed., Type 1 for Type 1 & Type 2 locations and UL 1283

6) Mode of Protection: All Mode. L-N, L-L, L-G, & N-G

7) Input Power Frequency: 40-68Hz

8) Response Time: < 1 nanosecond

9) Standard Monitoring: Status indicator lights (one per phase & one service LED); Form C dry contacts for suppressor status; Audible alarm with silence button

10) Short Circuit Current Rating: 200 kAIC short circuit current rating. Component Level fusing (CLF) allows direct bus connection without the need for upstream over-current protection.

11) Provide flush mount kit where shown on the drawings

b. ANSI/IEEE C62.41.1-2002, C62.41.2-2002, & C62.45-2002 Measured Limited Voltage and UL Voltage Ratings

Model Number	System Voltage	System Configuration	Protection Mode	MCOV	ETF Models A1 Ring Wave 2kV, 67A 180° Phase Angle	ETF Models A3 Ring Wave 6kV, 200A 180° Phase Angle	All Models B3 Ring Wave 6kV, 500A 90° Phase Angle	UL1449 2nd Ed./ UL1449 3rd & 4th Ed. Voltage Protection Ratings

TK-LP080-3Y208-L	120/208V	3-Phase WYE 4-wire+grnd	L-N	150V	29V	56V	437V	400/700
			L-G	150V	46V	81V	592V	400/700
			L-L	300V	39V	88V	612V	800/1000
			N-G	150V	40V	112V	324V	400/700

2. 480/277 Volt Panelboards. Provide where scheduled

   a. Total Protection Solutions#TK-TT2-100-3Y480-FL

      1) Maximum Rated Surge Current: 100kA per phase (50kA/mode)

      2) Repetitive Surge Current Rating: 3,000 impulses per mode based on actual test data (using ANSI/IEEE C62.41.1-2002 C3 combo wave)

      3) Application: ANSI/IEEE C62.41 Location C, B & A. Ideal for distribution panels, branch panels and critical loads

      4) Design: Hybrid parallel design with individual fused MOV's and UL

      5) 1283 EMI/RFI filter Warranty: 25-Year Unlimited Free Replacement

      6) Safety Listing: UL 1449 4th Ed., Type 1 for Type 1 & Type 2 locations and UL 1283

      7) Modes of Protection: All modes: L-N, L-G, N-G & L-L

      8) Input Power Frequency: 40-68Hz

      9) Connection Method: Parallel to electrical distribution system

      10) Response Time: Less than 1 nanosecond

      11) Standard Monitoring: Status indicator lights (one per phase)

      12) Short circuit Current Rating: 200 kAIC – no upstream over-current protection device (breaker or fuse) required.

      13) Provide flush mount kit where shown on the drawings

3. Distribution boards HB AND HC

   a. TPS #TK-ST160-3Y480

      1) Modes of Protection: All Modes. L-N, L-L, L-G, & N-G

      2) Input Power Frequency: 40-68Hz

      3) Response Time: < 1 nanosecond

      4) Standard Monitoring: Status indicator lights (one per phase & one service

      5) LED); Form C dry relay contacts for suppressor status; Audible alarm

      6) with silence button

      7) Short Circuit Current Rating: 200 kAIC on all units.

      8) No upstream over-current protection required on CLF unit.

9) Non CLF units require 60A Max fuse or breaker.

10) Enclosure: Steel, Weatherproof. NEMA 4 (IP 56)

11) Connection: Hardwired via internal lugs #10 AWG-#2 AWG

12) Mounting: Multi-point mounting feet

b. Provide 50/3 breaker.

B. Surge protective devices shall be electrically connected to each phase bus of the panelboard, and should be installed close to the main incoming lugs or circuit breaker. Maximum distance is 8-12” from the bus and breaker

C. Provide 30/3 circuit breaker whether scheduled or not

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards in accordance with NECA 407 and NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Examine equipment exterior and interior prior to installation. Report any damage and do not install any equipment that is structurally, moisture, or mildew damaged.

C. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected

D. Torque bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications

E. Reference Standards:

1. Panelboards: Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NECA 407 and NEMA PB 1.1.

2. Consult Architect for resolution of conflicting requirements.

F. Special Techniques:

1. Equipment Mounting:

a. Wall mount standard panels

b. Install Power (Distribution) panelboards on cast-in-place concrete equipment base(s).

c. Attach panelboard to vertical finished or structural surface behind panelboard.

d. Comply with requirements for seismic control devices specified in Section 260548

2. Mount top of trim 6.5 feet above finished floor unless otherwise indicated or panel is larger.

3. Mount panelboard cabinet plumb and rigid without distortion of box.

4. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

5. Install overcurrent protective devices and controllers not already factory installed.

a. Set field-adjustable, circuit-breaker trip ranges.

b. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver in accordance with manufacturer's published instructions.

6. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

7. Install filler plates in unused spaces.

8. Stub four 1 inch (25 mm) empty conduits from flush panelboards into accessible ceiling space or space designated to be ceiling space in future. Stub four 1 inch (25 mm) empty conduits into raised floor space or below slab not on grade.

9. Arrange conductors in gutters into groups and bundle and wrap with wire ties and label with circuit numbers

10. Mount spare fuse cabinet in accessible location.

G. Interfaces with Other Work:

1. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553

B. Panelboard Nameplates: Label each panelboard with nameplate complying with requirements for identification specified in Section 260553

C. Device Nameplates: Label each branch circuit device in power panelboards with nameplate complying with requirements for identification specified in Section 260553

D. Install warning signs complying with requirements in Section 260553

E. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles must be located on interior of panelboard door.

F. Breaker Labels: Faceplate must list current rating, UL and IEC certification standards, and AIC rating.

G. Circuit Directory:

1. Provide directory card inside panelboard door, mounted in metal frame with transparent protective cover.

a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits and location. For example Receptacles Room 56 West Wall.

2. Circuit directory must use final room numbers that appear on the door of the room. Obtain door numbers from architect prior to creating directories.

3. Provide computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

a. Circuit directory must identify specific purpose with detail sufficient to distinguish it from other circuits.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers

2. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573

END OF SECTION

SECTION 26 27 26 – WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, Special receptacles
2. Switches
3. Receptacles with arc-fault and ground-fault protective devices.
4. Locking receptacles.
5. Multioutlet assemblies
6. Connectors, cords, and plugs.

1.2 SUBMITTALS

A. Product Data for all wiring devices

B. Shop Drawings: List of legends and description of materials and process used for pre--marking wall plates.

C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

D. Samples if requested

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.4 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

B. Cord and Plug Sets: Match equipment requirements.

1.5 SPARE PARTS

A. Provide the following spare parts. Include 50 feet of MC Cable with 3#12 with reach receptacle so owner may elect to use devices during project. Any not used to be turned over to the owner as spare parts.

B. Receptacles – 5

C. Controlled Receptacles - 2

D. GFI Receptacles -1

E. Plates – 5

PART 2 PRODUCTS

2.1 GENERAL WIRING DEVICE REQUIREMENTS.

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use. RoHS compliant. Comply with NEMA WD 1.

B. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.

2. Devices shall comply with requirements in this Section.

C. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.

2. Cord and Plug Sets: Match equipment requirements.

D. Wiring Device Color

1. All wiring devices shall be White color

2. Controlled receptacles shall be Green Color and labeled

3. Receptacles on Emergency Power: Match wiring device color but provide “Emergency” engraved plate

4. Isolated Ground receptacles shall match wiring device color but have orange triangle

E. Plates shall be stainless steel

F. Manufacturers

1. Legrand/Pass and Seymour (Basis of Design)

2. Hubbell

3. Leviton

2.2 RECEPTACLES

A. Duplex Straight Blade

1. Convenience Receptacles, extra heavy duty. tamper resistant, 125 V, 20 A: 5-20R

2. Comply with ANSI C73, NEMA WD 1 and NEMA WD 6, and UL 498 and UL Fed Spec WC-596: File E13399, 10 year warranty.

3. Manufacturers

a. Pass and Seymour TR5362

b. Leviton T5362

c. Hubbell HBL5362TR

4. Single receptacles meet same standards as above

B. Isolated Ground Straight Blade

1. Convenience Receptacles, extra heavy duty. tamper resistant, 125 V, 20 A: 5-20R

2. Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 and UL Fed Spec WC-596: File E13399.

3. Manufacturers

a. Pass and Seymour TRIG5362

b. Leviton T5362-IG

c. Hubbell HBLIG5362TR

C. Controlled Straight Blade

1. Specs per above, both outlets marked controlled.

a. Manufacturers

1) Pass and Seymour TR5362CDN – Green Color

2) Leviton 5362-2PN

3) Hubbell HBL5362C2TR – Green color

2. Twistlock, L5-20R

a. Manufacturers

1) Pass and Seymour L520R

2) Leviton 2310-B

3) Hubbell: HBL2310

b. Twistlock
1) Pass and Seymour L530 and L630

2.3 GFCI RECEPTACLES

A. Duplex Straight Blade

1. Convenience Receptacles, extra heavy duty. tamper resistant, 125 V, 20 A

2. GFCI and components shall be designed, manufactured, tested and installed to comply with NFPA 70 (NationalElectrical Code) and the following: cULus Listed File Number E42190, Standard UL498 Attachment Plugs and Receptacles, UL943 GFCIs. Federal

Specification WC596. Standard CSA C22.2 No. 42 General Use Receptacles, CSA C22.2 No.144 GFCIs. Conforms to NEMA WD-1 and WD-6.

3. Manufacturers

a. Pass and Seymour 2097TR (No Substitute in Kitchen areas)

b. Leviton GFTR2-F

c. Hubbell GF5362SG

4. Single receptacles meet same standards as above

B. Controlled GFCI Straight Blade

1. Specs per above, both outlets marked controlled.

2. Manufacturers

a. Leviton#G5362-2TN

2.4 SPECIAL RECEPTACLES

A. Power outlets shall be industrial specification grade.

B. Standards and Certifications: ANSI: C-73, CSA C22.2 No. 42: File 152105, NEMA WD-6, NOM 057, UL49 File E13399, Warranty: 10-Year Limited

1. Dryer: 14-30R

a. Pass and Seymour #3864

b. Leviton #278

c. Hubbell # HBL9430A

2. Range: 14-50R

a. Pass and Seymour #3894

b. Leviton #279

c. Hubbell # HBL9450A

3. Special outlets shown on drawings will be industrial hard use specification grade to match NEMA designation on drawings

4. Provide custom stainless steel plate per below.

2.5 SWITCHES

A. Switches that are part of the low voltage lighting control system are specified in 260923

B. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application. General Characteristics: Extra Heavy Duty Industrial Spec Grade, ANSI: C-73, CSA C22.2 No. 111: File #152105, NEMA: WD-1 & WD-6, NOM: 057, RoHS: Compliant, UL Fed Spec WS896E: File #E7458, UL Standard: UL 20, Warranty: 10-Year Limited

C. Toggle Switch

1. Manufacturers

a. Pass and Seymour PS20AC1 series

b. Leviton 1221 series

c. Hubbell HBL1221 series

2. Configuration:

a. Extra-heavy-duty, 120-277 V, 20 A, single pole, double pole, three way, and four way as shown.

D. Key Switch

1. Meet same standards as above

2. Manufacturers

a. Pass and Seymour# PS20AC1

b. Leviton 1221-2l with key per switch

c. Hubbell # HBL1221L

3. Configuration:

a. Extra-heavy-duty, 120-277 V, 20 A, single pole, double pole, three way, and four way as shown.

E. Pilot Light Switch

1. Meet same standards as above

a. Manufacturers

1) Pass and Seymour# PS20AC1CPL

2) Leviton #1221-PLC

3) Hubbell #HBL1221PL

2. Configuration:

a. Extra-heavy-duty, 120-277 V, 20 A, single pole, double pole, three way, and four way as shown

F. Special switches meet same specs as above and of configuration shown on the drawings.

2.6 PLATES

A. Brushed-finish wall plates are made with .032" Type 302/304 stainless steel. This alloy is nonmagnetic and contains 18 percent chromium and 8 percent nickel for superior corrosion resistance. UL Listed, Standard UL514, Cover Plates for Flush Mounted Wiring Devices. CSA Certified

B. Configurations include but are not limited to duplex, double duplex, decora, double decora, switch, switch to match gangs on drawings, special outlets, combo switch/receptacle, combo switch/decora, blank plates

C. Manufacturer

1. Pass and Seymour SS Series

2. Leviton 8400X Series

3. Hubbell SSJ Series

D. Special plates shall be provided for emergency outlets and shall be engraved with red “Emergency” on them.

PART 3 EXECUTION

3.1 EXAMINATION

A. Receptacles:

1. Verify that receptacles to be procured and installed for Owner-furnished equipment are compatible with mating attachment plugs on equipment.

B. Cord Reels:

1. Examine roughing-in for cord reel mounting and power connections to verify actual locations of mounts and power connections before cord reel installation.

2. Examine walls, floors, and ceilings for suitable conditions where cord reel will be installed.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's instructions and Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

5. Cut back and pigtail, or replace all damaged conductors.

6. Straighten conductors that remain and remove corrosion and foreign matter.

7. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

10. Install double duplex, four-plex, and multiple switch locations under common plate.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Reference Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA NEIS 130.

2. Mounting Heights: See 260533

3. Receptacle Orientation: Unless otherwise indicated in Contract Documents, orient receptacle to match configuration diagram in NEMA WD 6 or as directed by the architect.

G. Identification:

1. Identify cover or cover plate for device with panelboard identification and circuit number in accordance with Section 260553

a. Mark cover or cover plate using dymo tape and provide durable mark inside device box or outlet box.

H. Interfaces with Other Work:

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Insert and remove test plug to verify that device is securely mounted.

2. Verify polarity of hot and neutral pins and hot and switch.

3. Measure line voltage.

4. Perform additional installation and maintenance inspections and diagnostic tests in accordance with NECA NEIS 130 and manufacturers' instructions.

5. Plug test all receptacles

6. Check GFCI function

B. Nonconforming Work:

1. Device will be considered defective if it does not pass tests and inspections.

2. Remove and replace defective units and retest.

3.4 PROTECTION

A. Devices:

1. Schedule and sequence installation to minimize risk of contamination of wires and cables, devices, device boxes, outlet boxes, covers, and cover plates by plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other materials.

2. After installation, protect wires and cables, devices, device boxes, outlet boxes, covers, and cover plates from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

B. Cord Reels and Fittings:

1. After installation, protect cord reels and fittings from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

C. Connectors, Cords, and Plugs:

1. After installation, protect connectors, cords, and plugs from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Elevator Disconnecting Means
4. Molded-case circuit breakers (MCCBs).
5. Enclosures.
6. Section.

1.2 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

A. Product Data:

1. For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
2. Enclosure types and details for types other than UL 50E, Type 1.
3. Current and voltage ratings.
4. Short-circuit current ratings (interrupting and withstand, as appropriate).

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Manufactuers

1. Square D by Schneider, Eaton

B. Source Limitations: Obtain products from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 FUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

4. Service-Rated Switches: Labeled for use as service equipment where shown on drawings

5. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.

6. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty, Three Pole, Single Throw, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Six Pole, Single Throw, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Three Pole, Double Throw, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.

4. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.4 ELEVATOR DISCONNECT

A. 600Vac, 3-phase

B. 30 to 400 amps

C. NEMA 1, 3R, 12 and 4 enclosure options

D. Complies with the following codes and standards

1. Elevator shutdown

2. ANSI/ASME A17.1, 2.8.3.3.2

3. NEC 620.51(B) (elevator shutdown)

4. NEC 240.12 (orderly shutdown)

5. Shunt trip voltage monitoring

a. NFPA 72, 6.16.4.4

6. Selective coordination

a. NEC 620.62

7. Auxiliary contact (hydraulic elevator)

a. NEC 620.91(C)

E. The switch utilizes Bussmann series Low-Peak™ Class J fuses to easily meet requirements for selective coordination following a simple 2:1 lineside to loadside amp ratio with any other Low-Peak fuse.

F. Provide Key Switch and Pilot Light

G. Provide 100 VA control transformer

H. Provide fire alarm control relay

I. Bussman PSXX-T20-R2-K-G-NX-F1-+

1. Provide with amperage required by the elevator installer.

2.5 MOLDED-CASE CIRCUIT BREAKERS

A. Circuit breakers must be constructed using glass-reinforced insulating material. Current carrying components must be completely isolated from handle and accessory mounting area.

B. Circuit breakers must have toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. Circuit-breaker handle must be over center, be trip free, and reside in tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon must be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with push-to-trip button, located on face of circuit breaker to mechanically operate circuit-breaker tripping mechanism for maintenance and testing purposes.

C. Maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings must be clearly marked on face of circuit breaker. Circuit breakers must be 100 percent rated

D. MCCBs must be equipped with device for locking in isolated position.

E. Lugs must be suitable for 90 deg C rated wire, sized in accordance with 75 deg C temperature rating in NFPA 70.

F. Standard: Comply with UL 489 with required interrupting capacity for available fault currents.

G. Breakers – as dictated by the 260573 coordination study

1. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic Trip Circuit Breakers: Field-replaceable rating plug, RMS sensing, with the following field-adjustable settings:

   a. Instantaneous trip.

   b. Long- and short-time pickup levels.

   c. Long- and short-time time adjustments.

   d. Ground-fault pickup level, time delay, and I-squared t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

5. GFLS Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6 mA trip).

6. GFEP Circuit Breakers: With Class B ground-fault protection (30 mA trip).

H. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.

2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

3. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

4. Alarm Switch: One contact that operates only when circuit breaker has tripped.

5. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.

6. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.

2.6 MOLDED-CASE SWITCHES

A. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

B. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

C. Features and Accessories:

1. Standard frame sizes and number of poles.

2. Lugs:

a. Compression type, suitable for number, size, trip ratings, and conductor material.

b. Lugs must be suitable for 90 deg C rated wire, sized in accordance with 75 deg C temperature rating in NFPA 70.

3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.

4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

2.7 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, UL 50E, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 3R.

3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2.8 FUSES

A. Eaton Bussman Low Peak or equal by Littlefuse or Ferraz by Powerfuse (Gould Shawmut)

B. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: Time delay for all motor circuits except when Class J needed

2. Type RK-1: Fast actine where specified

3. Type J: where required to fit enclosure

4. Type T: for special applications where approved only

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA FU 1 for cartridge fuses.

E. Comply with NFPA 70.

F. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.9 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

B. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.

C. Finish: Gray, baked enamel.

D. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.

E. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

2.10 SPARE-PARTS

A. Provide 1 spare 30 amp disconnect

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Commencement of work will indicate Installer's acceptance of areas and conditions as satisfactory.

3.2 INSTALLATION

A. Comply with manufacturer's published instructions, NFPA 70 and NECA NEIS 1

B. Special Techniques:

1. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

2. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

3. Comply with mounting and anchoring requirements specified in Section 260548

4. Install fuses in fusible devices.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.

b. Inspect anchorage, alignment, grounding, and clearances.

c. Verify that unit is clean.

d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.

e. Verify that fuse sizes and types match the Specifications and Drawings.

f. Verify that each fuse has adequate mechanical support and contact integrity.

g. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on Drawings.

h. Verify correct phase barrier installation.

i. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

B. Tests and Inspections for Molded-Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on Drawings.

b. Inspect physical and mechanical condition.

c. Inspect anchorage, alignment, grounding, and clearances.

d. Verify that unit is clean.

e. Operate circuit breaker to ensure smooth operation.

f. Inspect bolted electrical connections for high resistance using one of the following methods:

1) Use low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels must be in accordance with manufacturer's published data. In absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.

h. Perform adjustments for final protective device settings in accordance with coordination study.

C. Nonconforming Work:

1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

2. Remove and replace defective units and retest.

3.5 PROTECTION

A. After installation, protect enclosed switches and circuit breakers from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 26 32 13 – ENGINE GENERATOR AND ASSOCIATED EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged engine-generator sets suitable for use in applications with the features as specified and indicated where the engine generators will be used as the Standby power source for the system.

B. Meters shall be provided at generator and ATS for load shedding.

C. Coordinate with supplier of propane tank for all connections required to propane fuel source.

D. Generator system shall be provided in alternate bid.

1.3 DEFINITIONS

A. Emergency Standby Power (ESP): Per ISO 8528: The maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 200 hours of operation per year with the maintenance intervals and procedures being carried out as prescribed by the manufacturers. The permissible average power output (Ppp) over 24 hours of operation shall not exceed 70 percent of the ESP unless otherwise agreed by the RIC engine manufacturer.

B. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.

2. Time-current characteristic curves for generator protective device.

3. Sound test data, based on a free field requirement.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Wiring Diagrams: Control interconnection, Customer connections.

C. Certifications:

1. Submit statement of compliance which states the proposed product(s) is certified to the emissions standards required by the location for EPA, stationary emergency application.

1.5 INFORMATIONAL SUBMITTALS

A. Source quality-control test reports.

1. Certified summary of prototype-unit test report. See requirements in Part 2 "Source Quality Control" Article Part A. Include statement indicating torsional compatibility of components.

2. Certified Test Report: Provide certified test report documenting factory test per the requirements of this specification, as well as certified factory test of generator set sensors per NFPA110 level 1.

3. List of factory tests to be performed on units to be shipped for this Project.

4. Report of exhaust emissions and compliance statement certifying compliance with applicable regulations.

B. Warranty:

1. Submit manufacturer's warranty statement to be provided for this Project.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 100 of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

D. Comply with NFPA 37 (Standard For the Installation and Use of Stationary Combustion Engines and Gas Turbines).

E. Comply with NFPA 70 (National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702).

F. Comply with NFPA 110 (Emergency and Standby Power Systems) requirements for Level 1 emergency power supply system.

1.7 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 0.0 deg C (32.0 deg F) to 40.0 deg C (104.0 deg F).

2. Relative Humidity: 0 to 95 percent.

3. Altitude: Sea level to 500.0 feet (152.4 m).

1.8 WARRANTY

A. Base Warranty: Manufacturer shall provide base warranty coverage on the material and workmanship of the generator set for a minimum of twenty-four (24) months for Standby product and twelve (12) months for Prime/Continuous product from registered commissioning and start-up.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: The basis for this specification is Cummins Power Generation equipment, approved equals may be considered if equipment performance is shown to meet the requirements herein.

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.

C. Capacities and Characteristics:

1. Power Output Ratings: Electrical output power rating for Standby operation of not less than 335KW, at 80 percent lagging power factor, 277/480, Series Wye, Three phase, 4 -wire, 60 hertz.

2. Alternator shall be capable of accepting maximum 1000.0 kVA in a single step and be capable of recovering to a minimum of 90% of rated no load voltage. Following the application of the specified kVA load at near zero power factor applied to the generator set.

3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component. The engine-generator nameplate shall include information of the power output rating of the equipment.

D. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 1.0 percent of rated output voltage from no load to full load.

2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 5 seconds. On application of a 100% load step the generator set shall recover to stable voltage within 10 seconds.

3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.

4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

5. Transient Frequency Performance: Not more than 15 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds. On application of a 100% load step the generator set shall recover to stable frequency within 10 seconds.

6. Output Waveform: At full load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for any single harmonic. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.

7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 8 seconds without damage to generator system components. For a 1-phase, bolted short circuit at system output terminals, system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.

8. Start Time: Comply with NFPA 110, Level 1, Type 10, system requirements.

9. Ambient Condition Performance: Engine generator shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition.

Ambient temperature shall be as measured at the air inlet to the engine generator for enclosed units, and at the control of the engine generator for machines installed in equipment rooms.

2.3 ENGINE

A. Fuel: Liquefied Petroleum Gas (Propane)

B. Rated Engine Speed: 1800RPM.

C. Lubrication System: The following items are mounted on engine or skid:

1. Lube oil pump: shall be positive displacement, mechanical, full pressure pump.

2. Filter and Strainer: Provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used.

3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions

E. Governor: Adjustable isochronous, with speed sensing. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate as appropriate to the state of the engine generator. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous states.

F. Cooling System: Closed loop, liquid cooled

1. The generator set manufacturer shall provide prototype test data for the specific hardware proposed demonstrating that the machine will operate at rated standby load in an outdoor ambient condition of 40 deg C.

2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

3. Size of Radiator overflow tank: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.

4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.

5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

6. Duct Flange: Generator sets installed indoors shall be provided with a flexible radiator duct adapter flange.

G. Muffler/Silencer: Selected with performance as required to meet sound requirements of the application, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. For generator sets with outdoor enclosures the silencer shall be inside the enclosure.

H. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element and restriction indicator.

I. Starting System: 12 or 24V, as recommended by the engine manufacturer; electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.

2. Cranking Cycle: As required by NFPA 110 for level 1 systems.

3. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Include required interconnecting conductors and connection accessories.

4. Battery Compartment: Factory fabricated of metal with acid-resistant finish.

5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation. The battery charging alternator shall have sufficient capacity to recharge the batteries with all parasitic loads connected within 4 hours after a normal engine starting sequence.

6. Battery Chargers: Unit shall comply with UL 1236, provide fully regulated, constant voltage, current limited, battery charger for each battery bank. It will include the following features:

    a. Operation: Equalizing-charging rate based on generator set manufacturer's recommendations shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.

    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 20 deg C to plus 40 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.

    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.

    d. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

    e. Provide LED indication of general charger condition, including charging, faults, and modes. Provide a LCD display to indicate charge rate and battery voltage. Charger shall provide relay contacts for fault conditions as required by NFPA110.

    f. Enclosure and Mounting: NEMA, Type 1, wall-mounted cabinet.

2.4 CONTROL AND MONITORING

A. Engine generator control shall be microprocessor based and provide automatic starting, monitoring, protection and control functions for the unit.

B. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. (Switches with different configurations but equal functions are acceptable.) When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

C. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

D. Configuration: Operating and safety indications, protective devices, system controls, engine gages and associated equipment shall be grouped in a common control and monitoring panel. Mounting method shall isolate the control panel from generator-set vibration. AC output power circuit breakers and other output power equipment shall not be mounted in the control enclosure.

E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:

1. AC voltmeter (3-phase, line to line and line to neutral values).

2. AC ammeter (3-phases).

3. AC frequency meter.

4. AC kVA output (total and for each phase). Display shall indicate power flow direction.

5. Ammeter-voltmeter displays shall simultaneously display conditions for all three phases.

6. Emergency Stop Switch: Switch shall be a red “mushroom head” pushbutton device complete with lock-out/tag-out provisions. Depressing switch shall cause the generator set to immediately stop the generator set and prevent it from operating.

7. Fault Reset Switch: Supply a dedicated control switch to reset/clear fault conditions.

8. DC voltmeter (alternator battery charging).

9. Engine-coolant temperature gage.

10. Engine lubricating-oil pressure gage.

11. Running-time meter.

12. Generator-voltage and frequency digital raise/lower switches. Rheostats for these functions are not acceptable. The control shall adjustment of these parameters in a range of plus or minus 5% of the voltage and frequency operating set point (not nominal voltage and frequency values.)

13. AC Protective Equipment: The control system shall include over/under voltage, over current, short circuit, loss of voltage reference, and over excitation shut down protection. There shall be an overload warning, and overcurrent warning alarm.

14. Status LED indicating lamps to indicate remote start signal present at the control, existing alarm condition, not in auto, and generator set running.

15. A graphical display panel with appropriate navigation devices shall be provided to view all information noted above, as well as all engine status and alarm/shutdown conditions (including those from an integrated engine emission control system). The display shall also include integrated provisions for adjustment of the gain and stability settings for the governing and voltage regulation systems.

16. Panel lighting system to allow viewing and operation of the control when the generator room or enclosure is not lighted.

17. DC control Power Monitoring: The control system shall continuously monitor DC power supply to the control, and annunciate low or high voltage conditions. It shall also provide an alarm indicating imminent failure of the battery bank based on degraded voltage recover on loading (engine cranking).

2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Overcurrent Protection: The generator set shall be provided with a UL Listed/CSA Certified protective device that is coordinated with the alternator provided to prevent damage to the generator set on any possible overload or overcurrent condition external to the machine. The protective device shall be listed as a utility grade protective device under UL category NRGU. The control system shall be subject to UL follow-up service at the manufacturing location to verify that the protective system is fully operational as manufactured. Protector shall perform the following functions:

1. Initiates a generator kW overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.

2. Under single phase or multiple phase fault conditions, or on overload conditions, indicates an alarm conditions when the current flow is in excess of 110% of rated current for more than 10 seconds.

3. Under single phase or multiple phase fault conditions, operates to switch off alternator excitation at the appropriate time to prevent damage to the alternator.

4. The operator panel shall indicate the nature of the fault condition as either a short circuit or an overload.

5. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot greater than 120% of nominal voltage.

6. The protective system provided shall not include an instantaneous trip function.

2.6 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H

D. Temperature Rise: 105 / Class F environment.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.

G. Enclosure: Drip-proof.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, 3-phase true RMS sensing, full wave rectified, and provide a pulse-width modulated signal to the exciter. No exceptions or deviations to these requirements will be permitted.

I. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

J. Subtransient Reactance: 15 percent maximum, based on the rating of the engine generator set.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Sound Attenuated Steel housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.

B. Construction:

1. Louvers: Equipped with bird screen to permit air circulation when engine is not running while excluding birds and rodents.

2. Hinged Doors: With padlocking provisions. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.

3. Exhaust System:

a. Muffler Location: Within enclosure.

4. Hardware: All hardware and hinges shall be stainless steel.

5. Mounting Base: Suitable for mounting on sub-base fuel tank or housekeeping pad.

6. A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.

7. Inlet ducts shall include rain hoods

C. Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 40 deg C.

D. Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 76 dBA measured at any location 7 m from the engine generator in a free field environment.

E. Site Provisions:

1. Lifting: Complete assembly of engine generator, enclosure shall be designed to be lifted into place as a single unit, using spreader bars.

2.8 AUTOMATIC TRANSFER SWITCH

A. Provide automatic transfer switch per voltage, amperage and configuration indicated on one line diagram in drawings.

B. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.

C. Provide meter at ATS for load shedding purposes.

2.9 VIBRATION ISOLATION DEVICES

A. Vibration Isolation: Generators installed on grade shall be provided with elastomeric isolator pads integral to the generator, unless the engine manufacturer requires use of spring isolation.

2.10 FINISHES

A. Indoor and Outdoor Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer’s standard color or as directed on the drawings.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters. In addition, the equipment engine, skid, cooling system, and alternator shall have been subjected to actual prototype tests to validate the capability of the design under the abnormal conditions noted in NFPA110.

Calculations and testing on similar equipment which are allowed under NFPA110 are not sufficient to meet this requirement.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test engine generator set manufactured for this Project to demonstrate compatibility and functionality.

2. Full load run.

3. Maximum power.

4. Voltage regulation.

5. Steady-state governing.

6. Single-step load pickup.

7. Simulated safety shutdowns.

8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation, application, and alignment instructions and with NFPA 110.

B. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

C. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.

D. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and seismic requirements of the site.

E. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.

F. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.

G. On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer’s recommended practice.

3.2 ON-SITE ACCEPTANCE TEST

A. The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and

shall have the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system. Tests shall include:

B. Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.

C. Installation acceptance tests to be conducted on site shall include a "cold start" test, a two hour full load (resistive) test, and a one-step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.

D. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

3.4 SERVICE AND SUPPORT

A. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year. The inventory shall have a commercial value of $3 million or more. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including engines, alternators, control systems, paralleling electronics, and power transfer equipment.

B. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be on call 24 hours per day, 365 days per year. The service organization shall be physically located within 100 of the site.

C. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

END OF SECTION

SECTION 26 51 00 – INTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Light Fixtures
2. Materials.
3. Luminaire support.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
6. Photometric data and adjustment factors based on laboratory tests IES LM-79 and IES LM-80.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

C. Samples: Provide where requested

D. Mockups: Provide where requested.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.5 SPARE MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Drivers

a. One for each type of fixture

2. Fixtures

a. Provide 1 spare of the following fixtures

1) PL-7
2) RL-1
3) RL-3

3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.6 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:

1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Comply with IEEE C2, "National Electrical Safety Code."

G. Comply with NFPA 70.

H. UL listed

I. Energy Star Rated

J. DLC rated

K. Mockups: Where requested for interior luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires in mockups before starting installations.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.8 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Final Completion.

PART 2 PRODUCTS

2.1 FIXTURE TYPES

A. See Schedule on drawings

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance:

1. Luminaires shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

2. Luminaires and lamps shall be labeled vibration and shock resistant.

2.3 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

C. Recessed luminaires shall comply with NEMA LE 4.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

F. California Title 24 compliant.

G. CRI of minimum 80 unless noted. CCT of 3500 K unless noted

H. Minimum Rated lamp life of 50,000 hours.

I. Lamps dimmable from 100 percent to 0 percent of maximum light output.

J. Internal drivers.

K. Nominal Operating Voltage: Per Drawings

L. Allow for Custom colors on all fixtures per architect from provided paint chip

2.4 DRIVERS

A. Input voltage range: Combination 120/277 volt except where noted differently on drawings

B. Frequency: 50/60Hz

C. Power factor: >0.9 @full load MTBF:

D. High surge protection: up to 10 kV (1 pulse) in protection class I or II

E. Lifetime: up to 100,000 h

F. Undervoltage protection

G. THD: <10%

H. Protection: Over voltage, Over current and Short circuit Withstand voltage

I. UL 8750 rated

J. Indoor and outdoor rated

K. 0-10VDC dimmable unless noted differently on the fixture or control schedule

L. Exterior drivers shall operate down to -40 F and be UL wet label

2.5 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.

2. Sheet metal components shall be steel unless otherwise indicated.

3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.

2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:

1. Manufacturer's standard grade.

2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

G. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

H. Glass: Annealed crystal glass unless otherwise indicated.

I. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

J. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

2.6 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.7 RATINGS

A. Fixture schedule will specify when UL Wet/Damp label, IK label and IP labels are required. Meet all requirements specified.

1. UL Dry, Damp, and Wet Labels

a. Wet label shall be used for all exterior locations unless noted differently

2. Impact (IK) Ratings per current standard (1-11) per BS EN60069-2-75

a. Fixtures in high impact areas shall bear IK rating per the fixture schedule.

3. Ingress Protection (IP) Ratings. Fixtures shall meet IP levels specified on the fixture schedule

2.8 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, [12 gage (2.68 mm)]

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

F. Recessed fixtures in acoustic panel ceilings with 2 ceiling support wires to structure and earthquake clips

G. Surface fixtures supported to structure, no attachment to ceiling for support.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and relamping.

3. Provide support for luminaire without causing deflection of ceiling or wall.

4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaires:

1. Secured to outlet box.

2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.

3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaires:

1. Attached to structural members in walls

2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:

1. Ceiling Mount:

a. Two 5/32-inch- (4-mm-) diameter aircraft cable supports

b. Pendant mount with [5/32-inch- (4-mm-)] <Insert value> diameter aircraft cable supports.

2. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.

3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.

4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.

5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Provide 2 ceiling support wires to structure and earthquake clips

2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.

3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.

2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 26 56 00 – EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luminaire types.
2. Materials.
3. Finishes.
4. Luminaire support components.
5. Luminaire mounted controls
6. Poles and handholes
7. Concrete Bases

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. IK: Impact Ratings

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

H. EPA: Equivalent projected area.

I. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

1.3 SUBMITTALS

A. Product Data: For each type of luminaire.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IES LM-79 and IES LM-80.

a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.

6. Wiring diagrams for power, control, and signal wiring.

7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

C. Samples: Provide where requested

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires [to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.

2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

B. Spare Parts and Special Tools: Furnish to Owner spare parts, proprietary equipment, and keys required to operate, maintain, repair, adjust, or implement future changes to poles, that are packaged with protective covering for storage on-site and identified with labels describing contents.

1.5 SPARE MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Drivers: One for each type of fixture

2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: One for every 20 of each type and rating installed. Furnish at least one of each type.

3. Diffusers and Lenses: One for every 20 of each type and rating installed. Furnish at least one of each type.

4. Spare fixture: Provide 1 spare fixture for fixtures with more than 30 installed.

1.6 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:

1. Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Comply with IEEE C2, "National Electrical Safety Code."

G. Comply with NFPA 70.

H. UL listed

I. Energy Star Rated

J. DLC rated

K. Mockups: Where requested

1. Obtain Architect's approval of luminaires in mockups before starting installations.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

B. Package aluminum poles for shipping in accordance with ASTM B660.

C. Store poles on decay-resistant skids at least 12 inch (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

D. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps

1.8 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including luminaire support components.

b. Faulty operation of luminaires and accessories.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 5 years from date of Final Completion

PART 2 PRODUCTS

2.1 FIXTURE TYPES

A. See Schedule on drawings

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance for fixtures:

1. Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

2. Luminaires and lamps shall be labeled vibration and shock resistant.

B. Seismic and Wind Performance for Poles

1. Delegated Design: Engage qualified professional engineer(s) to design and pole power system.

2. Structural Characteristics: Comply with AASHTO LTS-6-M.

a. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied in accordance with AASHTO LTS-6-M.

b. Live Load: Single load of 500 lb (2200 N) distributed in accordance with AASHTO LTS-6-M.

c. Ice Load: Load of 3 lb/ft2 (145 Pa), applied in accordance with AASHTO LTS-6-M for applicable areas on the Ice Load Map.

d. Wind Load for Poles Exceeding 50 ft (15 m) Height:

1) Basic Wind Speed: 100 mile/h (45 m/s) from AASHTO LTS-6-M for this Project>.

2) Wind Importance Factor: 1.0.

3) Minimum Design Life: 50 years

4) Velocity Conversion Factor: 1.0

e. Wind Load for Poles Not Exceeding 50 ft (15 m) Height:

1) Basic Wind Speed: 100 mile/h (45 m/s).

2) Wind Importance Factor: 1.0

3) Minimum Design Life: 50 years.

4) Velocity Conversion Factor: 1.0.

f. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1.

g. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless steel fasteners and mounting bolts unless otherwise indicated.

3. General Finish Requirements:

a. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

b. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.3 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1598 and listed for wet location unless noted otherwise.

E. CRI of minimum 70 unless noted. CCT of 3000 K unless noted

F. Minimum Rated lamp life of 50,000 hours.

G. Allow for Custom colors on all fixtures per architect from provided paint chip

H. Source Limitations:

1. Obtain luminaires from single source from a single manufacturer.

2.4 DRIVERS

A. Input voltage range: Combination 120/277 volt except where noted differently on drawings

B. Frequency: 50/60Hz

C. Power factor: >0.9 @full load MTBF:

D. High surge protection: up to 10 kV (1 pulse) in protection class I or II

E. Lifetime: up to 100,000 h

F. Undervoltage protection

G. THD: <10%

H. Protection: Over voltage, Over current and Short circuit Withstand voltage

I. UL 8750 rated

J. 0-10VDC dimmable unless noted differently on the fixture or control schedule

K. Drivers shall operate down to -40 F and be UL wet label

L. Provide fusing where specified.

2.5 POLES

A. Fixture indicates pole height, shape, and material. Where not specified provide aluminum poles

B. Provide Handhole in all poles: Oval shaped, with minimum clear opening of 2-1/2-by-5 inch (65-by-130 mm), with cover secured by stainless steel captive screws.

C. Pole fasteners and mounts shall be stainless steel

1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and may not cause galvanic action at contact points.

2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

D. Poles with Cameras

1. At poles with cameras provide the following

a. Handhole per above at camera bracket

2. Pole shall accommodate the following camera size and weight and maintain all structural ratings per above

a. Camera shall be pendant wall mounted to the pole

b. Camera size shall be 9” Tall by 12” diameter, camera will extend off pole at least 16 inches

c. Camera weight will be minimum 20 pounds with mount

E. Pole Mounting Hardware

1. Anchor Bolts: Manufactured [to ASTM F1554, Grade 55,]with a minimum yield strength of 55,000 psi (380 000 kPa). Galvanizing: Hot dip galvanized in accordance with ASTM A153, Class C.

2. Nuts: ASTM A563, Grade A, Heavy-Hex. Galvanizing: Hot dip galvanized in accordance with ASTM A153, Class C.

3. Washers: ASTM F436, Type 1. Galvanizing: Hot dip galvanized in accordance with ASTM A153, Class C

F. Painting

1. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.

2. Surface Preparation: Clean surfaces in accordance with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, in accordance with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.

3. Powder Coat: Comply with AAMA 2604.

4. Electrostatic-applied powder coating; single application and cured to a minimum 2.5 to 3.5 mil (64 to 89 µm) dry film thickness. Coat interior and exterior of pole for equal corrosion protection.

G. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

H. Concrete Bases

1. Minimum base sizes below. Delegated design requirements per above based on actual installation and soil conditions. Use larger bases where required by manufacturer or on site earthwork contractor, soils engineer, or civil engineer.

a. Poles over 16 feet shall be provided with a 24” precast concrete base equal to Old Castle/Utility Vault 24R series

1) Where subject to vehicle hits the base shall be 8’ tall with 2’ exposed above grade.

a) Utility Vault #24R-8-LB

2) Where protected from vehicle hits the base shall be 6’ tall and flush with grade

a) Utility Vault#24R-6-LB

b. Poles and Bollards 16 feet and under shall use a minim 18” diameter base equal to Old Castle/Unitlity Vault 18R series

1) Where subject to vehicle hits the base shall be 7’ tall with 2’ exposed above grade.

2) Utility Vault #18R-7-LB

3) Where protected from vehicle hits the base shall be 6’ tall and flush with grade

4) Utility Vault#18R-5-LB

2.6 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum, Stainless steel, or Epoxy-coated steel. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

1. Acrylic Diffusers: 100 percent virgin acrylic plastic or polycarbonate, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

2. Glass: Annealed crystal glass unless otherwise indicated.

3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.

2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.

b. Lamp diameter, shape, size, wattage and coating.

c. CCT and CRI for all luminaires.

2.7 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.

2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

2.8 RATINGS

A. Fixture schedule will specify when UL Wet/Damp label, IK label and IP labels are required. Meet all requirements specified.

B. UL Dry, Damp, and Wet Labels

C. Wet label shall be used for all exterior locations unless noted differently

D. Impact (IK) Ratings per current standard (1-11) per BS EN60069-2-75

E. Fixtures in high impact areas shall bear IK rating per the fixture schedule.

F. Ingress Protection (IP) Ratings. Fixtures shall meet IP levels specified on the fixture schedule

2.9 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, canopy ceilings, and overhang ceilings for suitable conditions where luminaires will be installed.

D. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

E. Examine roughing-in for foundation and conduit to verify actual locations of installation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Install lamps in each luminaire.

D. Fasten luminaire to structural support.

E. Supports:

1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and relamping.

3. Support luminaires without causing deflection of finished surface.

4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support: Attached to structural members in walls

G. Pole Mounted:

1. Attached to concrete base

2. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole and as directed.

3. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer

H. Wiring Method: Install cables in raceways. Conceal raceways and cables.

I. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.

J. Coordinate layout and installation of luminaires with other construction.

K. Adjust luminaires that require field adjustment or aiming.

L. Comply with requirements in Section 260519 and Cables" and Section 260533 for wiring connections and wiring methods.

3.4 INSTALLATION OF BOLLARD LUMINAIRES

A. Align units for optimum directional alignment of light distribution.

1. Install on concrete base per above.

3.5 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on field directed or as shown on drawings.

B. Install on concrete base

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section

3.7 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 2 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.

2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3. Adjust the aim of luminaires in the presence of Architect.

END OF SECTION

SECTION 27 15 00 – DATA AND COMMUNICATIONS CABLING

PART 1 GENERAL

1.1 SUMMARY

A. Provide all materials and labor for the installation of a communications (telephone and data) (voice and data) cabling and termination system. This section includes Communications cabling, termination, and administration equipment and installation requirements for the specified System

B. Include all materials for the installation of a video surveillance cable plant and termination system including data cable and fiber cable.

C. The Bid includes cabling and termination. Use 568B standard.

1. WAPs are Category 6A
2. Intercom: Category 6
3. All Others: Category 6
4. Fiber: OS2

D. Contractor must be a current manufacturer certified for both fiber and copper installation.

E. Color Code for Installed Cables

1. Data - Blue Color
2. Video Surveillance –Blue color
3. Intercom –Orange Color
4. WAPs –Violet Color
5. Access Control/Security – Blue Color

1.2 REFERENCES

A. General:

1. TIA – Telecommunications Industry Association
2. EIA – Electronic Industries Alliance
3. IEEE – Institute of Electrical and Electronics Engineers
4. BICSI - Building Industry Consulting Service International
5. NEC - National Electrical Code (NFPA 70)
6. NESC - National Electrical Safety Code
7. WISHA - Washington Industrial Safety and Health Act
8. OSHA - Occupational Safety and Health Act

9. IBC - International Building Code (IBC)

10. NECA – National Electrical Contractors Association

11. NEMA – National Electrical Manufacturers Association

12. UL – Underwriters Laboratories

1.3 STANDARDS

A. Primary Standards

1. TIA/EIA-568 - Commercial Building Telecommunications Cabling Standard – Both Copper and Fiber

2. TIA/EIA-569 - Pathways and Spaces

3. TIA/EIA-606 - Administration

4. TIA/EIA-607 – Grounding and Bonding

5. TIA-4966 – Educational Facilities

B. Other Standards

1. TIA-604 – Fiber Optic Connector

2. TIA-455/Fiber Optic Testing

3. TSB-162 – WAPS

4. TIA-598 – Fiber Color Coding

5. TIA-570 (For residential projects only)

6. TIA-968 – Telephone Terminal Equipment

7. TAI-222 – Antenna Supports

8. TIA - 526:

9. TIA-1179 – Healthcare Facilities

10. TIA-942 – Data Centers

11. TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems

12. TSB75: Additional Horizontal Cabling Practices for Open Offices

13. NECA/FOA 301: Standard for Installing and Testing Fiber Optic Cables

14. NECA/BICSI 568: Standard for Installing Commercial Building Telecommunications Systems

15. NECA 101 – Pathways

16. IEEE 802.3 (series): Local Area Network Ethernet Standard, including the IEEE 802.3z Gigabit Ethernet Standard

17. ISO/IEC IS 11801: Generic Cabling for Customer Premises

18. BICSI: BICSI Telecommunications Distribution Methods Manual (TDMM)

    a. Individual Standards

        1) BICSI 001: Educational Facilities

        2) BICSI 003: BIM

        3) BICSI 005: ESS

        4) BICSI 006: DAS

        5) BICSI 007: IoT/Intelligent Building

        6) BICSI 008: Wi-Fi/WLAN

        7) BICSI N1: ICT Installation

        8) BICSI N2: PoE Installation

        9) BICSI N3: Bonding and Grounding

        10) BICSI G1: OSP: General Practices

1.4 SYSTEM DESCRIPTION

A. Furnish, install, test and place into satisfactory and successful operation all equipment, materials, devices, and necessary appurtenances to provide a complete ANSI/TIA/EIA, NECA/NEIS and ISO/IEC compliant communications Structured Cabling System as hereinafter specified and/or shown on the Contract Documents. The system is intended to be capable of integrating voice and data signals onto a common media, and shall be tested EIA/TIA and ANSI standards

B. The work shall include all materials, equipment and apparatus not specifically mentioned herein or noted on the plans but which are necessary to make a complete working ANSI/TIA/EIA and ISO/IEC compliant cabling system.

1.5 DEFINITIONS

A. See following for sample list. Industry standard definitions for all terms

1. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

2. EMI: Electromagnetic interference.

3. FTP: Shielded twisted pair.

4. F/FTP: Overall foil screened cable with foil screened twisted pair.

5. F/UTP: Overall foil screened cable with unscreened twisted pair.

6. IDC: Insulation displacement connector.

7. Jack: Also commonly called an "outlet," it is the fixed, female connector.

8. LAN: Local area network.

9. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

10. RCDD: Registered Communications Distribution Designer.

11. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

12. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

13. S/FTP: Overall braid screened cable with foil screened twisted pair.

14. S/UTP: Overall braid screened cable with unscreened twisted pairs.

15. UTP: Unscreened (unshielded) twisted pair.

1.6 SUBMITTALS

A. Provide standard manufacturer's cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

B. Quality Control Submittals: Provide submittal information for review as follows:

1. In accordance with quality assurance requirements below, submit the contractor-qualifications documentation.

2. Documentation indicating that the Contractor will have only manufacturer-trained and manufacturer-certified employees perform installation, testing, and firestopping work, as detailed below.

3. Documentation demonstrating that the Contractor employs a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing with BICSI. The document shall declare that the RCDD is a direct full time employee of the Contractor also that the Contractor will continue to employ a minimum of one RCDD throughout the duration of the project.

4. List of references for no less than five similar projects (in terms of size and construction cost) performed by the Contractor under the Contractor's current business name within the past three years. Detail the following for each project:

a. Project name and location

b. Construction cost

c. A brief description of the project, the components involved, and the SCS manufacturer used on the project.

d. Number of station drops

e. Customer contact names, phone numbers, and addresses

C. Shop Drawings: Reviewed and stamped by RCDD

1. Submit a cable routing and grouping plan submittal as follows:

a. Where the cable routing and grouping is to be provided as shown on the Contract Documents, do not provide a cable routing and grouping plan. Submit written documentation stating that the cable routing and grouping will be provided as shown on the Contract Documents, that the Contractor has reviewed the routing and grouping on the Contract Documents with applicable Subcontractors and suppliers and agrees that it does not create conflicts with other building utility infrastructure, and that the routing and grouping meets applicable codes, regulations and standards.

b. Where changes in cable routing and grouping are proposed, submit complete floor plan(s) and/or detail drawing(s) showing the proposed routing, raceway sizes and locations, and cabling in a manner equal to that of the Contract Documents. Ensure that any cabling changes are coordinated with accommodating changes to the raceway routing and grouping. Specifically note each location where the proposed routing and grouping is different from the Contract Documents. Submit written documentation detailing the reason for each change request. Each change request must be approved in writing by the Engineer after review by the owner prior to proceeding with the change.

2. Submit patch panel and wire management elevations as follows:

a. Where patch panels and wire management are to be provided as shown on the Contract Documents, do not submit elevations. Submit written documentation stating that the patch panel and wire management will be provided as shown on the Contract Documents, that the Contractor has reviewed the elevations on the Contract Documents with applicable Subcontractors and suppliers and agrees that it does not create conflicts between trades, and that the elevations meet applicable codes, regulations and standards.

b. Where changes to patch panels and wire management are proposed, submit patch panel and wire management elevations along with written documentation detailing the reason for the change. The change request must be approved in writing by the Engineer after review by the owner prior to proceeding with the change.

D. Submit a list of proposed test equipment for use in verifying the installation of the SCS. Proposed test equipment shall meet the criteria as stated in PART 3 – TESTING.

1. Submit for each testing device:

a. Manufacturer and product number

b. Documentation from the manufacturer showing date and outcome of last re-calibration. Testing device shall have been re-calibrated within the manufacturer’s recommended calibration period, encompassing the period of time when the testing device will be used on this project.

c. Documentation from the manufacturer showing software revision. Software revision shall be most current revision available for the device and shall be based upon the most current ANSI/TIA/EIA testing guidelines.

E. Closeout Submittals: Provide submittal information for review as follows:

1. A communications-specific Operations and Maintenance (O&M) Manual for Communications shall be required for this project. O&M information submitted under other related communications sections (e.g. Raceway and Boxes for Communications Circuits, Bonding and Grounding for Communications, etc.) shall be included in the O&M Manual and statements should be included in each section directing the Contractor to provide applicable information in the O&M Manual for Communications.

2. 2 copies of either a CDR or DVD of the test data for all copper and fiber cables compatible with latest version of software. Single copy of notebook bound, printed, color, double sided and sequentially organized of all copper and fiber test results

3. 2 copies of either a CDR or DVD of the project's completed as-built drawings denoting the installed and individually labeled data drops at their locations in PDF and Current AutoCAD format from digital CAD versions of the Electrical Data/Comm sets (See example below)

F. O&M Manual for Communications - At the completion of the project, submit O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to the Engineer/Designer in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description. Provide bound copies of the O&M Manual for Communications per Division 1.

G. Record Drawings - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of all changes to Contract Documents such as drawings, specifications and spreadsheets, including maintenance hole/handhole butterfly drawings.

1. Document changes to the system from that originally shown on the Contract Documents and clearly identify system component labels and identifiers on Record Drawings.

2. Keep Record Drawings at the job site and make available to the Owner and Engineer/Designer at any time

H. As- Built Drawings

1. Record Drawings shall be converted to As-Built Drawings at project completion.

2. As-Built Drawings shall include actual install conditions, including sleeve locations, cable routing, and detail rack elevations showing patch panel locations and rack elevations.

1.7 QUALITY ASSURANCE

A. Contractor Qualifications:

1. Contractor shall be trained and certified by the Manufacturers to install, test, and maintain the system and be certified by the Manufacturers to provide the Manufacturers' Warranties specified in this section.

2. Contractor's employees directly involved with the supervision, installation, testing, and certification of the system shall be trained and certified by the selected manufacturers. Training and certifications by employee type are required as shown below:

    a. Supervisors/Project Foremen: All (100%) shall be trained/certified for installation and testing.

    b. Test Technicians: All (100%) shall be trained/certified for installation and testing.

    c. Other personnel: Personnel not directly responsible for installation supervision, installation, testing or certifying the system (i.e. project managers, cleanup crew, etc.) are not required to be manufacturer trained and certified but should not participate in any testing or installation of the products.

3. Contractor's employees whose duties include the application of firestopping material shall be trained and certified by the specified firestopping manufacturer. Training and certifications by employee type are required as shown below:

    a. Supervisors/Project Foremen: All (100%) shall be trained/certified for installation.

    b. Firestopping Technician: All (100%) shall be trained/certified for installation.

4. Contractor shall employ a minimum of one Registered Communications Distribution Designer (RCDD) certified by and in current good standing with BICSI. The RCDD shall be a direct full time employee of the Contractor (i.e. an RCDD consultant/sub-contractor to the Contractor is not acceptable). Contractor shall continue to employ a minimum of one RCDD throughout the duration of the project.

5. Contractor shall have successfully completed no less than five similar projects (in terms of size and construction cost) under the Contractor's current business name within the past three years.

1.8 MANUFACTURER CERTIFICATION

A. Manufacturer's rep shall visit the site at 25%, 50%, and at completion to confirm installation is per the manufacturer's requirement and to meet the specified warranty.

    1. Provide coordination with the cabling manufacturers to ensure that manufacturers' inspectors are available to schedule site visits, inspections, and certification of the system. Provide and coordinate any modifications and have manufacturer's rep re-inspect and certify the system prior to the scheduled use of the system by the Owner. Owner will attend manufacturer's inspections.

        a. Notify owner minimum 1 week before manufacturer installation.

B. Manufacturer's rep shall write reports and document the visits to confirm installation is per all standards or the manufacturer and relevant standards.

C. The Contractor is solely responsible for all costs associated with scheduling the manufacturer's rep inspection, the inspection itself and any manufacturer-required re-inspections, and for any modifications to the installation as required by the manufacturers.

1.9 WARRANTY

A. Manufacturer Warranties:

1. Copper

    a. Provide Leviton Performance Lifetime Warranty for all installation. The warranty certifies that all passive connecting hardware, cabling for both copper and fiber systems has been installed by a certified installer, will support all applications designed and as follows:
        1) Subject to the limitations and conditions set forth herein, Leviton (the Manufacturer") warrant to the end-user, for the duration of the warranty, and not for the benefit of anyone else, that the structured cabling and connectivity hardware products (the "Products") comprising the Leviton structured cabling system (the "System") installed at the indicated project site will:
            a) Be free from defects in material and workmanship.
            b) Meet or exceed applicable ratified ANSI/TIA and ISO/IEC link/channel transmission performance standards in effect at the time of installation.
            c) Support any current or future application which is designed for transmission over a structured cabling system as defined by the above referenced standards in effect at the time of installation.

2. Fiber

    a. Provide Corning 25-year warranty for local area network (LAN) for installed fiber products

3. That the products will be free from manufacturing defects in materials and workmanship.

    a. That the cabling products of the installed system shall exceed the specification of ANSI/TIA/EIA 568-C and exceed ISO/IEC 11801 standards.

    b. That the system shall be application independent and shall support both current and future applications that use the ANSI/TIA/EIA 568-C and ISO/IEC 11801 component and link/channel specifications for cabling.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

B. Conduct onsite pre-installation meetings with the owner's IT department as follows:

1. Prior to starting installation of any materials

    a. Contractor shall demonstrate knowledge of standards and manufacturer requirements.

    b. Contractor shall accommodate specific requirements of the owner

2. Prior to starting installation in Communications Rooms (MDF and IDF)

    a. Owner reserves the right to modify layouts of communications rooms based on field conditions. Contractor shall accommodate changes directed by the owner and shall notify owner at meeting if any directions will result in an increase in cost

3. At cabling termination and prior to owner installation of equipment

a. Confirm room atmosphere, installation, and grounding complies with the specification, certifications, and manufacturer's requirements.

b. Room must be dust free, clean and cooled prior to the contractor requesting installation of equipment.

1.11 SPARE PARTS

A. Outlets Cat 6 – 10

B. Outlets Cat 6a – 2

C. Plates - 5

D. Biscuit Jackbox – 3

PART 2 PRODUCTS

2.1 MANUFACTURER

A. The following are approved manufacturer's

1. Copper Cabling and Termination

a. Leviton

b. Or alternate accepted equal products

2. Fiber Cabling and Termination

a. Corning (No Substitute)

3. Racks, Wire Management, Cable Runway, and Cable Tray

a. Chatsworth

b. B-Line

2.2 GENERAL REQUIREMENTS

A. Physically verify existing site conditions prior to purchase and delivery of the materials, including but not limited to lengths of conduit and/or pathway to be used for routing backbone cabling. Pre-cut materials of insufficient length are the sole responsibility of the Contractor.

B. All copper-related components shall be part of the copper product line and all fiber optic-related components shall be part of the fiber optic product line – components shall not be intermixed between manufacturers' product lines. The product lines shall be engineered "end-to-end" – the system and all of its components shall be engineered to function together as a single, continuous transmission path.

C. Racks, rack cable distribution hardware, ladder rack, and other rack and distribution components shall be manufactured by a single manufacturer unless stated otherwise in this Specification

D. Provide all incidental and/or miscellaneous hardware not explicitly specified or shown on the Contract Documents that is required for a fully operational, tested, certified and warranted system.

E. Cable Tray and Cable Runway

1. All Communication's Rooms (MDF and IDF) shall be provided with a dual level cable management system as shown on the drawings.

a. Cable runway shall be routed on top of the racks and connect all racks to the wall as shown on the drawings

b. Cable Tray shall be routed approximately 18-24 inches above the cable runway to act as a consolidation point, location of service loops, and for strain relief

F. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

G. Grounding: Comply with TIA-607-B.

H. Plenums: Any cable passing through and air plenum shall be CMP plenum rated

I. Underground: Communication's station cable shall not be run underground except where noted specifically on the drawings or by specific contractor request and approval by the owner.

1. Any cable run underground shall be outside plant (OSP) rated.

2. Contractor shall provide protectors on all cables run underground outside the building slab

a. Station Cable

1) Protector shall be UL listed to UL-497 and EN/IEC 60950-1 and protect all 4 pairs, support POE pass through, and allow for minimum Category 6A

2) Ditek DTK-110C6APOE or equal

b. Multipair Cable

1) Commscope/Systimax BEP solid state protector

2) Fiber where required by code.

2.3 COMMUNICATIONS CABLE

A. Communication's cable consists of cabling for data, telephone(voice), access control, intercom, video surveillance systems

1. Data, Video Surveillance, Access Control/Security, and Intercom. Category 6: Shall exceed Category 6 transmission requirements as specified in ANSI/TIA/EIA 568-C and ISO/IEC 11801:

a. Plenum: Leviton (Berk-Tek) Lanmark 6, #10136226 (Blue) and 10141073 (Orange)

b. Riser: Leviton (Berk-Tek) Lanmark 6, #10136339 (Blue) and 10189773 (Orange)

2. WAPs Category 6A. Shall exceed Category 6A transmission requirements as specified in ANSI/TIA/EIA 568-C and ISO/IEC 11801

   a. Plenum: Leviton Lanmark 10G #11140407 (Violet Color)

   b. Riser: Leviton Lanmark 10G, # 11140415 (Violet Color)

3. Cable Underground

   a. Data, Video Surveillance, Access Control/Security, and Intercom: Category 6: Cable shall exceed Category 6 transmission requirements and be OSP rated.

      1) Levitoin Lanmark 6 OSP #10139885

   b. WAPs: Category 6A:

      1) Leviton Lanmark-10G OSP#11094458

   c. Provide protector per specification above.

4. Runs over 295 Feet

   a. Data: Not permitted

   b. Video Surveillance: Provide Page Datacom Gamechanger LSZH OSP Cable #258330804

B. Main Communications Cable

1. Provide (4) Communications Data Cables per above between MDF and each IDF. Terminate on patch panel and label MDF1,MDF2, etc.

2.4 FIBER OPTIC CABLE

A. Singlemode

1. Fiber shall meet OS2 standards, be SMF, 12 strand, distribution type unless noted

   a. Indoor Fiber Cable

      1) Corning Clear Curve# 012U81-33131-24, provide plenum rated if routed in plenums

   b. Outdoor and Underground Cable

      1) Corning #012EU4-T3100D20, OSP dry cable rated for direct bury

2. All fiber optic cables must be in innerduct.

2.5 COMMUNICATION OUTLETS

A. Outlet color to be white

B. Data, Video Surveillance, Intercom, and Access Control/Security

1. Outlets shall be EIA/TIA 568 Category 6 modular with number of RJ45 jacks indicated by Symbol on front. Provide blanks in unused sections. Color to match wiring devices in 262726. Label all jacks individually.

    a. Leviton 61110-XXX

C. WAPs (Category 6a in both base and alternate bid):

1. Outlets shall be EIA/TIA 568 Category 6A, modular with number of RJ45 jacks indicated by Symbol. Provide blanks in unused sections. Black Color. Label all jacks individually.

    a. Leviton 6110G-Re6, color to be black

D. Plates

1. Plates shall be stainless steel with 6 mounting spaces for connector and ID window top and bottom showing outlet number

    a. Leviton#43080-1L6.

2. WAPS, Intercom, and Access control shall be terminated in Biscuit Jack.

    a. Leviton#41089. Biscuit jacks to be black for WAPs, white for all other installations

3. Blanks shall be Leviton#41084-XX to match outlet color.

4. Wall phone plates where show with mounting: Leviton 4108-1SP

E. Labels

1. Label will be different for different systems and shall match the drawings.

2. Data:

    a. Based on Room Number - MDF/IDF - Room # - Location # - Outlet #

    b. Example "A-104-2-4"

3. WAPs

    a. WAP - MDF/IDF - WAP #

    b. Example "WAP-A-33"

4. Intercom

    a. INT - MDF/IDF - WAP #

    b. Example "INT-A-33"

5. Cameras

    a. CAM - MDF/IDF - WAP #

b. Example "CAM-A-33"

6. Access Contro

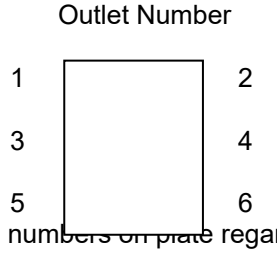
a. AC - MDF/IDF - WAP #

b. Example "AC-A-33"

7. Labels shall be at top center of each plate either an M (for MDF - No succeeding number) or I succeeded by the IDF number that drop is connected to, followed by a dash and then the room number, then a trailing dash.

a. Must use an 18 pt Times New Roman serif font on all labels so as to distinguish and "I" from a "1". Numbers do not require any preceding zeros.

F. Place the number of the jack centered above each of the 2 x 3 array of jacks, or to the side, using left-right, top-down order.



G. All outlets get 6 numbers on plate regardless of number of jacks installed.

H. WAPS, Video Surveillance, Intercom, and Access Control are on biscuit jacks

2.6 DATA PATCH PANELS

A. Data, Intercom, Video Surveillance, and Access Control/Security

1. EIA/TIA 568, Category 6, RJ45 insert jacks on front, 48 port.

a. Leviton Extreme 69270-U48

2. Label with jack number shown on drawings. Do not use preceding IDF or MDF notation for label on patch panel only. Provide field room number under outlet matching room location of installation

3. Exception: Provide 24 (-U24)port where shown on drawings.

B. WAP Patch Panels (Category 6A)

1. EIA/TIA 568, Category 6A, RJ45 insert jacks on front. Provide patch panels in MDF and all IDFs.

a. Leviton 6A586-U48

2. Label with jack number shown on drawings. Do not use preceding IDF or MDF notation for label on patch panel only. Provide field room number under outlet matching room location of installation

3. Exception: Provide 24 port (-U24) where shown on drawings.

2.7 FIBER OPTIC PATCH PANELS

A. The optical fiber cross-connect/interconnect system rack mount should provide a centralized, rack-mounted termination, identification and service assignment point for optical fiber horizontal, backbone and equipment cabling at the horizontal or main cross connects, using optical fiber patch cords for connections. Provide all accessories for a complete system

B. Corning PCH patch panel with (OS2 LC UPC panels)

1. General Specifications

   a. Product Type Rack-Mountable Hardware

   b. Accessory Type PCH

   c. Mounting Type Rack 19-in, Rack 23-in

   d. Application Data Center, Enterprise Networks

2. Standards

   a. RoHS Free of hazardous substances according to RoHS 2011/65/EU

   b. UL-Listed United States and Canadian safety standards

3. Design

   a. Housing Type PCH

   b. Locking Availability Front or rear

   c. Number of Panels per Housing 2

   d. Panel or Module Type CCH

   e. Splice Tray Options 4 category 2R, 2 category 4R

   f. Fiber Capacity (01U) Up to 24 fibers installing FC/SC/ST® Compatible connectors, or up to 48 installing LC connectors

   g. Fiber Capacity (02U) Up to 96 installing LC connectors

4. Connector Specs

5. Housing Material Metal

6. MDF Corning PCH-02U, maximum 8 panels or 96 fibers, blanks in unused

7. IDF Corning PCH-01U, maximum 2 panels or 24 fibers, blanks in unused

2.8 DATA PATCH CORDS

A. Data, Intercom, Video Surveillance, and Access Control/Security: Pre-manufactured (factory-terminated), stranded unshielded twisted pair (UTP), thin with 8- pin modular plugs (RJ45), Category 6. No boots provide on patch cables.

1. Leviton Extreme Category 6 #6H460-XX

B. WAP: Pre-manufactured (factory-terminated), stranded unshielded twisted pair (UTP), thin, with 8- pin modular plugs (RJ45), Category 6A. Optical Cable Corp OCC, Belden CAT 6A.

1. Levition Extreme Cat 6a #H6A10-XXX

C. Colors and Counts

1. Data – Blue

a. 10’ – 100

b. 7’ – 100

c. 5’ – 100

d. 3’ - 20

2. Camera, HVAC, VAP Sensors – Yellow

a. 10’ –5

b. 7’ – 5

c. 5’ – 20

d. 3’ – 30

3. WAP – Violet, Category 6A

a. 10’ –10

b. 7’ – 20

c. 5’ – 50

d. 3’ - 100

4. Security, Fire Alarm, Access Control, Cameras – Red

a. 10’ –10

b. 7’ – 10

c. 5’ – 10

d. 3’ - 30

5. Intercom – Orange or Yellow, to be confirmed.

a. 10’ – 20

b. 7’ – 20

c. 5’ – 20

d. 3' – 60

2.9 FIBER OPTIC PATCH CORDS:

A. Multimode Duplex, 50 Micron, OM4, LC on each end

1. Leviton PCF-M4-;-R2-R-R-XXXX

B. Counts

a. 10' – 5

b. 7' – 10

c. 5' – 15

d. 3' – 20

2.10 PATHWAYS AND CABLE SUPPORTS

A. Installation and materials for the raceway and boxes for the SCS shall be as specified under Division 26 Section

B. All cabling pathways are to be installed within 4 feet of the ceiling grid. No cabling pathway is to be located above 4 feet above ceiling grid.

C. Cable Supports: All cable to be installed in J-Hooks, Raceway, or Cable Tray. No other means acceptable. All connected to structure via a rigid stem. All outlets shall have conduit stubbed from outlet to cable tray and bonded to the cable tray.

1. 2" J-Hooks: Eaton/B-Line BCH32, Maximum 40 cables

2. 4" J-Hooks: Eaton/B-Line BCH64. Maximum 50 cables

3. J-Hook Supports: BCH series Beam, threaded rod, ATR, etc attachments

4. Rings: BRS-32A

5. Velcro Cable Strap: SB727 series

6. D-Rings

2.11 CABLE TRAY

A. Cable Tray: Provide in all MDF and IDF above the cable runway, approximately 18-24" above runway.

1. Basket (Wire Mesh) Cable Tray is 4" high, 18" Wide with IEC 61537 Black Class C8 coating

a. Provide Flexible Cable Tray painted with C8 Black Coating

1) Eaton/B-Line#FT4X18

2) Chatsworth#60283450-003

2. Include the following and all additional accessories for a complete system as shown on drawings. Equal products by Eaton/B-Line Acceptable.

   a. Wall mount: Medium Duty Cantilever: Chatsworth RPlus#62085X03-004 of width required for tray

   b. Ceiling Mount: Omega SPLUS#62082X04 or width required

   c. Joint Clamps: Chatsworth#604800061-50

   d. Accessory Clamp (for joining waterfalls). Chatsworth #4080158-050

   e. Splice Plate: Chatsworth 67080053-010

   f. Radius Drop: CPI #60500-701 and 67020139-010

   g. Conduit Bracket: CPI#67080040-010

   h. Bend Radius: CPI #34742-706

   i. Ground Kit: CPI #68000032-020/68000033-020 with 680000370929 strap

   j. Cable Tie Clip and Hook and Loop: CPI#68000110-20 and 89011000-001

   k. Wire Cutter: CPI # 68000058-001

2.12 CABLE RUNWAY

A. Cable Runway: Provide cable runway on top of racks and attach to wall. Runway shall be UL Listed.

   1. Runway shall be B-Line SB-13AL, black color, 9” rung spacing or equal by Chatsworth

   2. Include the following and all additional accessories for a complete system as shown on drawings

      a. Redi-Rail: B-Line #SB13AL12FB

      b. Radius Drop: B-Line #SB13ALDO12FB

      c. Bend Radius: B-Line #SB2104FB

      d. Splice Kit and Bars: B-Line #SB2107FB

      e. Ground Kit: B-Line #SB6691x73/4

      f. Support: Wall Mount: B-Line #SB21312KFB (Minimum every 4 feet)

      g. Ceiling Support – B-Line #9ZN-Rxxx xxx = 3/8” or ½” ATR

      h. Runway Wall Angle Support Kit: B-Line #SB211312FB

      i. Cable Retaining Post 6”: B-Line #SB12606FB

      j. Equipment Rack Top Plate Runway Support Kit; B-Line #SB213312FB

      k. End Caps: B-Line #SB21B

l. Innerduct: 1 ¼" Outside Diameter, bright orange in color. Plenum rated.

m. Pull Strings: Plastic or nylon with a minimum test rating of 200 lb.

n. Velcro Wraps: ½ inch wide wraps.

2.13 EQUIPMENT RACKS/ENCLOSURES

A. Unless otherwise indicated, equipment racks/enclosures and incidental equipment color shall be black or clear aluminum.

B. Unless otherwise indicated, equipment rack and incidental materials and equipment shall be provided by the selected Rack/Distribution Equipment manufacturer. Do not intermix products from different manufacturers except as specifically shown.

C. Free Standing Equipment Racks: EIA-standard 7-foot high x 19-inch wide racks with universal alternating-hole pattern, complete with top angles, self-supporting bases, and mounting holes on both sides of the rails.

1. Rack: Eaton B-Line SB556084XUFB

2. MDF Vertical Cable Management Eaton B-Line SB861610DFB. Double Sided 10" Wide Vertical Cable Manager between racks and Eaton B-Line SB86166DFB on the end of each rack.

3. IDF Vertical Cable Management Eaton B-Line SB81006FB Double Sided 6" Wide Vertical Cable Manager between racks and on end of each rack.

4. Horizontal Cable Management: Eaton B-Line SB87019S2FB

5. Power Strips (2 per rack - to be mounted at lowest section): Eaton PW101BA1U140

6. Double-sided shelves (provide 4 total for building): Eaton B-Line SB596S19103SFB

7. Grounding kit and #6 AWG insulated copper conductor grounded to the nearest TGB.

8. Horizontal Rack Busbar: Eaton B-Line SB57903

9. #6 Ground Wire: Eaton B-Line SBUBC6xxK xx= 14,18 or 32

10. Incidental materials required for proper construction, mounting and securing.

2.14 BACKBOARD

A. Grade AC Fire rated plywood of Nominal Thickness of 23/32"

1. UL Evaluation Report ER7002-01

2. Flame spread requirement by Underwriters Laboratories in the extended 30 minute duration of ASTM E-84, "Standard Test Method for Surface Burning Characteristics of Building Materials." Each piece of treated wood bears the Underwriters Laboratories Classification mark identifying it as being produced under its Classification and Follow Up Services.

3. Board Grade AC

4.	Nominal Thickness	23/32"
5.	Actual Thickness	23/32"
6.	Nominal Width	4'
7.	Actual Width	4'
8.	Board Length	8'
9.	Treatment	Fire Treated
10.	Product Type1	Treated Lumber
11.	Nominal Size	23/32" x 4'

2.15 UNINTERRUPTILBE POWER SUPPLY

A. Provide a UPS for each MDF and IDF per the following .

B. MDF x 1, APC Smart UPS online # SRT5KRMXLT with AP9641 management card

1. True online UPS, 5400 VA with network card

2. 208 Volt input, Nema L6-30R input, Output Connection Type 2 NEMA L6-20R, 2 NEMA L6-30R

C. IDF x 5, APC SmartUPS online#SRT3000RMXLA with AP9641 management card

1. True online UPS, 3000 VA with network card

2. 208 Volt input, Nema L5-30R input, Output Connection Type 8 NEMA 5-20R, 1 NEMA L5-30R

2.16 FIRESTOPPING

A. Firestopping material: Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions. Manufactured by:

B. STI Firestop

1. SSS, LCI, SIL Firestop Sealant

2. SSP Putty Pads on boxes in all rated walls. See 260533/260534

3. EZ Path is acceptable substitution for conduit

2.17 LABELING AND ADMINISTRATION

A. Labels:

1. As recommended in ANSI/TIA/EIA 606 and UL969. Permanent (i.e. not subject to fading or erasure), permanently affixed, and created by a hand-carried label maker or a computer/software-based label making system. Handwritten labels are not acceptable.

2. For Station Cable:

a. Brother P-Touch Edge Product Family (or approved equal)

3. For Backbone Cable:

a. Brother P-Touch (or approved equal) in the MDF and IDF within 12" of termination point.

4. Hand-carried label maker:

a. Brother P-Touch (or approved equal).

B. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.18 WAPS

A. WAPS will be furnished by the owner and installed by the contractor. The current design allows for 83 interior WAPS and 2 exterior WAPs. See plans for locations

B. The WAPS will be as determined by the owner but similar to Juniper AP43 interior and Juniper AP63 with remote antenna – exterior label visible from ground

C. Brackets

1. Ceilings: Provide Oberon 1044 recessed ceiling

2. Wall: Provide Oberon 1007 horizontal bracket. Mount horizontal

3. Gym: Provide AccelTex Solutions #ATS-02960 bracket with cover

4. Exterior: Provide Oberon 1007. Mount horizontal

a. In addition run #10 ground wire from WAP to nearest ground.

D. On all WAPS in gym, Commons and on exterior install in protective cage furnished by the owner.

PART 3 EXECUTION

3.1 GENERAL

A. Comply with NECA 1 and NECA/BICSI 568.

B. No cable grouping shall contain more than 50 cables

C. General Requirements for Cabling:

1. Comply with TIA-568-C.0, TIA-568-C.1, and TIA-568-C.2.

2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.

3. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

5. Consolidation points may be used upon direct approval of the engineer.

6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

7. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.

8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.

9. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.

10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

11. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

D. Open-Cable Installation above ceilings:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 48 inches apart.

3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Cable run layouts indicated on the drawings are generally diagrammatic. Exact routing of conduit and wiring shall be governed by the location of obstructions and building structural conditions. Cable runs shall strictly adhere to BICSI standards for EMI distances.

F. All cables passing into and out of all MDF/ IDF must be in sleeves with bushings and have proper fill ratios. Provide (1) 4" spare sleeve with capped.

G. Backboards. For reference backboards shall be fire rated and capable of supporting attached equipment, and painted with a minimum of two coats (over primer) of fire retardant, non-conductive paint, and one coat of white colored semi- gloss top coat paint with fire rating symbol exposed. Mount A-C plywood backboards with the "A" side exposed. Install up to 8 feet AFF minimum.

H. Group connecting hardware for cables into separate logical fields.

I. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.

2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).

b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

J. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).

1. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).

2. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).

K. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

1. Electrical Equipment Rating Less Than 2 kVA: No requirement.

2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).

3. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

L. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).

1. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

M. Routing:

1. Route Cable in as direct a route to MDF and IDF as possible and along building structural lines unless alternate approved

a. Install plenum cable in environmental air spaces, including plenum ceilings.

2. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

N. Conduit Sleeves are not necessarily shown on the drawings. The contractor shall provide conduit or EZ path sleeves as required to accommodate routing of all communications cables and all sleeves shall have 25% spare capacity. Provide sleeves where required for cable pass-thru through building structures and/or fire rated barriers above the ceiling. Provide roto-

hammering or core drilling where required for sleeve installation. Seal (and if a fire rated barrier, firestop) between sleeve and building structure and/or barrier. Size sleeves:

1. Sleeves shall be minimum 2” and maximum 4”

2. Communications cables shall not share sleeves with any other cables.

O. Seismic Joints: All cabling passing through a seismic joint shall be looped to allow for joint movement.

P. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

Q. Cable run layouts indicated on the drawings are generally diagrammatic. Exact routing of conduit and wiring shall be governed by the location of obstructions and building structural conditions. Cable runs shall be run as short as possible.

R. Communications cables shall not share sleeves with any other cables.

S. All cables passing into and out of all MDF/ IDF must be in sleeves with bushings and have proper fill ratios.

T. Backboards. For reference backboards shall be fire rated and capable of supporting attached equipment, and painted with a minimum of two coats (over primer) of fire retardant, non-conductive paint, and one coat of white colored semi- gloss top coat paint with fire rating symbol exposed. Mount A-C plywood backboards with the "A" side exposed. Install up to 8 feet AFF minimum.

U. D-Rings: Provide D-Rings as necessary for vertical management only for exposed cables on backboards in telecommunications rooms.

V. Innerduct: Provide bright orange innerduct as pathway for backbone fiber optic cables (backbone only – not station cables), from backbone fiber patch panels to conduit or plenum entrances, and as shown in the Contract Documents.

W. Pull Strings: Provide a pull string in conduits that are to remain vacant.

3.2 MDF / IDF CREATION

A. Room Layout

1. Details of the MDF/ IDF layout must be reviewed by Owner prior to construction, including rack locations, PBX location, ladder locations, etc.

2. Lighting in MDF/ IDF to be 12 inches away from any cable bundles to minimize EMI.

3. Keep MDF/ IDF accessible and clean to facilitate other services that may need access during construction phase.

4. Any cable(s) entering MDF/ IDF must be collected onto ladder rack(s) mounted to perimeter wall(s) forming a continuous pathway connecting to the rack(s).

3.3 EQUIPMENT RACKS/ENCLOSURES

A. Provide EIA racks/cabinets and all associated hardware according to locations, elevations, and plan views as shown in the Contract Documents.

B. For Floor Mount Racks/Cabinets:

1. Using cable runway, horizontally affix the top of a given rack/cabinet to the wall as shown on the Contract Documents. Bolt horizontal ladder rack to rack/cabinet and to walls. Bolt rack/cabinet to floor.

2. Any cable(s) entering MDF/ IDF must be collected onto ladder rack(s) mounted to perimeter wall(s) forming a continuous pathway connecting to the rack(s).

3.4 PATCH PANELS

A. Provide patch panels and horizontal wire management according to locations, elevations, and plan views as shown on the Contract Documents.

B. Fiber: Size and install rack-mountable patch panels as shown on the Contract Documents. Use fiber patch panels to terminate multimode fiber backbone cables.

C. Copper: Size and install rack-mountable patch panels as shown on the Contract Documents. Use copper patch panel to terminate horizontal cable on rack(s). All for spacing between patch panels for horizontal cable management.

3.5 SERVICE LOOPS

A. Provide the following service loop lengths

1. Communications Outlets: Minimum 3 feet coiled above the ceiling

2. WAP: Minimum 15 feet coiled above the ceiling

3. Copper in Communications Room: Minimum 10 feet coiled in upper cable tray

4. Fiber: Minimum 10 feet each end

3.6 CONNECTORS

A. Copper Connectors (modular jacks):

1. For Horizontal Distribution:

a. Provide connectors and install using T568B wiring pattern.

b. Mount connectors at 90-degrees (i.e. straight, not angled)

c. Must re-apply all dust covers to all jacks after punching down the cable.

d. All terminations must adhere to BICSI AND EIA/TIA standards,

3.7 STATIONS

A. Faceplates: Provide faceplates for stations in the locations and gang counts shown on the Contract Documents. Faceplates shall completely conceal outlet boxes, reducer plates, etc. Faceplates shall provide a snug and sure fit for connectors – loose connectors are not acceptable and be mounted neatly and parallel to adjacent building lines.

B. Flush-mount connectors on faceplates.

1. Faceplate Mounting Brackets: Provide faceplate mounting brackets as required and as shown for flush mounted communications outlets. Provide blanks in all unused ports.

3.8 CABLE

A. For Horizontal Distribution: Provide station cable in types, sizes, and quantities as shown on drawings. Install cable between the station and it's associated communications room. Provide one cable per each connector at each station.

B. For Intrabuilding Backbone Distribution: Provide intrabuilding backbone cable in types, sizes, and quantities as shown on the Contract Documents. Install intrabuilding backbone cables between communications rooms within the same building. Provide cables of the same type in the same color – multiple colors of the same cable type are not acceptable.

C. Install cable in compliance with ANSI/TIA/EIA and ISO/IEC 11801 requirements and BICSI practices.

D. Adhere to the bending radius and pull strength requirements as detailed in the ANSI/TIA/EIA standards and the manufacturer’s installation recommendations during cable handling and installation.

1. Pull all cables simultaneously where more than one cable is being installed in the same raceway.

2. Use pulling compound or lubricant where necessary. Use compounds that will not damage conductor or insulation (Polywater, or approved equal).

3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway. Repair or replace conduit bushings that become damaged during cabling installation.

E. Install cable in a continuous (non-spliced) manner unless otherwise indicated.

F. Install exposed cable parallel to and perpendicular to surfaces on exposed structural members and follow surface contours where possible.

G. Tie or clamp cabling. Attaching cables to pipes, electrical conduit, mechanical items, existing cables, or the ceiling support system (grids, hanger wires, etc.) is not acceptable. Install velcro-wraps in conformance with the SCS manufacturer’s installation recommendations. Do not over-tighten velcro wraps or cause cross- sectional deformation of cabling.

H. Cable at the backboards:

1. Lay and dress cables to allow other cables to enter raceway (conduit or otherwise) without difficulty at a later time by maintaining a working distance from these openings.

2. Route cable as close as possible to the ceiling, floor, sides, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.

3. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Support cables so as not to create a load on the equipment upon which the cables are terminated. Velcro-wrap similarly routed and

similar cables together and attach to D-rings vertically and/or horizontally, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.

I. Cable in the telecommunications rooms:

1. For telecommunications rooms with ladder rack, lay cable neatly in ladder rack in even bundles and loosely secure cabling to the ladder rack at regular intervals with Velcro straps.

2. Any cable(s) entering MDF/ IDF must be collected onto ladder rack(s) mounted to perimeter wall(s) forming a continuous pathway connecting to the rack(s).

J. Cable terminating on patch panels located on racks:

1. Route cables in telecommunications rooms to patch panels on racks by routing across ladder rack across top of rack and then down vertical ladder rack to patch panel.

K. Copper Cable: Terminate all pairs within a cable. Un-terminated cable pairs are not acceptable.

1. For horizontal distribution: Provide station cable in the locations shown on the Contract Documents. Provide service loops as specified above each drop location at the entrance of each stubbed conduit above the ceiling grid and for classroom drop conduits running entirely to primary hallway cable trays, then lay cable loosely in tray to act as future slack.

2. For intrabuilding backbone distribution: Install intrabuilding backbone cable in the locations shown on the Contract Documents. Provide a service loop long enough in the commun cation rooms to reach termination equipment if moved to the farthest side of the room in the future, but no less than a minimum length of 10 feet at each end.

3. Fiber Cable: Terminate all fiber strands within a fiber cable. The installation of “dark fiber” is not acceptable.

a. For Intrabuilding Backbone Distribution:

1) Test fiber optic cable on the reel upon delivery to the job site, and again prior to installation. Permanently affix the test results to the reel and submit a copy to the Owner prior to installation. Do not install cables that fail the on-reel test. Replace any cables that fail the on-reel test at no additional expense to the Owner.

2) Test shall conform to the procedures as outlined in the paragraph entitled TESTING at the end of this specification section.

3) Demonstrate that the test results are in agreement with the factory test results as shipped with the reel.

4) Provide a service loop long enough in the MDF IDF to reach termination equipment if moved to the farthest side of the room in the future, but no less than a minimum of 10 feet at each end.

5) The service slack stored inside the fiber patch panel cabinets shall be a minimum of 3 m (10 ft).

L. Patch Cords

1. Coordinate with the owner and either deliver patch cords to the owner or install port to port at locations directed by the owner.

3.9 FIRESTOPPING

A. Install firestopping in compliance with NEC, IBC, and IFC as well as TIA-569-D

B. Comply with "Firestopping Systems" stated in BICSI manual.

3.10 GROUNDING

A. Comply with requirements in Section 260526.

B. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

C. Comply with TIA-607-B and NECA/BICSI-607.

D. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 2 AWG grounding electrode conductor.

E. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.11 LABELING AND ADMINISTRATION

A. General: Labeling and administration shall comply with ANSI/TIA/EIA 606 and standard industry practices.

B. Must use Times New Roman serif font at 18 point for faceplate labeling and fit to size legibly for patch panel labels so as to distinguish between "I" and "1".

C. Color Coding: Apply industry standard color coding to cable termination fields. Always apply the same color at both ends of any given cable. Cross-connections are generally made between termination fields of different colors. The color may be applied to the backboard behind the termination equipment, may be the color of a cover on the termination equipment, or may be the actual color of the insert label on the termination equipment. Use the following color code:

1. Orange: Identification of the telecommunication service (telephone company) demarcation point.

2. Green: Identification of network connections on the customer side of the demarcation point.

3. White: Identification of first-level backbone in the building containing the main cross-connect, or may be used to identify the second-level backbone in buildings not containing the main cross-connect.

4. Gray: Identification of the second-level backbone in the building containing the main cross-connect.

5. Blue: Identification of the horizontal distribution (station) cables. A blue color coding is only required at the telecommunications room end of the cable, not at the station end of the cable.

D. Racks: Label racks as shown on the Contract Documents. Affix label centered across top cross-member of rack.

E. Grounding/Bonding

1. Label bonding conductors: “WARNING! COMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT”

F. Cables:

1. Label Location: Label at each end of the cable within 12" of the termination.

2. Station Cables: Label station cables with the same label as the outlet number that terminates the cable at the station location. Handwritten (neat and legible) labels using a permanent black marker such as a Sharpie are allowed.

3. Copper Backbone Cables: Label intrabuilding copper backbone cables in the form “C (MDF/ IDF), ###-PR, CAT##, ###-FT ” where “C” stands for media type (“C” for “administrative copper” media), “(MDF/ IDF)” is the origination and destination telecommunications rooms between which the cable routes, “###-PR” is the pair count, “CAT##” is the cable type (i.e. CAT3 or CAT5E), and ###-FT is the cut length.

a. Example: If a copper backbone cable running between MDF1 and IDF6 were a 150-FT long, 100-PR, CAT3 cable, then the label for the cable would read “C (MDF/ IDF), 100-PR, CAT3, 150-FT”

G. Fiber Backbone Cables: Label intrabuilding fiber backbone cables in the form “F (MDF/ IDF), ###-ST, type, ###-FT ” where “F” stands fiber, “(MDF/ IDF)” is the origination and destination telecommunications rooms between which the cable routes, “###-ST” is the strand count, “type” is the fiber type (i.e. SM, 50MM, etc), and ###-FT is the cut length.

1. Example: If a 12-strand, 50 micron fiber backbone cable running between telecommunications rooms “MDFA” and “IDFC” were 75-FT long, then the label for the cable would read “F (MDFA” and “IDFC), 12-ST, 50MM, 75-FT”

2. Provide labels at each end of each cable within 12” of telecommunications room entrance and again within 24” of termination point.

H. Termination Blocks and Protectors:

1. General:

a. Label termination block ports/pairs sequentially beginning on the first row of each termination block column. Begin with “001” for the first port/pair.

b. Label termination strip pairs sequentially (left to right).

I. Patch Panels:

1. For Horizontal Distribution:

a. General: Label patch panels as shown on the Contract Documents.

b. IDF to MDF Uplink Ports: In each IDF and in the MDF, label copper uplink ports using the following format:

2. Must use TIA/EIA 598-A color code for all fiber strand termination and all terminated fiber needs to be in the recommended order and be consistent at both ends.

3. Both ends of fiber termination must be labeled to identify where the other end is coming from. A fiber legend displayed inside the termination box is acceptable.

4. Label fiber termination box with destination MDF/ IDF.

5. Station Connectors (Ports): Per outlet number and plate style above

6. Conduits: Label each conduit end in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room identifier, pull box identifier, outlet identifier (use the label of the first port of the outlet as the outlet identifier), etc.).

3.12 TESTING

Equipment must be tested with district-owned hardware to ensure compatibility. (ie: Chromebooks or staff issued devices/laptops)

A. Provide test records on a form approved by the Owner and Engineer/Designer. Include the test results for each cable in the system. Submit the test results for each cable tested with identification. Include the cable identifier, outcome of test, indication of errors found, cable length, retest results, and name and signature of technician completing the tests. Provide test results to the Owner and Engineer/Designer for review and acceptance within two weeks of Substantial Completion.

1. Print test records for each cable within the system directly from the tester and submit in paper form (in a binder) and in electronic form (on CDROM) to be reviewed by the Owner and approved by the Engineer. Handwritten test results will not be accepted nor any spreadsheet tabulated data forms.

2. Provide PDF or of the JDSU or Fluke test data for all copper and fiber cables compatible with latest version of software. Single copy of notebook bound, printed, color, double sided and sequentially organized of all copper and fiber test results

3. Provide PDF copies of project’s completed as-built drawings denoting the installed and individually labeled data drops at their locations in PDF format from digital CAD versions of the Electrical Data/Comm sets (See example below)

4. See sample following this section for level of test results to be delivered to the owner in PDF form.

B. Test the System after installation for compliance to all applicable standards as follows:

1. Copper:

a. For Horizontal Distribution, including Backbone Distribution: Test all pairs of each copper station cable, for conformance to ANSI/TIA/EIA 568 to specified level.

b. Test each end-to-end link (the entire channel from the connector at the station to the connector or termination in the telecommunications room) utilizing sweep

tests, for alien cross talk, continuity, shorts, polarity, near- end cross talk (NEXT), far-end cross talk (FEXT), attenuation, installed length, transposition (wire map), mutual capacitance, characteristic impedance, resistance, ACR, and presence of AC voltage. Use the Power Sum method to test NEXT and FEXT.

c. Use a TIA/EIA Level III testing instrument from either Fluke or JDSU, or owner pre-approved for all copper testing. The test instrument needs to be re-calibrated within the manufacturer's recommended calibration period, with the most current software revision based upon the most current ANSI/TIA/EIA testing guidelines and be capable of storing and printing test records for each cable within the system.

d. In addition to the above, perform tests both recommended and mandated by the cable manufacturer for the warranty

C. Fiber: Test fiber optic cable on the reel upon delivery to the job site prior to installation, and again after installation.

1. Prior to testing, calculate the cable loss budget for each fiber optic cable and clearly show the result on the test documentation. Calculate maximum loss using the following formula, assuming no splices:

2. For Backbone Distribution:

a. Max Loss = [(allowable loss/km) * (km of fiber)] + [(.3db) * (# of connectors)]

b. A mated connector to connector interface is defined as a single connector for the purposes of the above formula.

c. A given fiber strand shall not exceed its calculated maximum loss (per the above formula).

3. Test all strands using a bi-directional end-to-end optical transmission loss test instrument (such as an OTDR) trace performed per ANSI/TIA/EIA 455-61 or a bi-directional end-to-end power meter test performed per ANSI/TIA/EIA 455-53A, and ANSI/TIA/EIA 568-C to eliminate any possible fiber core misalignments at connectors or splice points.

a. Calculate loss numbers by taking the sum of the two bi-directional measurements and dividing that sum by two.

b. Provide test measurements as follows:

4. Test results shall conform to:

a. The criteria specified in ANSI/TIA/EIA-568B

b. OS2 testing criteria

c. Manufacturer's requirements

D. Identify cables and equipment that do not pass to the Owner and Engineer/Designer. No marginal or star passes allowed. Marginal Pass must be enabled on all test instruments. All FAILS need to be corrected and no re-certify status of test data accepted. Determine the source of the non-compliance and replace or correct the cable or the connection materials,

and retest the cable or connection materials at no additional expense to the Owner. Provide new test results to the Owner and Engineer/Designer in the same manner as above.

1. In addition to the above, if it is determined that the cable is at fault, remove the damaged cable and replace it with a new cable. Cable “repairs” are not acceptable. The procedure for removing the cable shall be as follows:

2. Prior to removal of damaged cable and installation of new cable:

3. Inform the Owner and Engineer/Designer of the schedule for the removal and installation.

4. Test the new cable on the reel

5. Test cables that occupy the same innerduct or conduit (if not in innerduct) as the damaged cable per paragraph B, above, regardless of whether or not they are new cables installed as part of this project or existing cables installed prior to this project.

6. Provide test results to the Owner and Engineer/Designer for approval by the Owner and Engineer/Designer.

3.13 WAPS

A. Install WAPS at locations directed by owner. Clip to ceiling tile where available or horizontal wall mount where directed. Exterior, Gym, and Commons WAPS to be installed in protective enclosure. On completion furnish the following information to the owner.

FLOOR	ROOM #	DEVICE TYPE	DEVICE NAME	MAC ADD	JACK #	MDF/ IDF #	RACK #	PATCH PANEL #	PATCH PANEL PORT	SWITCH PORT	% COM-PLETE
		WAP									
		ACCESS CONTROL									
		HVAC									
		INTERCOM									
		PHONE									
		STATION									
		DATA									
		ETC									

3.14 PATCH CABLES

A. Install patch cables as directed by the owner. Plug patch cables into switchports designated. Group in a clean professional manner with appropriate length cables and use Velcro wraps for a clean install. Cables shall have minimal slack except as directed by the owner. . On an on-going basis, update the customer's shared google spreadsheet as wiring and device installation is completed. Customer needs the information in the spreadsheet in order to allow devices on the network. Spreadsheet needs to be updated at least weekly. Provide the following table to the owner at completion.

3.15 FIELD QUALITY CONTROL

A. Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.

2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

B. Manufacturer Services:

1. Manufacturer shall inspect final installation and test results and send warranty letter to the owner.

END OF SECTION

SECTION 27 30 00 – TWO WAY COMMUNICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Provide a complete and fully functional two way communications system from the elevator lobby to the main office. System shall be installed complete per IBC 1009

B. The Command Center is to be located at a central control point on the first floor or as determined by local Authority Having Jurisdiction. Call Boxes are to be located on all floors above and below the first floor, ideally next to a stairwell emergency exit or elevator landing on each floor.

C. The Command Center must be capable of connecting to an existing Network and providing inputs for the IP Call Boxes. Visual indicators on the IP Command Center allow rescue personnel to know which IP Call Box needs assistance. The IP Command Center must allow rescue personnel to speak to each IP Call Box individually. The IP Command Center must include both a handset and speakerphone to communicate back to the IP Call Boxes.

D. The IP stations

1. The emergency communication hardware shall comply with the Americans with Disabilities Act (ADA). The IP Call Box shall have the ability to be programmed with up to 2 emergency phone numbers (either both off-site or Base Station and off-site). Upon activation of the emergency push button, a call will be automatically placed to the IP Command Center. If no one answers at the IP Command Center, the IP Call Box must dial a secondary location outside the building to activate two-way off-site person to person voice communications

1.2 QUALITY ASSURANCE

A. All command unit installation, configurations, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.

B. All equipment shall be warrantied against any defects in material and workmanship under normal use for a period of sixty (60) months from date of installation, provided that manufacturer receives a completed "Installation Certification" certifying the date on which the system has been installed. An "Installation Certification" card shall be enclosed with every unit. In the event that no "Installation Certification" is received by manufacturer, the sixty (60) months will commence on the date of shipment by the manufacturer.

1.3 CERTIFICATIONS AND STANDARDS

A. The command unit shall be designed to meet the following standards:

1. Accessibility

a. ADA: Standards for Accessible Design – 2010 §7

b. ANSI ICC A117.1 (2009): Accessible and Usable Buildings and Facilities

c. IBC (2015) §1009

d. NFPA 72: National Fire Alarm and Signaling Code – 2016 §24.10

e. Illinois Accessibility Code

2. Safety

a. UL 60950-1

3. Direct connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN)

a. FCC (47 C.F.R. Part 68)

1.4 MANUFACTURER

A. Manufacturer are as follows

1. Talkaphone or equal

2. Switches: By Owner

1.5 INSTALLER

A. Installer must be a Talkaphone certified installer

B. Installer must have installed at least 3 school projects of similar size and complexity

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.

3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.

C. Design Data: Include an equipment list consisting of every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

D. Product Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

1.8 WARRANTY

A. Provide the Limited Warranty for Product Line for Repair and Replacement

1. Warranty Period: FIVE Years

PART 2 PRODUCTS

2.1 TWO WAY COMMUNICATIONS SYSTEM

A. Since system is in 2 different buildings VOIP will be used. Contractor to provide switch for this system only. Mount cell dialer in the MDF.

B. Master Station: Talkaphone AOR-IP-40-CU with flush mount trim ring

1. Construction: 18 gauge painted steel enclosure, acrylic window

2. Mounting: IP Command Unit flush mounts optional trim ring

3. Communication:

a. IP Command Unit provides both an LCD and keys with LEDs to indicate IP

b. Call Station line status (i.e. idle, ringing, or busy)—receives and selectively originates calls

4. Power Source: IP Command Unit, IP Supervisor, and UPS Supervisor receive power from UPS (120VAC).

5. IP Call Stations receive power over Ethernet (PoE).

6. Wiring: Minimum Cat5e or Cat6.

7. Fire resistive Ethernet cable is supported.

8. Environment: IP Command Unit, AOR-IP Call Stations, IP Supervisor, UPS, and UPS

9. Supervisor are for indoor use.

C. Station: Talkaphone AOR-IP-CSE-FM

1. Flush mount

2. Fully compliant with IBC, ADAAG, ICC A117.1 Ch. 7, and NFPA 72

3. Network supervision available when used in conjunction with IP supervisor (Model AOR-IP-SUP)

4. Automatically plays back a recorded location message to the local IP Command Unit (not off-site)

5. Auto-answers calls initiated at the IP Command Unit

6. Exceptional sound clarity during conversation (over 85dB, configurable)

7. Power over Ethernet (PoE, 802.3af)

8. Vandal resistant stainless steel faceplate and metal button

9. LED indicator for the hearing impaired

10. Push button once to call, then speak hands-free

11. Built-in auto-dialer can dial up to five (5) phone numbers: if the first number doesn't answer or is busy, dials next number

D. Signage

1. System shall include signage required by AHJ and manufacture. Talkaphone AOR Sign series

E. Graphics

1. Command Center must include wording identifying the location of each Call Box and light an LED when a particular Call Box has been activated.

2. The Call Box wording must include “Emergency Phone”, International Phone symbol, and raised Braille lettering.

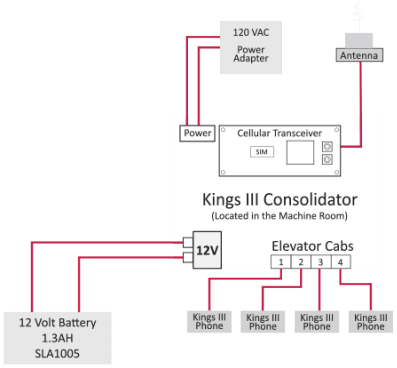
F. Cabling

1. Cabling for two-way communication system shall meet the applicable requirements for pathway survivability. Cabling installation shall consist of the following:

a. 2 hour fire-rated circuit integrity (CI) cable as required by manufacturer and AHJ

2.2 CELLULAR DIALER

A. Provide (2) Kings III Skyline cellular dialer with ethernet backup for elevator and two communications system. Include antenna



B.

C. Locate elevator device in the elevator machine room or MDF as directed by the elevator inspector. Locate two communication device in the MDF

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for network before device installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Fully program system for operation as required by the AHJ.

C. Tests and Inspections:

1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.

2. Verify operation of control-station equipment.

3.3 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain video-surveillance equipment. Provide 2 hours of training. Record all sessions and deliver to owner

END OF SECTION

SECTION 27 41 16 – CONFERENCE, FITNESS, AND MONITOR AV SYSTEMS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. The intent of this specification is to provide a complete and properly AV system for the pick-up, amplification, distribution, and reproduction of voice and/or other audio program material and audio-visual display including projectors in the Conference rooms, Fitness Room, and other locations as indicated on the drawings. The system shall be of modular design to facilitate both expansion and service and shall be completely solid state. All necessary hook-up and testing shall be by a factory approved representative. All equipment shall be listed with a Nationally Recognized Testing Laboratory (NRTL) such as U.L.

B. Audio Visual system is included in Alternate Bid#5. Base bid includes all conduit rough in and power for the system.

C. All system equipment shall be supplied and installed by an authorized factory distributor. The sound system contractor shall have been in the business of furnishing the specific product lines for a minimum of 5 years.

D. The installing contractor shall upon request submit a listing of similar installations that have been in service for at least 5 years and are working satisfactory. The contractor shall maintain a mobile service force capable of offering full factory authorized warranty service and able to be on site within one hour.

E. The entire system shall be guaranteed for a period of one year from the date of acceptance or first beneficial use, whichever is first, against defects in materials, workmanship, design and improper adjustment. Any defects in the system shall be corrected at no expense to the Owner, provided the system does not show signs of abuse. During the guarantee period any work found not to be in conformance with the plans, specifications and addenda shall be brought into conformity with same at no additional cost to the Owner.

F. These specifications are based on products manufactured by Lightspeed, Cables to Go, Qomo, Chief, Kramar and other manufacturers. Brand names are used to establish levels of quality and performance.

G. Approval request for installation of equipment not as specified herein must be received by the architect not less than ten days prior to bid opening. Proposals must be accompanied by complete technical data including: Equipment list on contractors letterhead listing major system components, such as loudspeakers, amplifying and control equipment including mixers, equalizers, signal processors, matching transformers, equipment housings, ancillary equipment, microphones, cabling etc. Compilation of manufacturers catalogs or specification sheets of major components and block diagrams. It is the sole responsibility of the contractor to prove equality to the satisfaction of the engineer including, laboratory test data, fabrication techniques, installation and testing procedures. Potential bidders submitting proposals for prior approval must provide, upon request, a working demonstration system for the Owner's inspection prior to final acceptance to insure that the submitted components are equal to the specified in all functional aspects.

H. Alternative proposals which are approved will be published by addenda. Proposals not complying with the prior approval requirements and conditions set forth will not be considered.

1.2 SUBMITTALS

A. Provide clearly identified, complete catalog cuts of all major components including but not limited to:

1. Equipment cabinets and enclosures

2. Cables for all interconnection of components, microphones and speakers.

3. Brackets

4. Backboxes and specialty rough-ins

5. Wire and cable

B. Provide shop drawings showing engineering details of equipment interconnection including point to point wiring, gain or losses between components in dBm, and equipment layout, speaker locations with proposed mounting and aiming. Proposed wire routing, rough-in and installation information.

1.3 OPERATIONS AND MAINTENANCE MANUALS

A. 3 complete bound O&M manuals describing maintenance and operation of the system. Include descriptions and service data on all component parts. Manual shall also include the following.

1. Warranty statement indicating effective dates.

2. Complete engineering data on all systems furnished including point to point wiring diagrams of the system in its "as built condition.

3. Step by step instructions on operational procedures, including power up and power down sequences, special operational guidelines and standard preventative maintenance procedures. One copy shall be permanently affixed to equipment rack.

1.4 SCOPE

A. Base Bid: AV systems shall be AV rough-in only for AV system devices as shown on the drawings.

B. Alternate #3: Provide complete and functioning Audio-Visual Systems including monitors, cables, sound system, etc., fully connected and operational.

PART 2 PRODUCTS

2.1 CONFERENCE ROOM, TECH ROOMS AND AREAS

A. Sound System: None provided

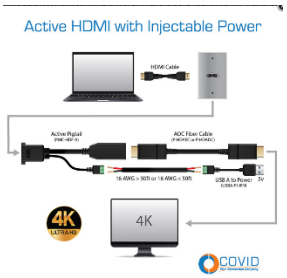
B. AV Outlets

C. AV OUTLETS

1. AV1: Custom 2 Gang Stainless Steel plate with

a. First Gang: Dual HDMI Jacks and Audio flush

1) HDMI jacks shall be Covid PMC-HDF-A active pigtail or Kramer Hybrid Optical Cable. System shall pass 4K/60 up to 50 feet.



2)

b. Second Gang: USB A and USB C

c. Black and Stainless Steel

2. AV2 where shown: Single gang with single HDMI and USB

a. Provide Startech USB combiner when AV2 is shown

3. AVM/AVS: Dual gang Stainless Steel 1.5” grommet pass through plate. Cables to go 40546

4. Cabling:

a. HDMI – Optical, 50 feet or as required. Extron HD Pro P, Covid AOC series, or Kramer Optical Hybrid HDMI of length required. System shall pass 4K, 60 HZ rated up to 50 feet.

b. 3.5mm Audio – Extron A Mini Series of length required.

c. USB A: Startech USB3SAB10M active extender cable

d. UCB C: Startech USB2C5C4M, maximum 13 feet

5. Patch Cables:

a. HDMI: Extron HDMI Pro/6. Provide 2 per system

b. Audio: Cables to Go 40412, provide 1 per system

c. USB3.0: Confirm with owner prior to ordering for either USB C or A. Startech#USB3S. Provide 1

D. Monitor and Mount

1. Monitor: FOIC

2. Monitor and Monitor Mount: Chief PNRUB with universal mounting

2.2 FITNESS ROOM AV SYSTEM

A. Audio-Visual System will be on portable carts provided by the owner. Contractor shall install sound system on the cart and connect to system. Allow for (1) cart provide by contractor and installed by contractor cable of mounting AV system as specified.

B. SOUND SYSTEM:

1. Cascadia Base Station

a. Description: Wireless audio hub

b. Wireless Communication: Access Technology (1.9 GHz)

c. Frequency Response: 20 Hz - 20 kHz Power Amp, 150 Hz - 6.5 kHz Wireless

d. Power Supply Options: 24VDC/2.5A or PoE+ 802.3at

e. Power Output: 40 WRMS total (20 WRMS/channel) with 24VDC supply

f. Tone Control: Bass/Treble control

g. Ethernet: 10/100Mbps

h. Audio Inputs: Three (3) 3.5mm inputs, one S/PDIF coaxial digital input

i. Audio Output: One (1) 3.5mm output, one S/PDIF coaxial digital output

j. Maximum Input/Output Level: 1.4VRMS / 1.4VRMS

k. Total Harmonic Distortion: <1%

l. Analog Control Signals: Inputs: PageFirst (25/70V page mute), Relay Input

2. Speakers

a. Lightspeed WMQ x 2

1) Driver Size: 4" with 1" tweeter

2) Frequency Response: 60 Hz - 20 kHz ± 6dB

3) Impedence: 8 Ohms

4) Power Handling: 30 W

3. Wireless Microphones x 2:

a. Lightspeed Flexmike

1) Description Pendant-style transceiver

2) Lanyard Magnetic clasp with integrated earbud

3) Wireless Communication Access Technology (1.9 GHz)

4) Audio Distortion <1%

5) Integrated Microphone Uni-directional electret

6) Earbud Output 3.5mm

7) Audio Input USB-C 2-way digital audio interface

8) Battery Power 3.7V Lithium Ion battery pack

9) Battery Life 8 hours (fully charged)

10) Charging 2 contacts for cradle charging

11) USB Connection Type C for charging and audio

12) Power On/off switch

b. Lightspeed Sharemike

1) Description Handheld transceiver

2) Lanyard None

3) Wireless Communication Access Technology (1.9 GHz)

4) Audio Distortion <1%

5) Integrated Microphone Uni-directional electret

6) Audio Input USB-C 2-way digital audio interface

7) Battery Power 3.7V Lithium Ion battery pack

8) Battery Life 8 hours (fully charged)

9) Charging 2 contacts for cradle charging

10) Power On/off button

c. Lightspeed Dual Flexmike Charger.

1) Capacity Two Microphones

2) Charging Methods Cradle

3) Power 5VDC

4) Provide rechargeable batteries plus 20% spare

4. Wireless Media Connector: Lightspeed media connector, mounted on teacher's desk.

a. Description Transceiver

b. Power Input 5V/1.0A USB-C connector

c. Wireless Communication Access Technology (1.9 GHz)

d. Tone control 1 bass / treble control

e. Digital audio interface USB-C 2-way digital audio interface

f. Audio output 3.5mm stereo (x2) mixed with volume control

g. Audio inputs 3.5mm stereo (x4) with volume control

h. Audio Link/Pair Indicator 1 LED on front panel

i. Device pairing Push button

C. AV OUTLETS

1. AV1 and AVM: Recessed extra deep 5” or 4-11/16” box per 260534 with blank stainless steel plate

2. AVS: Dual gang Stainless Steel 1.5” grommet pass through plate. Cables to go 40546

3. Conduit: 1.25”

4. Cabling: Not included

D. HEARING ASSISTANCE SYSTEM

1. The portable hearing assistance system shall be an FM band RF broadcast type complete with transmitter, co-axial antenna and

2. Williams Sound PFM Pro RCH system. Provide

a. One for Fitness Room

2.3 MONITOR Only Locations

1. Monitor: FOIC

2. Monitor and Monitor Mount: Chief PNRUB with universal mounting

PART 3 INSTALLATION

3.1 GENERAL

A. Equipment shall be completely installed, tested, adjusted and operating properly under the terms of this specification. Systems shall be complete and operational as installed.

B. All wiring installed in metallic raceway if concealed in wall, inaccessible ceiling space, and/or open to structure areas. Open cabling methods allowed elsewhere. Separate conduit runs shall be provided for microphone lines, speaker lines and A.C. power. Wire shall be #18 X 2 stranded with overall jacket for speakers, #20 X 2 stranded with overall shield and jacket for microphone and line levels Equal to Belden numbers: 5200UE, 5400FE. Wiring for AV systems may be open above ceilings if cable is Plenum Rated.

C. Installation is to be performed under the supervision of a qualified project technician. This technician shall be factory trained in the proper installation of the proposed equipment, shall approve and sign all documents and shop drawings attesting to compliance, and shall be present for final adjustment and training of the owners forces. All appropriate local electrical codes for installation of these systems shall be met.

D. All high voltage A.C. voltage lines shall be three wire with a coded #14 green ground wire. Electrical contractor is to provide earth grounding to the sound cabinets via either system ground rods or building safety ground. All grounding shall be done so that no more than 25 ohms of resistance to ground is maintained. Electrical Contractor shall provide duplex receptacle in ceiling area above mixer amplifier location for installation of sound system transformer.

E. Component, interconnection and cable shield grounds are to be installed so that the system is free of groundloops, hum, noise, instability and crosstalk.

F. Equipment shall be installed as specified. Equipment and installation shall be of a design to eliminate shock hazard to the operators. All equipment for a complete finished system shall be supplied even if not expressly mentioned in these specifications. The complete Audio-Visual system shall be installed and tested per the owner.

G. Only standardized test procedures shall be used for equalization, measurement of impedances, adjusting electrical levels, adjusting sound levels, minimizing hum, polarity measurements, time alignments, etc.

H. The following tests shall be performed on the system and the results shall be included in the operations and maintenance manuals for permanent record.

1. Each speaker line shall be tested for total speaker load impedance.

2. The total system shall be installed from microphone to loudspeakers in absolute polarity. A positive pressure on the microphone shall produce a positive pressure from all loudspeakers.

3.2 TESTING

A. Full test and demonstrate system operation from each location to owner. System shall pass 4K/60 through the system.

B. Source device testing shall be done with owner provide equipment include phones, tablets, Chromebooks, laptops, document cameras, and PCs. Test will not be considered complete until testing is shown to owner with owner provided devices

3.3 TRAINING

A. The contractor shall instruct the owner’s forces in proper operation and routine maintenance of the system. Include minimum 1 hour of training, record all sessions and deliver 3 copies to owner.

B. A complete technical manual with servicing instructions shall become part of the permanent owners’ operations and maintenance manual. It shall include at a minimum:

1. Manufacturer's owners’ manuals on major components, including schematics and parts lists.

2. Complete as built drawings showing internal wiring of all equipment assemblies, wiring between equipment assemblies, running sheets showing color codes and terminal connections of all equipment assemblies and junction boxes.

3. Tap connections of all speaker transformers and power amplifier outputs.

4. Designations and settings of all equalizers, etc. installed in the system.

5. Name, address and telephone number of the installing contractors service organization.

3.4 WARRANTY AND SERVICE

A. The system shall be warranted to be free of defects in materials and workmanship for a period of one year from date of Substantial Completion. During this period any defect shall be repaired or replaced at no charge to the owner

END OF SECTION

SECTION 27 51 23 – INTERCOM AND CLOCK SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. It is the intent of this Section in conjunction with the applicable Drawings to provide an IP based school intercommunication system (System). The System shall provide all of the features specified such as creating paging groups; ad-hoc, live or prerecorded audio broadcasts; administer broadcasts from a secure web interface or IP phone; programmed bell scheduler; message scheduling; simultaneous broadcast to multiple paging groups; and master clock system. The system shall be capable of integrating with Owner's IP Phone System for telephony interface.

B. The bid includes 2 separate prices for evaluation by the owner

1. Alternate Bid 6a – AND equipment with Singlewire Fusion Software

2. Alternate Bid 6b – Telecor Equipment with Singlewire Fusion Software

C. The contractor shall include 5 years of Singlewire Advanced licenses for all devices. Provide copy of licensing to owner.

D. Connect via contacts to the Access Control system. Upon pushing the lockdown/panic button the system shall initiate a lockdown page throughout the school

E. Connect to the owner's voice phone system.

1.2 WORK INCLUDED

A. Provide all labor, materials, tools, and equipment for a complete and operational system as called for in the specifications and Drawings, specifically:

1. Public Address speakers, ceiling mounted, wall mounted horn, both interior and exterior.

2. Volume attenuators as shown on the Drawings to adjust the speaker sound level. Emergency and fire alarm messages shall override volume control.

3. Paging override signal to local sound systems. Coordinate with AV contractor

4. Messaging POE calendar clocks

5. Interactive Graphical User Interface (IGUI) to intercom functions including zone or all page, answering intercom call-ins, selecting and distributing program sources to predefined zones or all zones and facilitating single action activation of multiple system interface e.g. access control and CCTV or other systems as directed by Owner.

6. All System configurations shall utilize Windows-based software. Proprietary software will not be accepted.

7. The System shall have the hardware and software necessary to be connected to the Owner's local area network (LAN) to administer the system. This includes the ability to make bell schedule changes, architectural numbering changes, zoning changes, etc.

1.3 QUALITY ASSURANCE

A. All major System equipment shall be of a single manufacturer, supplied and installed by an authorized factory distributor of the supplied equipment with full warranty privileges. The Contractor shall be authorized by the OEM to pass thru the OEM's warranty of the installed equipment to the District. In addition, the OEM and Contractor shall accept complete responsibility for the design, installation, certification, operation, and physical support for the system. This documentation, along with the system Contractor and OEM certifications must be provided in writing as part of the Contractor's Technical submittal.

B. The Contractor's Technicians assigned to the installation and programming of the system shall be fully trained, qualified, and certified by the OEM on the engineering, installation, operation, and testing of the system. The Contractor shall provide formal written evidence of current OEM certification(s) for the installer(s) as a part of their submittal or to the Consulting Engineer before being allowed to commence work on the system.

C. The System contractor shall have furnished and installed school intercommunication systems continuously for no less than five years.

D. The manufacturer shall provide proof that the system is of a modular design and supported with software updates and improvements to the product. Systems that require major replacement of head-end equipment to upgrade their system will not be acceptable.

E. The System shall be designed specifically for school applications. The System shall be installed by a contractor who has a minimum of three similar school communication systems currently installed and operating satisfactorily in Western Washington.

F. The System contractor shall furnish and install all materials, even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all the specified requirements.

G. All major components shall be listed with the Underwriter's Laboratories. No exception to this will be accepted.

H. The System contractor shall guarantee availability of 24-hour local service by factory- trained personnel of the equipment manufacturer. The contractor shall have available stock of the manufacturer's standard parts.

1.4 FUNCTIONS – COMMUNICATIONS

A. The System shall contain software and hardware for seamless integration between the telephone and intercommunication systems, and will allow access to all of the school related intercom features from the telephone system. The Contractor shall be responsible for coordinating interface requirements with the District IT department.

B. The System shall utilize the Owner-provided VoIP telephones to access all intercom features. The System will be connected via Ethernet switches.

C. The System shall be capable of configuring recipient groups by specifying the parameters. Coordinate actual configuration with District prior to installation.

D. The System shall be capable of programming privileges by user.

E. The system shall provide office or classroom exclusion of loudspeakers from all-call, audio programs, and class change signals to allow for privacy during tests and meetings.

F. Calls to the classroom will provide for calling the loudspeaker for hands-free answer back intercommunication. The system shall provide single-step transfer from loudspeaker to private handset communication. Systems that restrict or prevent this feature will not be acceptable.

G. Provide software for Owner supplied workstations

1.5 TYPICAL CONFIGURATION – NORMAL SCHOOL HOURS

A. Provide for answering call-ins registered in the office area digital display from the office telephones by pressing a single "response" button on any telephone. Systems that require the dialing of multiple digits to answer the call will not be acceptable.

B. Provide for two-way loud-speaking communications with hands-free answer back to any location equipped with a loudspeaker extension.

C. Provide for automatically sounding a warning tone signal over any speaker selected for two-way "amplified voice" communication to alert the classroom teacher to the call and prevent unauthorized monitoring. The warning tone signal shall sound as soon as the speaker is selected, and shall automatically repeat at regular intervals for the duration of the call if no two-way communication occurs. Systems that do not sound a warning tone signal or allow for the canceling of the warning tone signal will not be acceptable.

D. Provide for restriction of all-call announcements and alarm signal origination to certain assigned administrative telephones.

E. Provide for the instantaneous distribution of pre-programmed all-call announcements simultaneously to all locations equipped with speakers by dialing a predetermined code number (i.e. school lock-down situations). Announcements shall be configured using an internal word database that allows for the building of messages to be played. Emergency announcements originating at any authorized telephone shall have priority over all regular system functions. Systems that do not allow for this capability will not be acceptable.

F. Provide for the instantaneous distribution of announcements to 16 pre-scheduled groups of speakers (zone paging capability) from any location equipped with an administrative telephone by dialing a predetermined code number.

1.6 SYSTEM CONFIGURATION – AFTER HOURS

A. Provide for answering of emergency intercom call-ins from a call switch to the office by ringing the office telephones, security office, remote telephone, or cell phone. A voice prompt on the telephone called will provide information regarding the call-in and pressing a single response button on the answering telephone will automatically connect the caller to the area that generated the call-in thus eliminating the need to dial the calling station's number.

1.7 FUNCTIONS – AUDIO PROGRAMMING

A. Transmit audio program from the multimedia control center to any one, several, or all loudspeakers simultaneously.

B. Provide software selection of audio program to any room station, individual zone, group of zones, or all zones.

C. Aurally monitor a program either before or during distribution.

1.8 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For intercom and clock systems.

1. Include plans, elevations, sections, and mounting details.

2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

3. Include diagrams for power, signal, and control wiring.

a. Identify terminals to facilitate installation, operation, and maintenance.

b. Single-line diagram showing interconnection of components.

c. Cabling diagram showing cable routing.

1.9 COORDINATION

A. Coordinate layout and installation of ceiling-mounted speaker microphones and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. A five-year manufacturers warranty shall be provided covering all intercommunications system head-end components, speakers, secondary clocks, and software. A ten-year warranty on all other equipment and the installation of the system shall also be provided. A copy of the warranty shall be submitted in writing with system documentation.

1.11 SPARE PARTS

A. Provide the following spare parts

1. Talkback speaker x 2

2. Clock/Message Board x 2

3. Speaker Baffle x 2

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Software: Singlewire Informacast Advanced

B. Alternate Bid 4A: Hardware: Devices by AND

C. Alternate Bid 4B: Hardware: Devices by Telecor

2.2 GENERAL

A. All materials and equipment installed under this contract shall be new, unused, free of defects, and of current manufacture. Equipment and material shall carry Underwriters Laboratory certification if required by local, state or national codes.

B. System shall have on site controller to allow system to function completely with the loss of the WAN connection

C. UPS shall be provided to keep intercom system functioning for minimum 1 hour after power failure

D. System shall provide for Sip phone integration to the owner's phone system

2.3 SOFTWARE

A. Singlewire InformaCast Fusion with all licensing for head end and all stations for 5 years

B. The intercommunication software shall be capable of provided all the required features and interfacing with other systems.

C. Alerting Features

1. Instant Alerting: Trigger notifications the moment an incident occurs

2. Launch notifications instantly from a virtual or physical panic button, the InformaCast Mobile, or web console.

3. Receive automated weather alerts, early earthquake warnings, gunshot detection, and Internet of Things triggers. Using a variety of methods, including RSS feeds, CAP feeds and email, automatically trigger alerts when predetermined criteria are met.

4. InformaCast Fusion's open API and contact closure integrations to the physical

5. environment, leverage the IoT to trigger alerts from devices like AED cabinets,

6. eyewash stations and more.

D. Communications

1. InformaCast mass notifications can be sent as live and recorded audio to speakers and phones and text can be sent to a desktop computer, deskphone displays, and digital signage.

2. Mobile alerts from InformaCast can be delivered as SMS text, push notification, email and/or recorded audio.

3. Connected devices can trigger visual alerts like flashing strobe lights, digital displays and scrolling text.

4. Visitors self-enroll to receive notifications simply by texting a designated number.

E. Provide Integrated Public Alert and Warning

1. System to have InformaCast notifications broadcast to cell phones within a geographical area where directed by the owner.

F. Command Center

1. InformaCast Command Center to quickly send alerts for common scenarios.

2. Customize easy-to-identify buttons for different situations and provide relevant details about what's happening.

3. Send notifications that ask for a response to gain realtime insights into who is safe and who needs help.

4. Utilize dynamic replies to send relevant follow up messages based on someone's response.

5. Quickly gather key stakeholders in Microsoft Teams, Webex, Zoom or on a conference call to assess the situation and deploy assistance.

G. Compatible devices

1. InformaCast Fusion can connect to a wide array of devices to consolidate management into a single system and add value to existing technology investments by leveraging them for safety. Compatible devices include

a. AND, Atlas, Valcom IP Speakers

b. AND Panic Buttons

c. AND, Atlas, and Valcom Zoom Controls

d. Telecor E Series

H. Administration and Usability

1. Each InformaCast Fusion user can have multiple phone numbers, emails and devices associated with their profile.

2. Use Active Directory or other LDAP directories to keep your user information automatically synchronized.

3. Bulk upload of user information with the User Loader tool.

4. Self registration and self-service to receive the notifications that are most relevant to them, relieving the administrative burden.

5. Configure custom branding, including new primary colors, secondary colors, logos, and even custom help content.

I. Target Notifications

1. Create groups to send select messages to the right people.

2. Designate zones to deliver messages to a specific building, wing or floor without disrupting other areas.

J. Scalable Deployment

1. InformaCast Fusion is built for growth, whether your organization needs to reach 100 people or 100,000.

K. Security

1. Messages are encrypted in transit and at rest.

2. Domains and permissions mean only those with authority can trigger messages.

3. Independent third party testing is conducted on a regular basis to ensure InformaCast Fusion is built to withstand current security threats.

L. Reporting

1. View reports that show whether your notification was delivered successfully and who read it once it was received.

2. Analyze notification results to understand how long it took notifications to be sent to different devices and users.

3. Receive actionable insights to make adjustments for future incidents.

2.4 HEAD END

A. Alternate Bid 4A

1. The software version of InformaCast Advanced requires users to have virtual computing resources Provide the InformaCast Advanced Server Appliance to meet informacast minimum specifications

2. Computing Specifications:

a. Intel quad-core processor I7 or equal

b. Minimum 16 GB RAM

c. Minimum 512 GB SSD

d. Hardware Ports:

1) DisplayPort (preferred console monitor) or HDMI

2) Gigabit Ethernet LAN port (non-power over Ethernet)

3) USB 3.0 or USB-C port (keyboard access)

e. UL 60950 certified.

B. Alternate Bid 4B

1. Telecor Head End

a. Telecor ETBU-MI Ethernet Termination Unit -

b. Telecor EMH eSeries Master Clock & Message Host

c. Telecor E300-MA eConsole Model A

d. Telecor ECI-MA Control Interface Model A

e. Telecor EPORT-MC management Interface Model C

f. Telecor ESIP SIP Interfce

g. Telecor EAMP-MA

h. Telecor ESBM-TB

i. Telecor EDSKT-1.1

j. Telecor SI-125

k. Telecor SI-250

l. Telecor 2406

m. Telecor 2481-TBP

2.5 INTERCOM AND PUBLIC ADDRESS OPERATION

A. Each room shall be equipped with an IP display and speaker unit with enclosed microphone and indicator light.

B. All speakers shall broadcast announcements and other audio messaging individually, as zoned, or all together.

C. Common zone analog paging speakers with an amplifier shall connect to the network using a ZONE C2 zone controller, which can also receive a microphone signal via a single pair wire. This is permitted only where specifically shown on the docuemnts.

D. The system shall use Power-over-Ethernet (PoE) network switches to deliver at least twelve (12.9) watts RMS to each endpoint.

E. The system shall provide the capability of assigning IP device locations to any one or more of the software programmable zones for target paging and messaging.

F. Provide for the distribution of emergency announcements and for the distribution of manually activated visual and audio alerts to all locations with speakers from any authorized web interface.

G. Through programming, it shall be possible to exclude selected speakers from the reception of paging and messaging.

H. Provide capability of restricting the origination of emergency announcements, all page, zone page, and alarm messaging origination to specific assigned stations.

I. Provide a Priority Paging Microphone for use by administrative personnel. The microphone shall be a desk type with a locking Push-to-Talk bar. When the Push-to-Talk bar is pressed, the system shall automatically initiate an all-page from the microphone.

J. The system shall also provide the capability of initiating audio and visual alerts manually from a web interface.

2.6 PROGRAM DISTRIBUTION OPERATION

A. The system shall provide for the streaming of audio.

B. The system shall provide facilities to stream audio (i.e. music, radio broadcasts).

C. Selected AND IP devices shall be configured to receive a stream of audio at a specified common multicast IP address. One AND IP device shall be configured to broadcast the audio on its line in to the specified common multicast IP address.

D. The staff member shall approach the “remote program and microphone interface” (music input jacks connected to the line-in of an AND IP device) and plug in a program source such as a radio, tape or CD player, or mp3 player.

E. Audio played from the program source shall be broadcast to the selected AND IP devices per the configuration.

F. Power Resets

2.7 CLOCK AND BELL SCHEDULE SYSTEM FUNCTIONS / OPERATION

A. The server shall provide a bell/tone scheduler with the following minimum capabilities:

1. The system shall provide the capacity for storing 255 or more events.

2. The system shall provide a minimum of 4 bell schedules to allow flexibility due to seasonal changes or special events. One or more of the schedules may be active at any given time.

3. Classroom speakers may be assigned to any one or more zones. The system shall provide the ability to distribute class change signals to any or all of the zones. Time Zones shall be separate from paging zones. The system shall provide separate bell duration for each zone.

4. The system shall provide up to sixteen (16) programmable holidays with fully automatic holiday program execution. Bells can be silenced or special schedules can be implemented. Normal bells will resume after the holiday period.

5. The system shall provide Automatic Daylight Savings Time Change. The time will be updated automatically when the server detects daylight savings changes.

6. The system shall provide the ability to review, edit, and delete events and schedules. Editing may take place via a web browser on computer within the network with sufficient access privileges.

7. The system shall provide the ability to test all output zones.

8. The system shall provide a time base based on atomic time gathered from an NTP server or the third-party software server for assured accuracy.

2.8 PERIPHERAL EQUIPMENT

A. Alternate Bid 4 A

1. Intercom Call-in Switch

a. Advanced Network Devices AND-BTN-KIT-1 single call switch for IP LED display models. The pushbutton shall be the momentary contact type. Intercom calls or pages are placed by momentarily depressing the pushbutton. Call switches shall be installed in all locations designated on the plans.

1) The switches shall be mounted on a single-gang brushed stainless steel faceplate.

2) Each switch shall each be connected to the GPIO input of one Advanced Network Devices display/speaker device via 2-conductor 22-gauge cable.

2. Advanced Network Devices BTN-KIT-MIC-ND for IP speaker models with no displays or IP LCD display models (IPSWDHD-MW or IPCSHD-MB). The pushbutton shall be the momentary contact type. Intercom calls or pages are placed by momentarily depressing the pushbutton. Call switches shall be installed in all locations designated on the plans.

a. The switches shall be mounted on a single-gang brushed stainless steel faceplate.

b. Each switch shall each be connected to the module of one Advanced Network Devices speaker via RJ25 (6P6C) cable.

3. IP Devices

a. Classrooms and Offices: Provide combination display/speaker device

1) Standard Resolution Display

a) The speaker and baffle assembly shall be an Advanced Network Devices IP LED display device with speaker (IPSWD-RWB), furnished and installed as indicated on the plans.

b) The speaker on the IP device shall be an 8" (20.32 cm) permanent magnet dual-cone type having a ceramic magnet. It shall have a frequency range of at least 60 Hz to 17,000 Hz, a 10-watt RMS program power-handling capability, and an axial sensitivity of at least 95 dB at 1 meter with a 1-watt input. The voice coil shall have 8-ohm impedance.

c) The speaker shall accept power from any IEEE802.3af (PoE) or IEEE802.3at (PoE+) compliant network switch or injector.

d) The LED display device shall include a 56 x 16 multi-color LED display capable of displaying the current time and any messages sent from the server.

e) The baffle shall be constructed of 18-gauge (IPSWD-RWB) or 22-gauge (IPSWS) cold rolled steel, and have a semi-gloss white baked epoxy finish.

2) Music Classrooms shall be provided with an external strobe to indicate announcements. IPSTROBE-I

b. Hallways:

1) Standard Definition Display

a) The display/speaker and baffle assembly shall be an Advanced Network Devices IP LED display device with speaker (IPCDS-RWB-U), furnished and installed as indicated on the plans.

b) The display/speaker shall accept power from any IEEE802.3af (PoE) or IEEE802.3at (PoE+) compliant network switch.

c) The LED display shall include a 56 x 16 multi-color LED display capable of displaying the current time and any messages sent from the server on both sides of the device.

d) The display/speaker and baffle assembly shall include secure mounting that can mount either to the wall or to the ceiling.

e) The baffle shall be constructed of 18-gauge (IPCDS-RWB-U or IPCSHD-DS-MB) cold rolled steel, and have a stainless-steel finish (IPCSHD-RWB-U), or matte black baked epoxy finish (IPCSHD-DS-MB).

4. Gymnasium and Large Commons:

a. Standard Definition

1) The speaker and baffle assembly shall be an Advanced Network Devices Large IP Signboard display device with speaker (IPSIGNL-RWB) and/or IP speaker (IPSWS) or as approved, furnished and installed as indicated on the plans.

2) The speaker shall be an 8" (20.32 cm) permanent magnet dual-cone type having a ceramic magnet. It shall have a frequency range of at least 60 Hz to 17,000 Hz, a 10-watt RMS program power-handling capability, and an axial sensitivity of at least 95 dB at 1 meter with a 1-watt input. The voice coil shall have 8-ohm impedance.

3) The speaker shall accept power from any IEEE802.3af (PoE) or IEEE802.3at (PoE+) compliant network switch or injector.

4) The LED display shall include a 56 x 16 multi-color LED display capable of displaying the current time and any messages sent from the server.

5) The baffle shall be constructed of 18-gauge (IPSIGNL-RWB) or 22-gauge (IPSWS) cold rolled steel, and have a stainless-steel finish (IPSIGNL-RWB) or semi-gloss white baked epoxy finish (IPSWS).

b. Provide Strobe to indicate announcements IPStrobe-1

5. Enclosures

a. Flush Mount - Classroom, hallway and wherever possible

1) Where speakers are to be recessed in walls, enclosures shall be Advanced Network Devices IPS-FM1 (for IPSWD-RWB), or Advanced Network Devices IPS-FM2 (for IPSWS), or as approved. The enclosure shall be constructed of 22-gauge galvanized steel, zinc treated, and have a semi-gloss white baked epoxy finish. The IPS-FM2 enclosure shall have a dimension of 10.75” square and 3.75” deep. The IPS-FM1 enclosure shall be 11.5 x 14.5” and 3.75” deep.

b. Surface Mount – Not to be used unless specifically accepted by engineer.

1) Where speakers are to be surface mounted, enclosures shall be Advanced Network Devices IPS-SM1 (for IPSWD-RWB), or Advanced Network Devices IPS-SM2 (included with IPSWS-SM), or as approved. The enclosure shall be constructed of 22-gauge (IPS-SM1) or 16-gauge (IPS-SM2) galvanized steel, and have a semi-gloss white baked epoxy finish. The IPS-SM2 enclosure shall have a dimension of 11.75” square and 4” deep. The IPS-SM1 enclosure shall be 13.25 x 14.5” and 4.75” deep. Note: The LCD display device (IPSWDHD-MW) ships with the surface-mounted back box.

c. Contractor will need to coordinate with other divisions for locating speakers to avoid conflicts and for optimal sound coverage.

6. Ceiling Speakers

a. Ceiling mounted speakers shall be an Advanced Network Devices IPSCM or IPSCM-RMe or as approved. The IPSCM shall be a lay-in ceiling tile replacement speaker and enclosure with dimensions 2 x 2 ft square. The IPSCM-RMe shall be a single speaker with 10.5” round baffles constructed of 16-gauge steel, with a semi-gloss white baked epoxy finish.

b. The speaker shall be an 8" (20.32 cm) permanent magnet dual-cone type having a ceramic magnet. It shall have a frequency range of at least 60 Hz to 17,000 Hz, a 10-watt RMS program power-handling capability, and an axial sensitivity of at least 95 dB at 1 meter with a 1-watt input. The voice coil shall have 8-ohm impedance.

c. The speaker shall accept power from any IEEE802.3af (PoE) or IEEE802.3at (PoE+) compliant network switch or injector.

d. Drop ceiling device where shown (IPSCM-RM-CB and IPSCM-RM-BB backbox

7. Outdoor Speakers

a. Outdoor paging speakers shall be an Advanced Network Devices IPSWS-SM-O weather-resistant compressed horn speaker. The baffle and enclosure shall be constructed of 16-gauge galvanized steel, with a semi-gloss white baked epoxy finish. The enclosure shall have a dimension of 11.75” square and 4” deep.

b. The paging speaker shall be a double re-entrant horn, compression type loudspeaker. It shall have a frequency range of at least 600 Hz to 14,000 Hz, at least 10W RMS program power-handling capability, and an axial sensitivity of at least 104 dB at 1 meter with a 1-watt input, and 8-ohm impedance.

c. The speaker shall accept power from any IEEE802.3af (PoE) or IEEE802.3at (PoE+) compliant network switch or injector.

d. Wire Types: All wiring to telephones and speakers is 8 conductor, 24-gauge un-shielded CAT5 Ethernet cable or better.

8. Stand alone Displays

a. The display clock shall be a IPCSHD (Double Sided where indicated)-MB

b. The display shall accept power from any IEEE802.3at (PoE+) compliant network switch.

c. The LCD display device shall include an LCD display of at least 4" x 11.5" size capable of displaying full-color graphics and images, the current time, and any messages sent from the server on both sides of the device.

9. Where analog devices are allowed (only where specifically shown on the plans) provide a ZoneC2 zone controller and amplifier

B. Alternate Bid 4B

1. Clock/Speaker/Strobe: Telecor E2444-LD-MA with flush backbox

2. E365-TB-STB-MA with strobe: ELD-1 for gym and commons

3. eCS-1 Call Switch

4. Telecor eCS-5 Volume Control

5. Dual display corridor meassage boards

6. Telecor eSeries E2444-BBF Recessed Backbox for e2444

7. Teleocr es8 talk back speaker

8. Telecor eS8-R Speakers (No Talk Back Speaker)

9. Telecor H10 Ceiling Back Box

10. Telecor T7 Tile Bridge

11. Telecor eS8-SQ Speaker with Square Baffle

12. Telecor H20 Wall Back Box

13. Telecor eAMP Amplifier

14. Atlas 161-RES Recessed Speaker Enclosure

15. Atlas VP161-APF Vandal Proof Baffle

16. Telecor eS8-R Speakers W/O Baffle (No Talk Back Wall Speaker)

17. Atlas VP161-R8 Recessed Vandal Proof Speaker (Gym)

18. Atlas 193-8 Box

19. American Time STI9740 Clock Speaker Wire Guards (Gym)

20. Port module

21. Amp

2.9 EXTERIOR BELL

A. Exterior bell as directed by owner

B. Each bell shall be provided with a 24VAC Class II transformer. Associated conduit and four-square box will be provided by the electrical contractor.

2.10 ANALOG DEVICES

A. Analog devices shall be provided only where specifically indicated on the drawings and grouped in zones per the drawings. All devices are IP unless noted.

1. Alternate Bid 4A

a. AND: IPSMOD acts as an IP endpoint hub for a single analog speaker: Drives a traditional 8-ohm speaker

b. AND ZONEC2 acts as an IP endpoint hub for An amplifier with traditional analog speakers

c. And: ZONE-LO acts as an endpoint for an amplifier connected to existing traditional speakers.

d. Speaker Amplifer: Bogen, Atlast or approved equal

e. Ceiling Speakers: SD72 Speaker, 62-8 Baffle, CS95-8 Back Box, and 81-8R T-Bar Bridge Kit. Provide EZ95 backbox where required.

f. Wall Speakers: Atlas D161 series with 198-8 backbox

g. Exterior Wall speakers: Atlas #VP14MB with 198-8 backbox

2. Alternate Bid 4B

a. Telecor Eport Drives a traditional 8-ohm speaker

b. Teleocr Eamp

c. Speaker Amplifer: Teleocr or approved equal

d. Ceiling Speakers: S8, Back Box, and 81-8R T-Bar Bridge Kit. Provide EZ95 backbox where required.

e. Wall Speakers: S8 series with 198-8 backbox

f. Exterior Wall speakers: Atlas #VP with speaker

2.11 ETHERNET SWITCHES

A. Owner shall provide POE switches for all devices connected to system

B. Switches shall support but not be limited to the following features

1. Support POE for all devices

2. Managed

3. Larer 2 minimum connectivity

4. Remtoe configuration

5. Prioritization

C. Manufacturer: As directed by the owner

2.12 UNINTERRUPTABLE POWER SUPPLY

A. In 271500

2.13 CABLING

A. All IP data cabling provided under 271500

B. All other cabling as required by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install system in accordance with manufacturer's instructions.

B. Boxes, equipment, speakers, clocks, etc shall be installed plumb and square.

C. Do not support speaker enclosures with lay in tiles or gypsum wall board. Provide adequate support for back-boxes so that no perceptible sag will occur once speaker and grille are mounted.

D. All installation shall be done in a neat and professional manner.

E. Configure software to meet specified functionality and provide a fully functional and operational system.

F. System shall be rack mounted in the MDF and IDF

G. Clock headend equipment shall be installed in MDF

3.2 CABLING

A. Cabling to support the System shall be as required by the manufacturer.

B. IP/POE cabling provided in 271500

3.3 START-UP

A. Review test reports prior to starting speaker and clock installation

B. Review all station numbers with the owner prior to final programming

C. Install software with IP interface complete. Confirm functionality with the owner

D. Program and synchronize all clocks complete. Connect master clock to master system

E. Connect owner's phone system

F. Coordinate with Security/Access Control contractor to receive signal and broadcast multiple lockdown messages throughout the school

G. Cycle through Daylight Savings Time and verify correct time change on all clocks. Document results and include in as-built documentation.

3.4 SYSTEM PROGRAMMING

A. Programming: Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative:

B. Tests and Inspections:

1. Schedule tests with at least seven days' advance notice of test performance.

2. After installing educational intercommunications and program systems and after electrical circuitry has been energized, test for compliance with requirements.

3. Operational Test: Test originating station-to-station, all-call, and page messages at each station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.

4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:

a. Disconnect speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure signal-to-noise ratio at speakers.

b. Repeat test for three speaker microphones.

c. Minimum acceptable ratio is 45 dB.

5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each speaker. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 5 percent total harmonics.

6. Signal Ground Test: Measure and report ground resistance at system signal ground.

C. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging and independent room speaker-line matching transformers.

3.6 TRAINING

A. A minimum of (2) 6 hour sessions shall be included for instruction of the personnel designated by the Owner as to the correct operation of the system. One additional four hour follow-up session will provide 6 months after system acceptance.

B. Provide system training to Owner which addresses all phases of operation including:

C. Remote access methodology

D. Build standard daily schedule for purposes of test and verification of operation.

END OF SECTION

SECTION 28 13 00 – ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Verkada cloud-based access control solution including cloud-based management platform using Verkada Command and the Verkada Pass App
2. AC41 4-Door Controller
3. AC42 4-Door Controller
4. AX11 IO Controller with Video Analytics Event Bridge
5. integration with Allegion Schlage AD Series (AD300, AD400, PIM400) and the Engage series (NDEB, LE, LEB) wireless locks
6. AD31 Multi-Format Card Reader
7. AD32 Multi-Format Card Reader
8. Verkada Badge Printing Software
9. ACC-Prox-1 Proximity Cards
10. Verkada Access Control accessories

B. Related Sections

1. 28 15 23 – Intercom Entry Systems
2. 28 17 11 – Visitor Management Systems
3. 28 20 00 – Video Surveillance
4. 28 30 00 – Environmental Sensor
5. 28 31 00 – Intrusion Detection

1.2 REFERENCES

A. Published specifications, standards, tests, Codes, or recommended standards of trade, industry, or governmental organizations apply to work in these Sections, including:

1. ADA – Americans with Disabilities Act
2. ANSI – American National Standards Institute
3. ASCII – American Standard Code for Information Interchange
4. ASTM – American Society for Testing and Materials
5. IBC – International Building Code
6. IEEE – Institute of Electrical and Electronics Engineers

7. ISO/IEC – International Organization for Standardization / International Electrotechnical Commission

8. NEC – National Electrical Code

9. NEMA – National Electrical Manufacturers' Association

10. NFPA – National Fire Protection Association

11. TIA/EIA – Telecommunications Industry Association / Electronic Industries Alliance

12. UL – Underwriters Laboratories, Inc.

1.3 DEFINITIONS

A. Abbreviations:

1. ACS – Access Control System

2. API – Application Programming Interface

3. DHCP – Dynamic Host Configuration Protocol

4. DPDT – Double pole, double throw

5. IP – Internet Protocol

6. LAN – Local Area Network

7. NFC – Near Field Communications

8. NVR – Network Video Recorder

9. ODBC – Open Database Connectivity

10. RAM – Random Access Memory

11. SPDT – Single pole, double throw

12. SSL – Secure Sockets Layer

13. SSO – Single sign-on

14. TCP – Transport Control Protocol

15. UPS – Uninterruptible Power Supply

16. VMS – Video Management System

17. Definitions:

18. ABA Track: Magnetic stripe that is encoded on track 2, at 75-bpi density in binary-coded decimal format.

19. Proximity Readers and Credentials: Readers and cards employing 125 KHz communication to validate when the card is presented within the proximity of the card reader.

20. Smart Card Readers and Contactless credentials: Readers and cards employing 13.56 MHz encrypted communication to validate when the card is presented within the proximity of the card reader.

21. Credential: Data assigned to an entity and used to identify that entity.

22. Trigger: Enables an action or a series of actions that are sent across any or all controllers, readers, contacts, or relays throughout the system. Triggers can be used to send commands to change the state of a door, multiple doors, contact states, relay states, shunt points, lockdowns or to activate predetermined overrides.

23. Pass-Through: The ability assigned to a person's credential that allows them to access a door even if in lockdown state.

24. Lockdown: An input or a credential that allows the system to be placed into a lockdown state.

25. Wiegand: Patented magnetic principle that originally used specially treated wires embedded in the credential card. Today Wiegand has become the communication standard for most reader heads.

1.4 SYSTEM DESCRIPTION

A. Cloud-based electronic access control platform, controllers, access control credential readers, and bridging hardware necessary to provide integrated access control for entry points.

B. Bridging to Fire Life Safety systems, video surveillance, and alarms.

C. Verkada Command: Access Control Cloud-Based Management Software

1. User Management and Permissions

a. Import Users via CSV or add users manually

a. Manage Users and Groups automatically with 3rd party IDPs via SCIM including (but not limited to) Okta, Azure AD, CyberArk

b. Control door access via user groups and Access Levels

c. Assign multi-format Credentials including cards, pins, and mobile Bluetooth access

d. Support bulk upload of User Photos for use in system display and card management

2. Door and Peripheral Management

a. Catalog events including live and historical footage

b. Filter by events such as unlocks, door opens, and access granted or denied

c. Create custom lock / access control / unlock / card + pin code schedules

d. Programmable inputs and outputs

e. Support for elevators security via configurable outputs

3. Video Integration

a. Associate existing Verkada cameras with doors

b. Add multiple cameras to see events from multiple angles

c. Video events associated with any individual

4. Site Management

a. Manage admins on a site-by-site basis. Allow certain Users the ability manage one site and not another.

b. Support for different Admin roles within the management platform

5. Alerting and Events

a. Configure real-time alerts via SMS or Email

b. Configurable alerts based on Door Held Open / Door Forced Open, Access Granted, Door Opens, Lockdowns, Offline, or Aux Trigger

c. Alerts can be configured to only dispatch on a configurable schedule

6. Lockdown Capabilities

a. Trigger a Lockdown via a wired button, wireless button, mobile app, or web

b. System supports configurable User Groups to trigger Lockdowns

c. System supports configurable User Groups for Access during Lockdowns

d. System supports configurable User Groups for resolving / disabling Lockdowns

7. Reporting

a. Standard reporting and export of data

b. System support Roll Call / Mustering Reporting

D. Verkada Pass App Touchless Entry via BLE

1. Verkada Pass App for either iOS or Android facilitates access control events through either tapping from inside the app or through Touchless Access via Bluetooth.

1.5 SUBMITTALS

A. Provide the following submittals for review and approval:

1. Product Data and Shop Drawings

2. System Programming

3. Operation and Maintenance Manuals (O&M's)

4. "As-Built" Record Drawings

B. Submit Product Data and Shop Drawings submittals for review and approval prior to commencement of work:

1. Manufacturer's name, brand name, exact part number, options, accessories, and catalog cutsheet references for all equipment supplied including cabling. Include manufacturer's published installation instructions. Indicate UL listings for system components.

2. Complete wiring diagrams for all components, including cable types and quantities, routings, floor plans indicating device locations, conduit sizes, and point-to-point termination and riser diagrams.

3. Device legend on the shop drawings that identifies the symbols used for all devices including mounting heights, back box requirements, part and model numbers, operating voltages (if applicable), wire and cabling requirements, label text, and panel termination points.

4. Fully dimensioned shop drawings including floorplans, enlarged plans, elevations, and installation details of all security devices, equipment rooms and closets, consoles, controllers, racks, enclosures, and fabricated equipment, showing locations of all major components including mounting details. Indicate UL system and rating listings for penetration firestop systems through rated partitions and floors.

5. Bill of Materials.

6. Material Safety Data Sheets (MSDS) for fire stopping materials and sealants.

C. Submit System Programming submittals for review and approval prior to commencement of work:

1. Proposed programming, including nomenclature conventions, device names and text descriptions, timings, camera call-up trigger alarms with associated cameras, and sequence of operations.

2. Approved device names and text descriptions as programmed into the security systems shall be reflected on the “As-Built” Record Drawings as well as on device and cable labels.

D. Submit Operation and Maintenance Manuals (O&M’s) submittals for review and approval prior to the completion of the project:

1. Updated product data and shop drawings submittals reflecting the final conditions.

2. Warranty letter with start and end date.

3. Warranty service and maintenance contact information: including names, address, phone number, and website address. Provide specific instructions or forms as required to initiate a trouble ticket or work order request.

4. Letter indicating that all software and licensing is the sole property of the Owner.

5. Troubleshooting checklist information.

6. Replacement parts and consumables ordering information including the contact information for local sources.

7. Provide an updated System Programming submittal including:

a. Final listing of doors, locations, and normal status in CSV format.

b. System administration and management operating instructions.

c. Setting up Users, User Groups, Access Levels, Doors, Door Schedules, and Exceptions

d. Assigning Access Groups to all Users.

e. Monitoring system activity.

f. Running standard reports.

g. Setting up logins and permissions.

E. Submit “As-Built” Record Drawings submittals for review and approval prior to the completion of the project:

1. Maintain a complete set of “As-Built” Record Drawings at the project site updated with mark-ups of the actual installation conditions.

2. Prior to the completion of the project transfer all installation conditions mark-ups to electronic drawings and submit to the Owner in CAD and PDF formats.

1.6 QUALITY ASSURANCE

A. Equipment shall be tested and found to comply with the limits for a Class A or B digital device, pursuant to part 15 of the FCC rules.

B. Security technology devices shall be mounted using compatible Verkada accessories.

C. Security technology devices shall be of the latest technology. No discontinued models or products are acceptable.

D. Installation technicians shall successfully complete the Verkada Certified Engineer (VCE) program prior to starting work. For more information, visit www.verkada.com/partners/trainings.

E. Contractor qualifications:

1. Minimum of two years of system design, engineering supervision, and installation experience in the access control industry.

2. Maintain a local office, with a service center staffed by trained technicians and must be adequately equipped to provide emergency phone service within 24 hours on a 24-hour, 365 days per year basis, whether or not the Owner purchases a maintenance contract with the Contractor.

3. Maintain an inventory of spare parts and other items critical to system operation, as necessary to meet the emergency service requirements.

4. Maintain an in-house engineering and project management capability consistent with the requirements of this project.

5. Provide a project manager who is actively engaged in the project. This person shall be the same individual throughout the course of the project and shall be the person responsible for the scheduling of the system programming, preparation of the submittals and project close-out documentation, training programs, system testing and report documentation, and the coordination of all subcontract labor. The Owner reserves the right to approve the Contractor’s project manager.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Ship equipment in original packaging to prevent damage. All handling shall be in accordance with manufacturer recommendations. Inspect all products and materials for any damage immediately upon delivery to the project site.

B. Provide protective covering during construction.

C. Replace equipment and products damaged during shipping, handling, distribution, storage, installation, or construction with new equipment and products.

D. Equipment and products stored at the project site or at an off-site location shall be protected from dust, dirt, and foreign matter. Protect equipment and products from water, damage, dents, bumps, and scratches.

1.8 SCHEDULING

A. Submit proposed construction schedule detailing the task milestones, durations, and sequences for the project for review and approval prior to commencement of work.

B. When work is performed in a sensitive area or in an area occupied with ongoing business activities coordinate with the Owner and the affected department's representative to determine the best time to perform the work required.

1.9 WARRANTY

A. Provide one-year parts and labor project warranty. Parts and labor shall be guaranteed against defects in materials and workmanship for one year from written notification of acceptance.

B. All Verkada hardware purchases are backed by a 10-year limited warranty. For more information, visit www.verkada.com/support/end-user-agreement.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer shall be Verkada Inc.

1. Headquarters: 405 E 4th Ave. San Mateo, CA 94401

2. Toll Free: (888) 829-0668

3. General: team@verkada.com

4. Sales: sales@verkada.com

5. Website: www.verkada.com

B. Non-Verkada Inc. products shall be limited to those identified as compatible within the product descriptions below.

2.2 LICENSING

A. Provide all required licenses for the specified system components.

B. All system component licenses shall be 5-year licenses.

2.3 DOOR CONTROLLERS

A. AC41 4-Door Controller by Verkada Inc.

1. Description: access control hardware controller provides power and control for up to 4 sets of access control hardware. Provides fire alarm interface and auxiliary signal integration into the access control system.

2. Technical Specifications

a. Power Consumption (at 10-14V):

1) No Readers: 1000mA

2) 4 Wiegand Readers: 2200mA

b. Power Supply: 160W PSU (capped at 100W for safety)

c. Relays:

1) Dry (External Power Supply): 6 Relays – 4 Door, 2 AUX at 500mA / 30VDC

2) Wet (Powered by AC41): 12V - 700mA per relay max, 24V - 350mA per relay max

d. Inputs: Nominal 5VDC: 1Kohm to each input (resistors built-in)

e. Contact Sensors: 4 Contact Sensors: Nominal 5VDC, 1Kohm to each input (resistors built-in)

f. Dimensions:

1) With Mount:

a) Length: 415.6mm / 16.36in

b) Width: 319.6mm / 12.58in

c) Height: 111.74mm / 4.4in

2) Without Mount:

a) Length: 415.6mm / 16.36in

b) Width: 319.6mm / 12.58in

c) Height: 105.74mm / 4.16in

g. Weight: 8.5kg / 18.74lb

h. Operating Temperature: 0°C to 50°C / 32°F to 122°F

i. Operating Humidity: 5% to 90%

j. Compliance:

1) FCC, CE

2) UL 294

3) UL 62368-1/CSA C22.2

4) CAN/ULC-60839-11-1:2016

5) NDAA

k. Connectivity:

1) Ethernet: 100/1000Mbps RJ-45 cable connector for network connection

2) USB: USB 2.0

l. Included Accessories:

1) Setup guide

2) Screw pack

m. Mounting Hardware: Dry wall anchors (M8) and screws (M5)

n. Network Settings:

1) An Ethernet connection with DHCP must be used to connect the AC41 to the Local Area Network (LAN).

2) Firewall settings: TCP port 443, UDP port 123 (NTP time synchronization)

B. AC42 4-Door Controller by Verkada Inc.

1. Description: access control hardware controller provides power and control for up to 4 sets of access control hardware. Provides fire alarm interface and auxiliary signal integration into the access control system.

2. Technical Specifications

a. Power Consumption: 60W maximum

b. AC Power Input:

1) 100 to 240VAC

2) 50 / 60Hz

3) 1.5A maximum

c. AUX Power: 1x 12V @ 250mA

d. Inputs:

1) 2x REX dry inputs per door

2) 1x DPI dry input per door

3) 2x auxiliary dry inputs

e. Readers:

1) 1x reader port (Verkada/RS-485 or Wigand) per door

2) Reader current consumption must be less than 250mA per reader.

3) Maximum of 4 readers powered simultaneously.

f. Dry Relays:

1) Dry relay max pass-through power: 24VDC @ 2A (resistive load)

2) 2x auxiliary dry relays

g. Wet Relays:

1) Wet relay switch-selectable power:

a) 12V operation: 700mA maximum

b) 24V operation: 350mA maximum

h. Contact Sensors:

1) 4x contact sensors

2) Nominal 5VDC

3) 1Kohm to each input (resistors built-in)

i. Dimensions:

1) With Mount:

a) Depth: 116.25mm / 4.6in

b) Width: 321mm / 12.6in

c) Height: 417mm / 16.4in

j. Weight: 6.35kg / 13.9lb

k. Operating Temperature: 0°C to 50°C / 32°F to 122°F

l. Operating Humidity: 5% to 90%

m. Compliance:

1) FCC, CE

2) UL 294

3) UL 62368-1/CSA C22.2

4) CAN/ULC-60839-11-1:2016

5) NDAA

n. Connectivity:

1) Ethernet: 100/1000Mbps RJ-45 cable connector for network connection

2) USB: USB 2.0

o. Included Accessories:

1) Lock key

2) Flat head screwdriver

p. Mounting Hardware: Mounting plate and 4 wood screws

q. Network Settings:

1) An Ethernet connection with DHCP must be used to connect the AC41 to the Local Area Network (LAN).

2) Firewall settings: TCP port 443, UDP port 123 (NTP time synchronization)

C. AC62 16-Door Controller by Verkada Inc.

1. Description: access control hardware controller provides power and control for up to 16 sets of access control hardware. Provides fire alarm interface and auxiliary signal integration into the access control system.

2. Technical Specifications

   a. Power Consumption: 350W maximum

   b. AC Power Input: 110-240VAC, 50-60Hz

   c. Inputs:

      1) 2x REX dry inputs per door

      2) 1x DPI dry input per door

      3) 2x auxiliary dry inputs

   d. Readers:

      1) 1x reader port (Verkada/RS-485 or Wiegand) per door

      2) 2x auxiliary reader ports (Verkada/RS-485)

      3) Reader current consumption must be < 250mA per reader

      4) Maximum of 16 readers can be powered simultaneously

   e. Relay Outputs:

      1) 1x wet or dry relay per door

      2) Wet relay switch-selectable power:

         a) 12V operation: 1A max

         b) 24V operation: 0.5A max

      3) 2x auxiliary dry relays

      4) Dry relay max pass-through power: 24VDC @ 2A (resistive load)

   f. AUX Power:

      1) 2x 12V @ 1A output

      2) 2x 24V @ 0.5A output

   g. Dimensions:

      1) Length: 773mm / 30in

      2) Width: 499mm / 20in

      3) Height: 186mm / 7in

   h. Weight: 20kg / 44lb

   i. Operating Temperature: 0°C to 50°C / 32°F to 122°F

   j. Operating Humidity: 5% to 90%

k. Compliance:

1) FCC Part 15 Class B

2) ICES-3 Class B

3) CE

4) UKCA

5) RCM

6) VCCI

7) UL 294

8) CAN/ULC 60839-11-1

9) UL 62368-1

10) CSA C22.2 No. 62368-1

11) IEC 62368-1

12) NDAA

l. Connectivity:

1) Ethernet: 100/1000Mbps RJ-45 for network connection

2) USB: USB 2.0

m. Included Accessories:

1) Lock key

2) Flat head screwdriver

n. Mounting Hardware: Mounting plate and 6 screws (#12x1")

2.4 IO CONTROLLERS

A. AX11 IO Controller by Verkada Inc.

1. Description:

a. Input/output controller which bridges up to 16 non-Verkada endpoint devices to a Verkada Command system.

b. Provides 16 AUX inputs and outputs.

c. Event Bridge: Bring door events with video analytics into Command while continuing to use existing 3rd-party access control or alarm system.

d. Support for both Verkada (over RS-485) and 3rd party card readers (over Wiegand).

e. 2x 12 Volt 4.5 Ah Sealed Lead Acid Rechargeable batteries for battery backup.

2. Technical Specifications

a. Power Consumption: 60W Max

b. Power Supply: 110-240VAC, 50-60Hz

c. Inputs: 16 Dry Inputs, Nominal 5VDC

d. Relay Outputs:

1) 16 Dry Relays

2) 1A/24VDC Contacts

e. Aux Power:

1) 16 inputs

2) 16 outputs

3) 2 External Outputs

4) 1A/12V Power Each

5) 2A Combined Max

f. Dimensions:

1) With Mount:

a) Length: 415.6mm / 16.36in

b) Width: 319.6mm / 12.58in

c) Height: 111.74mm / 4.4in

2) Without Mount:

a) Length: 415.6mm / 16.36in

b) Width: 319.6mm / 12.58in

c) Height: 105.74mm / 4.16in

g. Weight: 8.3kg / 18.3lbs

h. Operating Temperature: 0°C to 50°C / 32°F to 122°F

i. Operating Humidity: 5% to 90%

j. Compliance:

1) FCC

2) CE

3) UL 294

4) UL 62368-1/CSA C22.2

5) CAN/ULC-60839-11-1:2016

6) NDAA

k. Connectivity:

1) Ethernet: 100/1000Mbps RJ-45 cable connector for network connection

2) USB: USB 2.0

l. Included Accessories:

1) Setup guide

2) screw pack

m. Mounting Hardware: Dry wall anchors (M8) and screws (M5)

n. Network Settings:

1) An Ethernet connection with DHCP must be used to connect the AX11 to the Local Area Network (LAN).

2) Firewall settings: TCP port 443, UDP port 123 (NTP time synchronization)

2.5 INTEGRATED CARD READER DOOR LOCKS

A. Compatible electromagnetic lock integration:

1. Connect doors secured by locks to the same Access Control Unit.

2. Configure doors from Verkada Command web interface.

3. Manage all doors and ACUs in Schlage mode Verkada Command cloud-based platform.

B. Compatible Electromagnetic Locks:

1. Allegion:

a. Schlage AD Series (AD300, AD400, PIM400)

1) Refer to Allegion Schlage documentation for hardware installation.

2) The Schlage AD series of locks come in two major variants, the AD400 wireless lockset and the AD300 wired lockset. The AD400 wireless lock connects to the Verkada AC41 through a wireless bridge called the PIM 400-485. The AD300 wired locks connect directly to the AC41. Both solutions communicate with the AC41 over RS485 via the aux RS485 port on the AC41 (the last cassette).

3) The Schlage AD series of locks has the AD400 wireless lockset and the AD300 wired lock set. They act the same to the end user. The only difference is the AD300 wires directly to the AC41 via RS485 and the AD400 connects to the AC41 through a wireless bridge called the PIM-400-485. The configuration process in Command is identical with the exception of selecting Wireless (AD400) or Wired (AD300) in Command when adding the locks.

4) The Schlage AD400 wireless lockset is configured using the Schlage Utility Software (SUS) which is a free Android app (there is no iOS app).

b. Engage series (NDEB, LE, LEB)

C. Refer to Allegion Schlage documentation for hardware installation.

1. This integration supports the NDEB, LE, and LEB series. The main distinction is that the LE and LEB locks are mortise locks.

2. NDE locks are not supported - they are outdated and use old SSL standards.

3. This integration is an offline integration. That means that all door events, user updates, schedule updates etc. will be published in command every 24 hours, unless forced to sync through the Allegion mobile app.

4. This means that the engage series integration does not support remote unlock or lockdowns.

5. Real time updates are available for tamper events and door forced open events.

2.6 MULTI-FORMAT CARD READERS

A. AD33 by Verkada Inc.

1. Description:

a. Access control credential readers to read data from presented access control credentials of multiple formats, communicate with Verkada Command access control database, and validate access to associated hardware.

b. Two-way communication with an integrated LED to display door status for entry and events.

c. Accessed and managed from Verkada Command.

2. Technical Specifications:

a. Dimensions:

1) Mullion:

a) Length: 95mm / 3.74in

b) Width: 45mm / 1.77in

c) Height: 21mm / 0.83in

2) Single Gang:

a) Length: 120mm / 4.72in

b) Width: 80mm / 3.15in

c) Height: 21mm / 0.83in

b. Low Frequency Credential Formats:

1) HID Prox II 26-Bit (H10301)

2) 37-Bit Wiegand HID H10304

3) 37-Bit Wiegand HID H10302

4) HID 35-Bit Corporate 1000

c. High Frequency Credential Formats:

1) MiFare / DESFire (CSN)

2) NFC

d. Ratings:

1) IP65

2) IK08

e. Compliance:

1) FCC

2) CE

3) UL 294

4) UL 62368-1/CSA C22.2

5) CAN/ULC-60839-11-1:2016

6) NDAA

7) TELEC

f. Operating Temperature: -40° to 65°C / -40° to 149°F

g. Controller Compatibility: Requires Verkada AC41 Access Control Unit

h. Mounting Hardware:

1) Single gang mounting plate

2) Mullion mounting plate

i. Power Consumption: 12V, 300mA max

j. Wiring (Wire Color | Abbreviation | Name):

Black	GND	Ground
White	A	RS485-A
Green	B	RS485-B
Red	+12V	+12V IN

2.7 BADGE PRINTING SOFTWARE

A. Verkada Badge Printing Software by Verkada Inc.

1. Description:

a. Verkada's badge printing software is a modern, simplified way to design and print employee and student badges. With badge printing, Verkada Access Control customers can now easily design, print and administer credentials across both physical badges and the Verkada Pass App, directly through Verkada Command.

2. Key Features:

3. Simplified Badge Printing: By embedding badge printing software within Verkada's user interface, customers can now manage the entire workflow with Verkada Command, saving time and software costs. Customers can design and print badges that leverage existing

user profiles, active directory integrations, and of course, access control configurations — all from Verkada Command.

4. Printer Agnostic: Verkada's badge printing solution is also printer agnostic and is compatible with most popular badge printers. Customers simply need to ensure that the badge printer driver is correctly installed on their computer and that their browser is able to recognize it. For customers without an existing badge printer, we have a recommended list of printers available on the Verkada Docs Page of our website.

5. Automated Profiles with SCIM: Verkada's badge printing software extends the capabilities of Verkada Access Control and Automated user creation through Verkada's SCIM integration and bulk user import functionality. Verkada Access Control customers can automatically synchronize their user profiles from single sign-on service providers like Okta and Azure Active Directory to more easily manage and manage user credentials.

6. Verkada Prox and NFC Cards: Verkada badge printing can print to any standard badge type supported on Verkada Access control — a full list is available on the Verkada website.

2.8 ACCESS CONTROL BADGES

A. ACC-PROX-1 Proximity Cards by Verkada Inc.

1. Description: Standard 26-Bit Prox Format access control credential in a card format with embedded T5577 chip.

2. Technical Specifications:

a. Name and Model Number: ACC-PROX-1

b. Base Part Number – PN: 2A-68001-A

c. Descriptor: Proximity Cards

d. Chip: T5577

e. Format: Standard 26-Bit prox

f. Compatibility: Standard FSK Prox

g. Dimensions:

1) Length: 86mm / 3.39in

2) Width: 54mm / 2.13in

3) Height: 1.9mm / 0.07in

h. Weight: 6.8g / 0.24oz

3. Provide (100) proximity cards.

B. ACC-EV3-1 Encrypted Cards by Verkada Inc.

1. Description: High frequency smart access control credential in a card format with embedded MIFARE DESFire EV3 chip.

2. Technical Specifications:

a. Name and Model Number: ACC-EV3-1

b. Base Part Number – PN: 2A-78001-A

c. Descriptor: High Frequency Smartcard

d. Chip: MIFARE DESFire EV3

e. Encryption: AES 128 bit

f. Compatibility: Standard MIFARE DESFire EV3

g. Dimensions:

1) Length: 85.9mm / 3.4in

2) Width: 54.2mm / 2.1in

3) Height: 1.9mm / 0.075in

h. Weight: 5.1g / 0.18oz

PART 3 - EXECUTION

3.1 INSTALLERS

A. Installation shall be performed by technicians that have successfully completed the Verkada Certified Engineer (VCE) program. For more information, visit http://www.verkada.com/partners/trainings.

3.2 EXAMINATION

A. Installation surfaces shall be clean and free from dust, dirt, and obstructions.

B. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

C. Examine rough-in for LAN and control cable conduit systems to server, PCs, controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Refer to the Verkada Quick Start Guide applicable to each product.

B. Pre-Installation Conference: Prior to installation arrange conference between supplier, Owner, and related trades to review materials, procedures, and coordinating related work.

C. Furnish or coordinate any inserts required for building into concrete, masonry, and other work, to support and attach work of this Section. Furnish or coordinate in ample time to comply with schedule of work into which inserts are built.

D. Verify that power and outlets are in correct locations.

E. Verify that building structure is properly prepared for mounting, attachment, and support of equipment.

F. Prior to installation of systems components and devices, verify all required preparations have been properly performed and that substrates are acceptable for installation.

1. Verify all rough-ins and field dimensions.

G. Report in writing to the Owner's representative any prevailing conditions that will adversely affect satisfactory execution of work in this Section.

1. Owner or their representative reserves the right to review proposed methods of construction and installation, reject proposed methods, and have the installation done in a satisfactory method at the Contractor's cost.

3.4 INSTALLATION

A. Refer to the Verkada Quick Start Guide applicable to each product.

B. For support, proceed to www.verkada.com/support.

C. Sequencing: The work shall be performed in the following sequence, unless directed otherwise by Owner or their representative:

1. Installation of cables, controllers, and power supplies.

2. Installation of new field devices and new readers.

3. Installation of front-end equipment.

4. Commissioning of the new system components.

5. End User training

D. Install work in accordance with manufacturer's recommendations and instructions as well as final shop drawings. All controllers and power supplies should be installed so as to allow easy access for service in the future.

E. Anchor components securely in place, plumb, level, and accurately aligned.

F. For card readers located in equipment traffic areas, and that are exposed to damage due to collision or impact from forklifts, or manually moved carts, carriers, or other equipment used by the Owner, provide protective bollards, railings, coverings etc. to ensure that all card readers installed are properly protected from such damage.

G. Provide fastenings, plates, and other incidental items required for complete and operational installation.

H. Provide required electrical work in accordance with Code requirements.

I. Security and protection:

1. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured during periods when a qualified operator in the employ of Contractor is not present.

2. Equipment protection: Provide protective covers, fenders, and barriers as necessary to maintain work of this Section in same condition as installed until time of substantial completion.

J. Cable requirements:

1. Twisted, shielded, plenum-rated type cable shall be used.

2. All exposed cables shall be in rigid conduit, electrical metallic tubing (EMT) raceway, or wire mold as approved by the Owner.

3. All concealed cables routed in j-hook pathways shall be fastened to the structure at least every four feet.

3.5 LABELING

A. Equipment and product labels shall be printed on self-adhesive labels. Hand written labels or writing directly on the equipment enclosures is not acceptable.

B. Label equipment and products with the device address as programmed into the security systems and as reflected on the “As-Built” Record Drawings.

C. Label networked equipment enclosures with the IP address.

D. Cables shall be individually labeled at origin and termination.

3.6 PROGRAMMING

A. Add all Verkada Access Controllers and Cameras to Owner’s Verkada Command via serial number.

B. Coordinate with the Owner to verify appropriate network connections for new components.

C. Coordinate with the Owner to verify proper programming for new components into the system.

D. Change default passwords to new, custom, secure passwords in compliance with any Owner password standards for endpoint devices.

E. Complete all Verkada Command configuration programming, including but not limited to:

1. Integrations with owner software systems, such as Microsoft Single Sign-On, Active Directory, or others. Coordinate with Owner for which compatible platforms.

2. Verkada Command user information, including:

   a. User groups

   b. Username format

   c. Number of users

   d. User accounts

3. Access system configuration, including:

   a. Normal operating schedule

   b. Holiday schedule

   c. Access groups

   d. Special system configurations, such as Lockdown or Evacuation

   e. Integrations with life safety systems, such as access control overrides from fire evacuation alarm events.

3.7 ACCEPTANCE TESTING

A. Final Test and Acceptance Plan

1. Develop a final test and acceptance plan to identify each new system component, intent of test, test method, and expected results.

2. Each component listed in the plan shall include space for test part signatures, brief comments, time of test and pass/fail check boxes.

3. Test all equipment, products, and devices in accordance with the plan to ensure completely operational and fully functional security systems. Submit a written final test and acceptance report for review and approval.

4. The report shall be submitted to the Owner's representative at least 30 days prior to the scheduled system acceptance test.

5. System acceptance of the access control system shall be conditioned upon successful completion and operational demonstration of all system functions and components as documented in the final test and acceptance report.

B. System Acceptance

1. System acceptance shall not occur until after the following activities have been successfully completed:

2. Correction of all deficiencies and punch list items noted on the final test and acceptance report.

3. Acceptance of final test and acceptance report.

4. Acceptance of all project close-out submittals.

5. Delivery of final project close-out documentation.

6. Successful training and demonstration, including operation of systems, systems administration, and system management.

7. Purging of Contractor user privileges and return of all credentials.

3.8 OWNER PERSONNEL TRAINING

A. On-site operator training:

1. Instruct operating staff in proper operation, including hands-on training.

2. Minimum of two, four-hour sessions covering the operations for each system installed.

3. Training sessions shall be provided to supervisors, end-user staff, security staff, maintenance personnel, IT personnel, and any other personnel designated by the Owner.

4. Provide training sessions on all work shifts, including day, evening, and night shifts.

B. On-site administrator training:

1. Instruct security system administrators for each system installed, including hands-on training.

2. Minimum of two, four-hour sessions covering the operations for each system installed.

3. Training shall cover all administrative and management functions, including features and controls, for each system.

C. Documentation:

1. Provide owner with system component installation, configuration, and programming documentation, including but not limited to:

a. Components:

1) model name

2) model number

3) manufacturer

4) serial number

5) installation location

6) installation network port name

7) installation network port location

8) network address(es)

b. Network port configurations

c. Verkada Command users:

1) Usernames

2) Passwords

3) User groups

4) User group permissions

d. Access control system configurations:

1) Schedules

2) Holidays

3) Event logic

4) Alarm logic

e. Access control users:

1) Groups

2) Group permissions

3) Individual

4) Individual permissions

END OF SECTION

SECTION 28 16 00 – INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Verkada cloud-based intrusion detection and alarm monitoring solution.
2. Alarm Panels
3. Alarm Consoles
4. Alarm Sensors
5. Alarm Accessories

1.2 RELATED SECTION

A. 28 10 00 Access Control

B. 28 15 23 Intercom Entry Systems

C. 28 17 11 Visitor Management Systems

D. 28 20 00 Video Surveillance

E. 28 30 00 Environmental Sensor

1.3 REFRENCES

A. Published specifications, standards, tests, Codes, or recommended standards of trade, industry, or governmental organizations apply to work in these Sections, including:

1. ADA – Americans with Disabilities Act
2. ANSI – American National Standards Institute
3. ASCII – American Standard Code for Information Interchange
4. ASTM – American Society for Testing and Materials
5. IBC – International Building Code
6. IEEE – Institute of Electrical and Electronics Engineers
7. ISO/IEC – International Organization for Standardization / International Electrotechnical Commission
8. NEC – National Electrical Code
9. NEMA – National Electrical Manufacturers' Association
10. NFPA – National Fire Protection Association
11. TIA/EIA – Telecommunications Industry Association / Electronic Industries Alliance
12. UL – Underwriters Laboratories, Inc.

1.4 DEFINITIONS

A. Abbreviations:

1. ACS – Access Control System
2. API – Application Programming Interface
3. DHCP – Dynamic Host Configuration Protocol
4. DPDT – Double pole, double throw
5. IP – Internet Protocol
6. LAN – Local Area Network
7. NFC – Near Field Communications
8. NVR – Network Video Recorder
9. ODBC – Open Database Connectivity
10. RAM – Random Access Memory
11. SPDT – Single pole, double throw
12. SSL – Secure Sockets Layer
13. SSO – Single sign-on
14. TCP – Transport Control Protocol
15. UPS – Uninterruptible Power Supply
16. VMS – Video Management System

1.5 SYSTEM DESCRIPTION

A. A cloud-based alarm monitoring platform and associated wired or wireless sensors.

B. Key Functions:

1. Intrusion detection events based on wired or wireless sensors.
2. Intrusion detection events based on integrations with Verkada camera or access control platforms.
3. 24/7 professional monitoring provided by trained operators through add-on services.
4. Arm and disarm through the cloud application.
5. Arm and disarm via Verkada Alarm Console with keypad, integrated camera, and talk-down.
6. 10-year warranty on all hardware.

C. Compliance and Availability

1. See the compliance webpage for current regional compliance and availability information: https://verkada.com/alarms-availability.

D. Alarms Platform component of Verkada Command

1. Alarms is powered by Verkada's Command Platform, providing secure remote access with an intuitive interface for ease of use.
2. Site Management
   a. See overview of current status and recent events from all sites.
   b. Schedule arming/disarming and configure keycodes for on-site management.
   c. Instantly view incidents and play back event footage with integrated Verkada video surveillance.
   d. Control access to Alarm-equipped sites with role-based permissions.
3. Device Management
   a. Configure wired and wireless sensors from Command.
   b. Create alarm triggers based on events from any Verkada device.
   c. Manage all deployed devices.
4. Professional Monitoring Configuration
   a. Enable video verification of alarms by trained security professionals.
   b. Enable dispatch of emergency services.

c. Configure an ordered list of contacts for monitoring agents to call and text when an alarm is raised.

5. Alarm Console Talk-Down
   a. From Command, initiate two-way video calls down to Alarm Consoles at any of your sites, from anywhere in the world.
   b. Make calls to Alarm Console to address staff, guests, or potential intruders.
   c. Configure custom messages to announce in the event of an alarm.

E. Verkada Alarms Mobile App

1. Available for iOS and Android.
2. Arm / disarm sites and raise panic alarms from a mobile device.
3. Grant users access to the app through Command and restrict which sites can be managed by which users.

1.6 SUBMITTALS

A. Provide the following submittals for review and approval:

1. Product Data and Shop Drawings
2. System Programming
3. Operation and Maintenance Manuals (O&M's)
4. "As-Built" Record Drawings

B. Submit Product Data and Shop Drawings submittals for review and approval prior to commencement of work:

1. Manufacturer's name, brand name, exact part number, options, accessories, and catalog cutsheet references for all equipment supplied including cabling. Include manufacturer's published installation instructions. Indicate UL listings for system components.
2. Complete wiring diagrams for all components, including cable types and quantities, routings, floor plans indicating device locations, conduit sizes, and point-to-point termination and riser diagrams.
3. Device legend on the shop drawings that identifies the symbols used for all devices including mounting heights, back box requirements, part and model numbers, operating voltages (if applicable), wire and cabling requirements, label text, and panel termination points.
4. Fully dimensioned shop drawings including floorplans, enlarged plans, elevations, and installation details of all security devices, equipment rooms and closets, consoles, controllers, racks, enclosures, and fabricated equipment, showing locations of all major components including mounting details. Indicate UL system and rating listings for penetration firestop systems through rated partitions and floors.
5. Bill of Materials.
6. Material Safety Data Sheets (MSDS) for fire stopping materials and sealants.

C. Submit System Programming submittals for review and approval prior to commencement of work:

1. Proposed programming, including nomenclature conventions, device names and text descriptions, timings, camera call-up trigger alarms with associated cameras, and sequence of operations.
2. Approved device names and text descriptions as programmed into the security systems shall be reflected on the "As-Built" Record Drawings as well as on device and cable labels.

D. Submit Operation and Maintenance Manuals (O&M's) submittals for review and approval prior to the completion of the project:

1. Updated product data and shop drawings submittals reflecting the final conditions.
2. Warranty letter with start and end date.
3. Warranty service and maintenance contact information: including names, address, phone number, and website address. Provide specific instructions or forms as required to initiate a trouble ticket or work order request.
4. Letter indicating that all software and licensing is the sole property of the Owner.
5. Troubleshooting checklist information.
6. Replacement parts and consumables ordering information including the contact information for local sources.
7. Provide an updated System Programming submittal including:
   a. Final listing of doors, locations, and normal status in CSV format.
   b. System administration and management operating instructions.
   c. Setting up Users, User Groups, Access Levels, Doors, Door Schedules, and Exceptions
   d. Assigning Access Groups to all Users.
   e. Monitoring system activity.
   f. Running standard reports.
   g. Setting up logins and permissions.

E. Submit "As-Built" Record Drawings submittals for review and approval prior to the completion of the project:

1. Maintain a complete set of "As-Built" Record Drawings at the project site updated with mark-ups of the actual installation conditions.
2. Prior to the completion of the project transfer all installation conditions mark-ups to electronic drawings and submit to the Owner in CAD and PDF formats.

1.7 QUALITY ASSURANCE

A. Equipment shall be tested and found to comply with the limits for a Class A or B digital device, pursuant to part 15 of the FCC rules.

B. Security technology devices shall be mounted using compatible Verkada accessories.

C. Security technology devices shall be of the latest technology. No discontinued models or products are acceptable.

D. Installation technicians shall successfully complete the Verkada Certified Engineer (VCE) program prior to starting work. For more information, visit www.verkada.com/partners/trainings.

E. Contractor qualifications:

1. Minimum of two years of system design, engineering supervision, and installation experience in the access control industry.
2. Maintain a local office, with a service center staffed by trained technicians and must be adequately equipped to provide emergency phone service within 24 hours on a 24-hour, 365 days per year basis, whether or not the Owner purchases a maintenance contract with the Contractor.
3. Maintain an inventory of spare parts and other items critical to system operation, as necessary to meet the emergency service requirements.
4. Maintain an in-house engineering and project management capability consistent with the requirements of this project.
5. Provide a project manager who is actively engaged in the project. This person shall be the same individual throughout the course of the project and shall be the person responsible for the scheduling of the system programming, preparation of the submittals and project close-out documentation, training programs, system testing and report documentation, and

the coordination of all subcontract labor. The Owner reserves the right to approve the Contractor's project manager.

6. Abide by and adhere to all Drug Free School Zone laws and participate in a drug-free workplace program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Ship equipment in original packaging to prevent damage. All handling shall be in accordance with manufacturer recommendations. Inspect all products and materials for any damage immediately upon delivery to the project site.

B. Provide protective covering during construction.

C. Replace equipment and products damaged during shipping, handling, distribution, storage, installation, or construction with new equipment and products.

D. Equipment and products stored at the project site or at an off-site location shall be protected from dust, dirt, and foreign matter. Protect equipment and products from water, damage, dents, bumps, and scratches.

1.9 SCHEDULING

A. Submit proposed construction schedule detailing the task milestones, durations, and sequences for the project for review and approval prior to commencement of work.

B. When work is performed in a sensitive area or in an area occupied with ongoing business activities coordinate with the Owner and the affected department's representative to determine the best time to perform the work required.

1.10 WARRANTY

A. Provide one-year parts and labor project warranty. Parts and labor shall be guaranteed against defects in materials and workmanship for one year from written notification of acceptance.

B. All Verkada hardware purchases are backed by a 10-year limited warranty. For more information, visit verkada.com/support/terms-of-sale.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer shall be Verkada Inc.

1. Headquarters: 405 E 4th Ave. San Mateo, CA 94401
2. Toll Free: (888) 829-0668
3. General: team@verkada.com
4. Sales: sales@verkada.com
5. Website: www.verkada.com

2.2 LICENSING

A. Provide all required licenses for the specified system components.

B. All system component licenses shall be 5-year licenses.

2.3 ALARM PANELS

A. BP41 Alarm Panel by Verkada Inc.

1. Description: The BP41 Alarm Panel incorporates third-party wired intrusion sensors into the Verkada Alarms solution. The panel also supports two wired outputs for signaling devices, such as sirens or strobe lights.
2. Technical Specifications:
   a. Power Consumption (at 10V to 14V): 60W
   b. Dimensions:
      1) Width: 319.6mm / 12.58in
      2) Height: 415.6mm / 16.36in
      3) Depth: 111.74mm / 4.4in
   c. Weight: 81.9kg / 18.06lb
   d. Operating Temperature: 0°C to 50°C / 32°F to 122°F
   e. Compliance: Please see https://www.verkada.com/alarms-availability/
   f. Inputs:
      1) 32 inputs for normally open or normally closed sensors
      2) Optional 1 kΩ single or double EOLR supervision
   g. Outputs:
      1) 2x 12V programmable outputs 1A each
      2) 12V AUX power 2A total/combined
   h. Connectivity:
      1) Ethernet: 100/1000Mbps RJ-45 cable connector for network connection
      2) USB: USB 2.0
   i. Included Accessories:
      1) Setup guide
      2) Screw pack
      3) Torx screwdriver
      4) AC cord
      5) 32x 1kΩ end-of-line resistors
   j. Mounting Options:
      1) M8 drywall anchors
      2) M5 screws

B. MX21 Wireless Relay by Verkada

1. Description: Power third–party sirens, strobes and other wired alarm signaling devices and configure them as automated alarm responses to deter intruders or alert nearby individuals. Lighter-weight alternative to a BP41 Alarm Panel.
2. Technical Specifications:
   a. Power Consumption: 30W maximum
   b. DC Power Input: 12VDC to 24VDC
   c. Wireless Communication:
      1) US and Canada: Proprietary 915 MHz
      2) UK and Europe: 868 MHz
      3) Australia: 916.8 MHz
   d. Inputs: Wired signal input
   e. Wireless Range:
      1) Line-of-Sight: 305m / 1,000ft
      2) Typical Environment: 61m / 200ft

f. Relay Outputs:
   1) 1 wet relay
   2) Relay output voltage = relay input voltage, e.g.:
      a) 12VDC input, 12VDC output 2.5A max
      b) 24VDC input, 24VDC output 1.25A max
g. Relay Durability: 100,000 cycles at max load
h. Operating Temperature: 0°C to 50°C / 32°F to 122°F
i. Operating Humidity: 0% to 90%
j. Dimensions:
   1) Length: 119.6mm / 4.71in
   2) Width: 44mm / 1.73in
   3) Height: 30.3mm / 1.19in
k. Weight: 226g / 7.97oz
l. Certifications:
   1) FCC
   2) IC
   3) CE
   4) UKCA
   5) RCM
   6) NDAA
m. Included Accessories: 1x T10 Torx wrench
n. Mounting Options:
   1) 1x VHB adhesive strip
   2) 2x wall anchors and screws

C. BH61 Wireless Alarm Hub by Verkada Inc.

1. Description: A PoE-powered hub that enables two-way communication with Verkada's wireless sensors.
2. Technical Specifications:
   a. Power Consumption: 14W
   b. Dimensions:
      1) Length: 155mm / 6.1in
      2) Width: 155mm / 6.1in
      3) Height: 67mm / 2.64in
   c. Weight: 870g / 30.69oz
   d. Wireless Communication:
      1) US and Canada: Proprietary 915 MHz
      2) UK and Europe: 868 MHz
   e. Internal Backup Battery:
      1) 7.3V/2850mAh
      2) 12 hours of backup with typical use
   f. Operating Temperature: 0°C to 45°C / 32°F to 113°F
   g. Operating Humidity: 0% to 90%
   h. Compliance: Please see https://www.verkada.com/alarms-availability/
   i. Connectivity:
      1) Ethernet: 10/100Mbps RJ-45 cable connector for Network/PoE connection
      2) USB: USB 2.0 for connection to ACC-CEL-LTE Cellular Backup Module by Verkada.
   j. Included Accessories:
      1) Quick start guide
      2) 3x machine screws
      3) 3x wing nuts
      4) 3x washers
      5) 4x wall screws
      6) 4x wall anchors
      7) Torx wrench
   k. Mounting Options:
      1) M8 drywall anchors
      2) M5 screws

2.4 ALARM CONSOLES

A. BC82 Alarm Console by Verkada Inc.

1. Description: The BC82 Alarm Console is an alarm keypad with an integrated camera, two-way talk-down speaker, digital panic button, and integrated wireless sensor hub.
2. Technical Specifications:
   - a. Power Consumption: 25W
   - b. Power Input: PoE+ (802.3at) 10 to 36VDC
   - c. Battery:
     1) 32.4 watt-hour rechargeable lithium-polymer battery
     2) estimated 12 hours battery backup
   - d. Processor: A12 Bionic chip with 64-bit architecture
   - e. Display:
     1) Type: 10.2-inch diagonal LED-backlit Multi-Touch
     2) Resolution: 2160 x 1620 Pixels
     3) Brightness: 500 nits
   - f. Camera Quality: 720p HD video
   - g. Audio:
     1) Stereo speakers
     2) 3.5 mm jack for external speakers
     3) dual microphones
   - h. Dimensions:
     1) Tablet:
        a) Height: 309.9mm / 12.2in
        b) Width: 161.3mm / 6.4in
        c) Depth: 40.3mm / 1.6in
     2) Mount Plate:
        a) Length: 281.9mm / 11.1in
        b) Width: 113.9mm / 4.5in
        c) Height: 17.5mm / 0.7in
   - i. Weight:
     1) Tablet: 1,240g / 2.7lbs
     2) Mount Plate: 400g / 0.9lb
   - j. Operating Temperature: 0°C to 40°C / 32°F to 104°F
   - k. Operating Humidity: 5% to 90%
   - l. Connectivity:
     1) Ethernet 10/100Mbps
     2) Bluetooth 5.0
     3) Dual Band (2.4GHz/5GHz) WiFi
     4) 2x USB 2.0
   - m. Display:
     1) 10.1” LED-backlit multi-touch
     2) 1960 x 1200 pixel resolution
   - n. Audio:
     1) Mono Speaker: 90dB at 1 meter
     2) Buzzer: 90dB at 3 meters
     3) 3.5mm output
     4) Dual microphones
   - o. Camera:
     1) 8MP
     2) 1080p HD video
   - p. Included Accessories:
     1) T10 screwdriver
     2) 4x wall screws
     3) 4x drywall anchors
   - q. Mounting Options:
     1) Wall Mount Plate
     2) ACC-CON-STND-1 Alarm Console Table-Top Mounting Stand

2.5 ALARM SENSORS

A. BR31 Wireless Door Sensor by Verkada Inc.

1. Description: Wireless sensor to detect if a door is in the closed position.
2. Technical Specifications:
   a. Power Supply: 2 x CR123A Lithium Batteries
   b. Dimensions:
      1) Sensor:
         a) Height: 139.7mm / 5.50in
         b) Width: 27mm / 1.06in
         c) Depth: 25.4mm / 1.00in
      2) Magnet:
         a) Height: 70mm / 2.75in
         b) Width: 16mm / 0.63in
         c) Depth: 17mm / 0.67in
   c. Battery Life: Up to 10 years
   d. Wireless Range:
      1) Line-of-Sight: 304.8m / 1000ft
      2) Typical Environment: 60.96m / 200ft
   e. Door Gap Width: Adjustable up to 5cm / 2in
   f. Wireless Communication:
      1) US and Canada: Proprietary 915 MHz
      2) UK and Europe: 868 MHz
      3) Australia: 916.8 MHz
   g. Weight:
      1) Sensor: 85g / 3oz
      2) Magnet: 25g / 0.88oz
   h. Operating Temperature: 0°C to 45°C / 32°F to 113°F
   i. Operating Humidity: 0% to 90%
   j. Compliance: Please see https://www.verkada.com/alarms-availability/
   k. Included Accessories:
      1) Quick Start Guide
      2) 4x Wood Screws
      3) 4x Sheet metal screws
      4) 1x T10 Torx L Key
      5) Very High Bond (VHB) Double Sided Tape Adhesive Mount
   l. Mounting Options:
      1) Wood and Metal screws
      2) Very High Bond (VHB) Double Sided Tape Adhesive Mount

B. BR32 Wireless Motion Sensor by Verkada Inc.

1. Description: Wireless sensor to detect if there is motion within the field of view.
2. Technical Specifications:
   a. Power Supply: 2 x CR123A Lithium Batteries
   b. Dimensions:
      1) Height: 94mm / 3.7in
      2) Width: 51mm / 2in
      3) Depth: 34mm / 1.33in
   c. Battery Life: Up to 5 years
   d. Wireless Range:
      1) Line-of-Sight: 304.8m / 1000ft
      2) Typical Environment: 60.96m / 200ft
   e. Detection Range: up to 10m / 32ft
   f. Field of View: 90° Horizontal
   g. Sensor Type: Passive Infrared (PIR)
   h. Wireless Communication:
      1) US and Canada: Proprietary 915 MHz
      2) UK and Europe: 868 MHz

3) Australia: 916.8 MHz
i. Weight: 93g / 3.28oz
j. Operating Temperature: 0°C to 45°C / 32°F to 113°F
k. Operating Humidity: 0% to 90%
l. Compliance: Please see https://www.verkada.com/alarms-availability/
m. Included Accessories:
1) Quick Start Guide
2) Wall Screws
3) Wall Anchors
n. Mounting Options:
1) Corner
2) Wall
3) Dry wall anchors and screws

C. BR33 Wireless Panic Button by Verkada Inc.

1. Description: Wireless button which, whin pressed, triggers a programmable alarm response.
2. Technical Specifications:
a. Power Supply: 1 x CR123A Lithium Battery
b. Battery Life: Up to 5 years
c. Wireless Range:
1) Line-of-Sight: 304.8m / 1000ft
2) Typical Environment: 60.96m / 200ft
d. Wireless Communication:
1) US and Canada: Proprietary 915 MHz
2) UK and Europe: 868 MHz
3) Australia: 916.8 MHz
e. Dimensions:
1) Height: 81mm / 3.2in
2) Width: 36mm / 1.42in
3) Depth: 24mm / 0.94in
f. Weight: 49g / 1.73oz
g. Operating Temperature: 0°C to 45°C / 32°F to 113°F
h. Operating Humidity: 0% to 90%
i. Included Accessories:
1) Quick Start Guide
2) Wall Screws
3) Wall Anchors
4) Torx Wrench
5) Very High Bond (VHB) Double Sided Tape Adhesive Mount
j. Mounting Options:
1) Wall or surface mount
2) Loop for lanyard attachment

D. BR34 Wireless Glass Break Sensor by Verkada Inc.

1. Description: Wireless sensor to detect the sound of breaking glass.
2. Technical Specifications:
a. Power Supply: 1 x CR123A Lithium Batteries
b. Battery Life: Up to 2 years
c. Wireless Range:
1) Line-of-Sight: 304.8m / 1000ft
2) Typical Environment: 60.96m / 200ft
d. Wireless Communication:
1) US and Canada: Proprietary 915 MHz
2) UK and Europe: 868 MHz
3) Australia: 916.8 MHz
e. Detection Range: up to 5m / 15ft
f. Sensor Type: Dual detection, requiring both impact and successive shattering frequencies to trigger alarm

g. Dimensions
   1) Height: 74mm / 2.91in
   2) Width: 74mm / 2.91in
   3) Depth: 22mm / 0.87in
h. Weight: 63g / 2.22oz
i. Operating Temperature: 0°C to 45°C / 32°F to 113°F
j. Operating Humidity: 0% to 90%
k. Compliance: Please see https://www.verkada.com/alarms-availability/
l. Included Accessories:
   1) Quick Start Guide
   2) Wall Screws
   3) Wall Anchors
m. Mounting Options:
   1) Ceiling
   2) Opposite wall facing glass
   3) Dry wall anchors and screws
n. Glass Type:
   1) Plate glass, thickness: 2, 3, 5, 6mm
   2) Tempered glass, thickness: 3, 5, 6mm
   3) Wired glass, thickness: 6, 8mm
   4) Laminated glass, thickness: 3, 6mm
   5) Size: minimum 30cm x 30cm
o. Note: To reduce false alarms, the glass break sensor should be mounted in an area free of loud noises or vibrations.

E. BR35 Wireless Water Leak Sensor by Verkada Inc.

1. Description: Wireless sensor to detect the presence of standing water.
2. Technical Specifications:
   a. Power Supply: 1 x CR123A Lithium Battery
   b. Probe cable length: 2.1 m / 7 ft
   c. Battery Life: Up to 5 years
   d. Wireless Range:
      1) Line-of-Sight: 304.8m / 1000ft
      2) Typical Environment: 60.96m / 200ft
   e. Wireless Communication:
      1) US and Canada: Proprietary 915 MHz
      2) UK and Europe: 868 MHz
      3) Australia: 916.8 MHz
   f. Sensor Type: Probe with copper-nickel plated contacts
   g. Dimensions:
      1) Height: 88mm / 3.46in
      2) Width: 25.4mm / 1.00in
      3) Depth: 27mm / 1.08in
   h. Weight: 67g / 2.36oz
   i. Operating Temperature: 0°C to 45°C / 32°F to 113°F
   j. Operating Humidity: 0% to 90% humidity
   k. Compliance: Please see https://www.verkada.com/alarms-availability/
   l. Included Accessories:
      1) Quick Start Guide
      2) 4x Wall Screws
      3) Very High Bond (VHB) Double Sided Tape Adhesive Mount
   m. Mounting Options:
      1) Wall
      2) Floor

2.6 ALARM ACCESSORIES

A. ACC–CEL–LTE Cellular Backup Module by Verkada Inc.

1. Description: Cellular data network backup connection to maintain alarm panel connectivity in the event of a loss of wired network service. The ACC-CEL-LTE Cellular Backup Module includes an embedded multi-carrier SIM with automatic failover across multiple networks for redundancy.
2. Technical Specifications:
   a. Power Consumption (5V): 0.5W
      1) Dimensions:
         a) Height: 152.4mm / 6in
         b) Width: 50.8mm / 2in
         c) Depth: 30mm / 1.18in
      2) Antenna:
         a) Height: 147.32mm / 5.8 in
         b) Width: 38.1 mm / 1.5 in
         c) Depth: 12.7 mm / 0.5 in
      3) Weight: 113g / 4oz
      4) Operating Temperature: 0°C to 45°C / 32°F to 113°F
      5) Operating Humidity: 0 to 90%
      6) Compliance: Please see https://www.verkada.com/alarms-availability/
      7) Connectivity: USB 2.0 for connection to BP41 Alarm Panel or BH61 Wireless Alarm Hub
      8) Included Accessories:
         a) Quick start guide
         b) Torx screwdriver
         c) 2x screws
         d) 2x drywall anchors
      9) Mounting Options: M8 drywall anchors and M5 screws

B. BZ11 Horn Speaker by Verkada inc.

1. Description: The BZ11 Horn Speaker with integrated microphone enables two-way communication between users and individuals in the environment. With the addition of an Alarms License, professional monitoring agents can talk down intruders in real time, or pre-recorded messages can be configured to play as an automated response if an alarm is raised.
2. Technical Specifications:
   a. Power Consumption: 25.5W
   b. Power Input: PoE+ (IEEE 802.3at)
   c. Connectivity: Ethernet 100/1,000Mbps
   d. Speaker:
      1) Max SPL: 115dB (1W/1m)
      2) Frequency Range: 330Hz to 8kHz
   e. Microphone:
      1) Frequency Range: 100Hz to 16kHz
   f. Dimensions:
      1) Length: 286mm / 11.26in
      2) Width: 274mm / 10.79in
      3) Height: 197mm / 7.76in
   g. Weight: 20.1kg / 4.43lb
   h. Operating Temperature: -20°C to 50°C / -4°F to 122°F
   i. Operating Humidity: 0% to 90%
   j. Included Accessories:
      1) Mount bracket
      2) Masonry screws
      3) Wall mount screws
      4) Wall anchors
   k. Mounting Options:
      1) Verkada Pole Mount
      2) Verkada Corner Mount

C. MX21 Wireless Relay by Verkada

1. Description: Powers third–party sirens, strobes and other wired alarm signaling devices and configure them as automated alarm responses to deter intruders or alert nearby individuals.
2. Technical Specifications:
   a. Power Consumption: 30W maximum
   b. DC Power Input: 12 to 24VDC
   c. Inputs: Wired signal input (optional)
   d. Relay Outputs: 1x wet relay
   e. Relay Durability: 100,000 cycles at maximum load
   f. Dimensions:
      1) Height: 30.3mm / 1.19in
      2) Width: 44mm / 1.73in
      3) Length: 119.6mm / 7.86in
   g. Wireless Range:
      1) Line-of-Sight: 304.8m / 1000ft
      2) Typical Environment: 60.96m / 200ft
   h. Wireless Communication:
      1) US and Canada: Proprietary 915 MHz
      2) UK and Europe: 868 MHz
      3) Australia: 916.8 MHz
   i. Weight: 226g / 8oz
   j. Operating Temperature: 0°C to 50°C / 32°F to 122°F
   k. Operating Humidity: 0% to 90%
   l. Compliance: Please see https://www.verkada.com/alarms-availability/
   m. Included Accessories:
      1) 1x T10 torx wrench
   n. Mounting Options:
      1) 1x VHB adhesive strip
      2) 2x wall anchors and screws

PART 3 - EXECUTION

3.1 INSTALLERS

A. Installation shall be performed by technicians that have successfully completed the Verkada Certified Engineer (VCE) program. For more information, visit www.verkada.com/partners/trainings.

3.2 EXAMINATION

A. Installation surfaces shall be clean and free from dust, dirt, and obstructions.

B. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

C. Examine rough-in for LAN and control cable conduit systems to server, PCs, controllers, panels, consoles, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Refer to the Verkada Quick Start Guide applicable to each product.

B. Pre-Installation Conference: Prior to installation arrange conference between supplier, Owner, and related trades to review materials, procedures, and coordinating related work.

C. Furnish or coordinate any inserts required for building into concrete, masonry, and other work, to support and attach work of this Section. Furnish or coordinate in ample time to comply with schedule of work into which inserts are built.

D. Verify that power and outlets are in correct locations.

E. Verify that building structure is properly prepared for mounting, attachment, and support of equipment.

F. Prior to installation of systems components and devices, verify all required preparations have been properly performed and that substrates are acceptable for installation.

1. Verify all rough-ins and field dimensions.

G. Report in writing to the Owner's representative any prevailing conditions that will adversely affect satisfactory execution of work in this Section.

1. Owner or their representative reserves the right to review proposed methods of construction and installation, reject proposed methods, and have the installation done in a satisfactory method at the Contractor's cost.

3.4 INSTALLATION

A. Refer to the Verkada Quick Start Guide applicable to each product.

B. For support, proceed to www.verkada.com/support.

C. Sequencing: The work shall be performed in the following sequence, unless directed otherwise by Owner or their representative:

1. Installation of cables, panels, consoles, and power supplies.
2. Installation of new field devices.
3. Installation of front-end equipment.
4. Commissioning of the new system components.
5. End User training

D. Install work in accordance with manufacturer's recommendations and instructions as well as final shop drawings. All panels, consoles, and power supplies should be installed so as to allow easy access for service in the future.

E. Anchor components securely in place, plumb, level, and accurately aligned.

F. For solution products located in equipment traffic areas, and that are exposed to damage due to collision or impact from forklifts, or manually moved carts, carriers, or other equipment used by the Owner, provide protective bollards, railings, coverings etc. to ensure that all products installed are properly protected from such damage.

G. Provide fastenings, plates, and other incidental items required for complete and operational installation.

H. Provide required electrical work in accordance with Code requirements.

I. Security and protection:

1. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured during periods when a qualified operator in the employ of Contractor is not present.
2. Equipment protection: Provide protective covers, fenders, and barriers as necessary to maintain work of this Section in same condition as installed until time of substantial completion.

J. Cable requirements:

1. Twisted, shielded, plenum-rated type cable shall be used.
2. All exposed cables shall be in rigid conduit, electrical metallic tubing (EMT) raceway, or wire mold as approved by the Owner.
3. All concealed cables routed in j-hook pathways shall be fastened to the structure at least every four feet.

3.5 LABELING

A. Equipment and product labels shall be printed on self-adhesive labels. Hand written labels or writing directly on the equipment enclosures is not acceptable.

B. Label equipment and products with the device address as programmed into the security systems and as reflected on the “As-Built” Record Drawings.

C. Label networked equipment enclosures with the IP address.

D. Cables shall be individually labeled at origin and termination.

3.6 PROGRAMMING

A. Complete all Verkada Command configuration programming, including but not limited to:

1. Personal/Staff information
2. Access times for all personal/staff
3. Definitions of openings for staff access
4. Holiday definitions
5. Special access privileges
6. Lock down conditions

B. Add all Verkada components to Command via serial number.

C. Contract will coordinate with the Owner to ensure that new components have appropriate network connections.

D. Coordinate with the Owner to ensure that new components will be properly programmed into the system.

E. Change default passwords to new custom secure passwords as directed by the Owner.

3.7 ACCEPTANCE TESTING

A. Final Test and Acceptance Plan

1. Develop a final test and acceptance plan to identify each new system component, intent of test, test method, and expected results.
2. Each component listed in the plan shall include space for test part signatures, brief comments, time of test and pass/fail check boxes.
3. Test all equipment, products, and devices in accordance with the plan to ensure completely operational and fully functional security systems. Submit a written final test and acceptance report for review and approval.
4. The report shall be submitted to the Owner's representative at least 30 days prior to the scheduled system acceptance test.
5. System acceptance of the access control system shall be conditioned upon successful completion and operational demonstration of all system functions and components as documented in the final test and acceptance report.

B. System Acceptance

1. System acceptance shall not occur until after the following activities have been successfully completed:
   a. Correction of all deficiencies and punch list items noted on the final test and acceptance report.
   b. Acceptance of final test and acceptance report.
   c. Acceptance of all project close-out submittals.
   d. Delivery of final project close-out documentation.
   e. Successful training and demonstration, including operation of systems, systems administration, and system management.
   f. Purging of Contractor user privileges and return of all credentials.

3.8 OWNER PERSONNEL TRAINING

A. On-site operator training:

1. Instruct operating staff in proper operation, including hands-on training.
2. Minimum of two, four-hour sessions covering the operations for each system installed.
3. Training sessions shall be provided to supervisors, end-user staff, security staff, maintenance personnel, IT personnel, and any other personnel designated by the Owner.
4. Provide training sessions on all work shifts, including day, evening, and night shifts.

B. On-site administrator training:

1. Instruct security system administrators for each system installed, including hands-on training.
2. Minimum of two, four-hour sessions covering the operations for each system installed.
3. Training shall cover all administrative and management functions, including features and controls, for each system.

3.9 DOCUMENTATION

A. Provide owner with system component installation, configuration, and programming documentation, including but not limited to:

1. Components:
   a. model name
   b. model number
   c. manufacturer
   d. serial number
   e. installation location

f. installation network port name
g. installation network port location
h. network address(es)

2. Network port configurations
3. Verkada Command users:
   a. Usernames
   b. Passwords
   c. User groups
   d. User group permissions
4. Alarm system configurations:
   a. Schedules
   b. Holidays
   c. Event logic
   d. Alarm logic
5. Alarm users:
   a. Groups
   b. Group permissions
   c. Individual
   d. Individual permissions

END OF SECTION

SECTION 28 23 00 – VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Video Surveillance System Base Bid: Video Surveillance system shall be rough-in only and to include Category 6 cabling per Section 27 15 00.

B. Alternate #7: Provide complete video surveillance system consisting of cameras, accessories, and licenses. Provide CD62 cameras at interior video data drop locations. Provide CH52-E cameras at exterior video data drop locations. Quantities shall be per drawings. Allow for an additional (5) CH52-E cameras, including data drop rough-in, up to 150ft for each, locations to be determined by Owner at construction start.

C. Section Includes:

1. Verkada cloud-based video surveillance solution including:

   a. Verkada Command cloud-based management platform

   b. Edge-based video analytics

   c. Indoor Dome Series cameras

   d. Outdoor Dome Series cameras

   e. Mini Series cameras

   f. Bullet Series cameras

   g. Fisheye Series cameras

   h. Multisensor Series cameras

   i. Viewing Station

   j. PoE Injectors

   k. Camera mounts, adapters, and accessories

2. Refer to the Verkada Camera Selector User Guide for assistance selecting the appropriate camera for field of view, form factor, zoom, resolution, video retention, and other selection factors.

3. Refer to the Verkada User Guide for Occupancy Trends for more information regarding the deployment of the Occupancy Trends People Analytics feature.

4. Refer to the Verkada User Guide for License Plate Recognition (LPR) for more information regarding camera selection as well as camera placement, installation, and setup for LPR use cases.

5. Refer to the Verkada User Guide for People Analytics for more information regarding key features, optimizing performance, camera selection and placement, lighting, privacy, and other selection factors.

6. Refer to the Verkada User Guide for Camera Setup Best Practices for more information regarding the following camera networking best practices:

D. Related Sections

1. 28 13 00 – Access Control
2. 28 16 00 – Intrusion Detection

1.2 REFERENCES

A. Published specifications, standards, tests, Codes, or recommended standards of trade, industry, or governmental organizations apply to work in these Sections, including:

1. ADA – Americans with Disabilities Act
2. ANSI – American National Standards Institute
3. ASCII – American Standard Code for Information Interchange
4. ASTM – American Society for Testing and Materials
5. IBC – International Building Code
6. IEEE – Institute of Electrical and Electronics Engineers
7. ISO/IEC – International Organization for Standardization / International Electrotechnical Commission
8. NEC – National Electrical Code
9. NEMA – National Electrical Manufacturers' Association
10. NFPA – National Fire Protection Association
11. TIA/EIA – Telecommunications Industry Association / Electronic Industries Alliance
12. UL – Underwriters Laboratories, Inc.

1.3 DEFINITIONS

A. Abbreviations:

1. ACS – Access Control System
2. API – Application Programming Interface
3. CCD – Charge Coupled Device
4. CCTV – Closed Circuit Television
5. CMOS – Complementary Metal-Oxide Semiconductor
6. DHCP – Dynamic Host Configuration Protocol
7. DNS – Domain Name System
8. DPDT – Double pole, double throw
9. FPS – Frames Per Second
10. IP – Internet Protocol

11. LAN – Local Area Network
12. LPR – License Plate Recognition
13. NFC – Near Field Communications
14. NVR – Network Video Recorder
15. ODBC – Open Database Connectivity
16. PoE – Power Over Ethernet
17. RAM – Random Access Memory
18. SPDT – Single pole, double throw
19. SSL – Secure Sockets Layer
20. SSO – Single sign-on
21. TCP – Transport Control Protocol
22. UPS – Uninterruptible Power Supply
23. VMS – Video Management System
24. WDR – Wide Dynamic Range

1.4 SYSTEM DESCRIPTION

A. A hybrid cloud video surveillance system with storage and image processing on edge devices managed through the Verkada Command cloud platform.

B. Verkada Command Management Software

1. Access and management for all cameras and users across all sites. Command management functions include:
    a. Set up for new cameras.
    b. Create new sites.
    c. Manage camera device and system settings.
    d. Access live and archived footage.
    e. Manage users.
2. Security and Permissions:
    a. SAML/OAuth support for single sign-on
    b. 2-factor authentication options
    c. User permissions can be controlled at camera, site and organization levels
3. Remote Access
    a. Web app access

b. Native apps for iOS, Android, and the Verkada VX52 Viewing Station

4. Archiving and Sharing:

a. Command licenses include unlimited cloud archiving.

b. Export footage in MP4 format

c. Create and share Live Links via text or email.

C. Analytics:

1. People Analytics

a. Intelligent edge-based video processing to identify individuals in a scene.

b. Filter identified individuals by attributes, including:

1) Date

2) Time

3) Appearance

4) Clothing color

5) Backpack detection

6) Facial matches

2. Face Search: Quickly search for matching people by selecting an existing face from organizational records uploaded image.

3. Person History:

a. Browse through snapshots of people detected in frame.

b. Save snapshots or access associated full-resolution video.

4. Occupancy Trends:

a. Estimate how many people cross a designated line in a camera field of view.

5. Cross-Camera Tracking:

a. Search video from different cameras of the same identified individual.

D. Vehicle Analytics:

1. Intelligent edge-based video processing to identify vehicles in a scene.

2. Filter identified vehicles by attributes, including:

a. Date.

b. Time.

c. Vehicle make.

d. Color.

e. Vehicle body type.

3. Vehicle History:

a. Browse through snapshots of vehicles detected in-frame

b. Save snapshots or associated full-resolution video

4. Cross-Camera Tracking:

a. Search video from different cameras of the same identified vehicle.

5. License Plate Recognition:

a. LPR coverage, monitoring, and search by plate number

b. Generate License Plate of Interest Alerts via SMS or email with an image or link to review the associated footage

1.5 SUBMITTALS

A. Provide the following submittals for review and approval:

1. Product Data and Shop Drawings

2. System Programming

3. Operation and Maintenance Manuals (O&M's)

4. "As-Built" Record Drawings

B. Submit Product Data and Shop Drawings submittals for review and approval prior to commencement of work:

1. Manufacturer's name, brand name, exact part number, options, accessories, and catalog cutsheet references for all equipment supplied including cabling. Include manufacturer's published installation instructions. Indicate UL listings for system components.

2. Complete wiring diagrams for all components, including cable types and quantities, routings, floor plans indicating device locations, conduit sizes, and point-to-point termination and riser diagrams.

3. Device legend on the shop drawings that identifies the symbols used for all devices including mounting heights, back box requirements, part and model numbers, operating voltages (if applicable), wire and cabling requirements, label text, and panel termination points.

4. Fully dimensioned shop drawings including floorplans, enlarged plans, elevations, and installation details of all security devices, equipment rooms and closets, consoles, controllers, racks, enclosures, and fabricated equipment, showing locations of all major components including mounting details. Indicate UL system and rating listings for penetration firestop systems through rated partitions and floors.

5. Bill of Materials.

6. Material Safety Data Sheets (MSDS) for fire stopping materials and sealants.

C. Submit System Programming submittals for review and approval prior to commencement of work:

1. Proposed programming, including nomenclature conventions, device names and text descriptions, timings, camera call-up trigger alarms with associated cameras, and sequence of operations.

2. Approved device names and text descriptions as programmed into the security systems shall be reflected on the "As-Built" Record Drawings as well as on device and cable labels.

D. Submit Operation and Maintenance Manuals (O&M's) submittals for review and approval prior to the completion of the project:

1. Updated product data and shop drawings submittals reflecting the final conditions.

2. Warranty letter with start and end date.

3. Warranty service and maintenance contact information: including names, address, phone number, and website address. Provide specific instructions or forms as required to initiate a trouble ticket or work order request.

4. Letter indicating that all software and licensing is the sole property of the Owner.

5. Troubleshooting checklist information.

6. Replacement parts and consumables ordering information including the contact information for local sources.

7. Provide an updated System Programming submittal including:

a. Final listing of doors, locations, and normal status in CSV format.

b. System administration and management operating instructions.

c. Setting up Users, User Groups, Access Levels, Doors, Door Schedules, and Exceptions

d. Assigning Access Groups to all Users.

e. Monitoring system activity.

f. Running standard reports.

g. Setting up logins and permissions.

E. Submit "As-Built" Record Drawings submittals for review and approval prior to the completion of the project:

1. Maintain a complete set of "As-Built" Record Drawings at the project site updated with mark-ups of the actual installation conditions.

2. Prior to the completion of the project transfer all installation conditions mark-ups to electronic drawings and submit to the Owner in CAD and PDF formats.

1.6 QUALITY ASSURANCE

A. Equipment shall be tested and found to comply with the limits for a Class A or B digital device, pursuant to part 15 of the FCC rules.

B. Security technology devices shall be mounted using compatible Verkada accessories.

C. Security technology devices shall be of the latest technology. No discontinued models or products are acceptable.

D. Installation technicians shall successfully complete the Verkada Certified Engineer (VCE) program prior to starting work. For more information, visit http://www.verkada.com/partners/trainings.

E. Contractor qualifications:

1. Minimum of two years of system design, engineering supervision, and installation experience in the access control industry.

2. Maintain a local office, with a service center staffed by trained technicians and must be adequately equipped to provide emergency phone service within 24 hours on a 24-hour, 365 days per year basis, whether or not the Owner purchases a maintenance contract with the Contractor.

3. Maintain an inventory of spare parts and other items critical to system operation, as necessary to meet the emergency service requirements.

4. Maintain an in-house engineering and project management capability consistent with the requirements of this project.

5. Provide a project manager who is actively engaged in the project. This person shall be the same individual throughout the course of the project and shall be the person responsible for the scheduling of the system programming, preparation of the submittals and project close-out documentation, training programs, system testing and report documentation, and the coordination of all subcontract labor. The Owner reserves the right to approve the Contractor's project manager.

6. Abide by and adhere to all Drug Free School Zone laws and participate in a drug-free workplace program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Ship equipment in original packaging to prevent damage. All handling shall be in accordance with manufacturer recommendations. Inspect all products and materials for any damage immediately upon delivery to the project site.

B. Provide protective covering during construction.

C. Replace equipment and products damaged during shipping, handling, distribution, storage, installation, or construction with new equipment and products.

D. Equipment and products stored at the project site or at an off-site location shall be protected from dust, dirt, and foreign matter. Protect equipment and products from water, damage, dents, bumps, and scratches.

1.8 SCHEDULING

A. Submit proposed construction schedule detailing the task milestones, durations, and sequences for the project for review and approval prior to commencement of work.

B. When work is performed in a sensitive area or in an area occupied with ongoing business activities coordinate with the Owner and the affected department's representative to determine the best time to perform the work required.

1.9 WARRANTY

A. Provide one-year parts and labor project warranty. Parts and labor shall be guaranteed against defects in materials and workmanship for one year from written notification of acceptance.

B. All Verkada hardware purchases are backed by a 10-year limited warranty. For more information, visit verkada.com/support/terms-of-sale.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturer shall be Verkada Inc.

1. Headquarters: 405 E 4th Ave. San Mateo, CA 94401
2. Toll Free: (888) 829-0668
3. General: team@verkada.com
4. Sales: sales@verkada.com
5. Website: www.verkada.com
6. Non-Verkada Inc. products shall be limited to those identified as compatible within the product descriptions below.

2.2 LICENSING

A. Provide all required licenses for the specified system components.

B. All system component licenses shall be 5-yearlicenses.

2.3 CAMERA SCHEDULE

NUMBER				LOCATION	TYPE	INT/EXT	MOUNTING
	CAM	1-	1-	MAIN ENTRY	DOME	EXT	BUILDING
	CAM	2-	4-	NE CORNER	360	EXT	CORNER
	CAM	3-	4-	SE CORNER	360	EXT	CORNER
	CAM	4-	1-	GYM STORAGE EXTERIOR	DOME	EXT	BUILDING
	CAM	5-	1-	GYM EXTERIOR	DOME	EXT	BUILDING
	CAM	6-	1-	GYM ENTRY	DOME	EXT	BUILDING
	CAM	7-	4-	GYM EXTERIOR	360	EXT	BUILDING
	CAM	8-	1-	SECOND ENTRY	DOME	EXT	BUILDING
	CAM	9-	4-	GYM EXTERIOR	360	EXT	BUILDING
	CAM	10-	1-	GATE ENTRY	DOME	EXT	BUILDING
	CAM	11-	4-	N STAIR EXTERIOR	360	EXT	BUILDING
	CAM	12-	1-	SW ENTRY L2	DOME	EXT	CEILING
	CAM	13-	1-	NW STAIR ENTRY L2	DOME	EXT	BUILDING
	CAM	14-	1-	SW STAIR ENTRY L3	DOME	EXT	CEILING
	CAM	15-	1-	SW STAIR ENTRY L4	DOME	EXT	BUILDING
	CAM	16-	1-	ROOF ENTRY	DOME	EXT	BUILDING
	CAM	17-	4-	ROOFTOP	360	EXT	CORNER
	CAM	18-	1-	MAIN ENTRY VESTIBULE	DOME	INT	CEILING
	CAM	19-	4-	RECEPTION	360	INT	CEILING
	CAM	20-	1-	CORRIDOR	DOME	INT	CEILING
	CAM	21-	1-	STAIR S1 L1	DOME	INT	CEILING
	CAM	22-	4-	GYM NW	360	INT	WALL
	CAM	23-	4-	GYM SW	360	INT	WALL
	CAM	24-	4-	LIBRARY	360	INT	CEILING
	CAM	25-	1-	LIBRARY	DOME	INT	CEILING
	CAM	26-	1-	STAIR S1 L2	DOME	INT	CEILING
	CAM	27-	4-	N CORRIDOR L3	360	INT	CEILING
	CAM	28-	2-	CORRIDOR L3	180	INT	CEILING
	CAM	29-	4-	SHARED LEARNING L3	360	INT	CEILING
	CAM	30-	1-	STAIR S1 L3	DOME	INT	CEILING
	CAM	31-	4-	N CORRIDOR L4	360	INT	CEILING
	CAM	32-	2-	CORRIDOR L4	180	INT	CEILING
	CAM	33-	4-	SHARED LEARNING L4	360	INT	CEILING
	CAM	34-	1-	STAIR S1 L4	DOME	INT	CEILING
	CAM	35-	1-	STAIR S1 ROOF	DOME	INT	CEILING

2.4 INDOOR DOME SERIES

A. CD32 Indoor Dome Camera by Verkada Inc.

1. Onboard Storage: 768GB
2. Sensor Resolution: 3MP (2048 x 1536 pixels)
3. Lens Type: Fixed
4. Image Sensor: 1/2.8” Progressive CMOS
5. Focal Length: 2.8mm
6. Iris: Fixed
7. Aperture: F1.6

8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.

9. Field of View (FoV after LDC):

   a. Horizontal: 97° (78°)

   b. Vertical: 71° (63°)

   c. Diagonal: 128° (91°)

10. IR Range: 15m / 50ft in low light

11. Audio: Yes

12. Resistance Ratings:

   a. IK08

   b. FCC

   c. IEC60950-1

13. Dimensions:

   a. With Mount Plate:

      1) Length: 146mm / 5.75in

      2) Width: 146mm / 5.75in

      3) Height: 104.3mm / 4.11in

   b. Without Mount Plate:

      1) Length: 146mm / 5.75in

      2) Width: 146mm / 5.75in

      3) Height: 99.8mm / 3.93in

14. Weight:

   a. With Mount Plate: 748g / 26.38oz

   b. Without Mount Plate: 608g / 21.45oz

15. Operating Power: 11W (IEEE 802.3af PoE)

16. Operating Temperature: -10°C to 50°C / 14°F to 122°F

17. Operating Humidity: 0% to 90%

18. Connectivity: Ethernet 10/100Mbps RJ-45 cable connector for Network/PoE connection

B. CD42 Indoor Dome Camera by Verkada Inc.

1. Onboard Storage: 768GB

2. Sensor Resolution: 5MP (2688 x 1944 pixels)

3. Lens Type: Fixed
4. Image Sensor: 1/2.8” Progressive CMOS
5. Focal Length: 2.8mm
6. Iris: Fixed
7. Aperture: F1.6
8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.
9. Field of View (FoV after LDC):
    a. Horizontal: 87° (78°)
    b. Vertical: 70° (63°)
    c. Diagonal: 101° (91°)
10. IR Range: 15m / 50ft in low light
11. Audio: Yes
12. Resistance Ratings:
    a. IK08
    b. FCC
    c. IEC60950-1
13. Dimensions:
    a. With Mount Plate:
        1) Length: 146mm / 5.75in
        2) Width: 146mm / 5.75in
        3) Height: 104.3mm / 4.11in
    b. Without Mount Plate:
        1) Length: 146mm / 5.75in
        2) Width: 146mm / 5.75in
        3) Height: 99.8mm / 3.93in
14. Weight:
    a. With Mount Plate: 748g / 26.38oz
    b. Without Mount Plate: 608g / 21.45oz
15. Operating Power: 11W (IEEE 802.3af PoE)
16. Operating Temperature: -10°C to 50°C / 14°F to 122°F

17. Operating Humidity: 0% to 90%

18. Connectivity: Ethernet 10/100Mbps RJ-45 cable connector for Network/PoE connection

C. CD52 Indoor Dome Camera by Verkada Inc.

1. Onboard Storage: 768GB

2. Sensor Resolution: 5MP (2688 x 1944 pixels)

3. Lens Type: 3x Optical Zoom

4. Image Sensor: 1/2.8” Progressive CMOS

5. Focal Length: 2.8 to 8mm

6. Iris: P-Iris

7. Aperture: F1.3 to F2.4

8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.

9. Field of View (FoV after LDC):

   a. Horizontal: 41° to 93° (37° to 84°)

   b. Vertical: 31° to 76° (28° to 68°)

   c. Diagonal: 50° to 107° (45° to 97°)

10. IR Range: 30m / 98ft in low light

11. Audio: Yes

12. Resistance Rating:

   a. IK08

   b. FCC

   c. IEC60950-1

13. Dimensions:

   a. With Mount Plate:

      1) Length: 146mm / 5.75in

      2) Width: 146mm / 5.75in

      3) Height: 104.3mm / 4.11in

   b. Without Mount Plate:

      1) Length: 146mm / 5.75in

      2) Width: 146mm / 5.75in

      3) Height: 99.8mm / 3.93in

14. Weight:
    a. With Mount Plate: 916g / 32.31oz
    b. Without Mount Plate: 776g / 27.37oz
15. Operating Power: 11W (IEEE 802.3af PoE)
16. Operating Temperature: -10°C to 50°C / 14°F to 122°F
17. Operating Humidity: 0% to 90%
18. Connectivity: Ethernet 10/100Mbps RJ-45 cable connector for Network/PoE connection

D. CD62 Indoor Dome Camera by Verkada Inc.

1. Onboard Storage: 768GB
2. Sensor Resolution: 4K (3840 x 2160 pixels)
3. Lens Type: 3x Optical Zoom
4. Image Sensor: 1/2.8” Progressive CMOS
5. Focal Length: 2.8 to 8mm
6. Iris: P-Iris
7. Aperture: F1.3 to F2.4
8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.
9. Field of View (FoV after LDC):
    a. Horizontal: 44° to 97° (40° to 87°)
    b. Vertical: 26° to 63° (23° to 57°)
    c. Diagonal: 50° to 106° (45° to 95°)
10. IR Range: 30m / 98ft in low light
11. Audio: Yes
12. Resistance Rating:
    a. Rating IK08
    b. FCC
    c. IEC60950-1
13. Dimensions:
    a. With Mount Plate:
        1) Length: 146mm / 5.75in
        2) Width: 146mm / 5.75in

3) Height: 104.3mm / 4.11in

b. Without Mount Plate:

1) Length: 146mm / 5.75in

2) Width: 146mm / 5.75in

3) Height: 99.8mm / 3.93in

14. Weight:

a. With Mount Plate: 916g / 32.31oz

b. Without Mount Plate: 776g / 27.37oz

15. Operating Power: 11W (IEEE 802.3af PoE)

16. Operating Temperature: -10°C to 50°C / 14°F to 122°F

17. Operating Humidity: 0% to 90%

18. Connectivity: Ethernet 10/100Mbps RJ-45 cable connector for Network/PoE connection

2.5 OUTDOOR DOME SERIES

A. CD32-E Outdoor Dome Camera by Verkada Inc.

1. Onboard Storage: 768GB

2. Sensor Resolution: 3MP (2048 x 1536 pixels)

3. Lens Type: Fixed

4. Image Sensor: 1/2.8” Progressive CMOS

5. Focal Length: 2.8mm

6. Iris: Fixed

7. Aperture: F1.6

8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.

9. Field of View (FoV after LDC):

a. Horizontal: 97° (78°)

b. Vertical: 71° (63°)

c. Diagonal: 128° (91°)

10. IR Range: 15m / 50ft in low light

11. Audio: Yes

12. Resistance Ratings:

a. IK08

b. FCC

c. IEC60950-1

13. Dimensions:

a. With Mount Plate:

1) Length: 146mm / 5.75in

2) Width: 146mm / 5.75in

3) Height: 104.3mm / 4.11in

b. Without Mount Plate:

1) Length: 146mm / 5.75in

2) Width: 146mm / 5.75in

3) Height: 99.8mm / 3.93in

14. Weight:

a. With Mount Plate: 748g / 26.38oz

b. Without Mount Plate: 608g / 21.45oz

15. Operating Power: 11W (IEEE 802.3af PoE)

16. Operating Temperature: -10°C to 50°C / 14°F to 122°F

17. Operating Humidity: 0% to 90%

18. Connectivity: Ethernet 10/100Mbps RJ-45 cable connector for Network/PoE connection

B. CD42-E Outdoor Dome Camera by Verkada Inc.

1. Onboard Storage768GB

2. Sensor Resolution: 5MP (2688 x 1944 pixels)

3. Lens Type: Fixed

4. Image Sensor: 1/2.8” Progressive CMOS

5. Focal Length: 2.8mm

6. Iris: Fixed

7. Aperture: F1.6

8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.

9. Field of View (after LDC):

a. Horizontal: 87° (78°)

b. Vertical: 70° (63°)

c. Diagonal: 101° (91°)

10. IR Range: 15m / 50ft in low light

11. Audio: Yes

12. Resistance Rating:

a. IK10

b. IP67

c. FCC

d. IEC60950-1

13. Dimensions:

a. With Mount Plate:

1) Length: 155mm / 6.1in

2) Width: 155mm / 6.1in

3) Height: 114.6mm / 4.51in

b. Without Mount Plate:

1) Length: 155mm / 6.1in

2) Width: 155mm / 6.1in

3) Height: 107.6mm / 4.24in

14. Weight:

a. With Mount Plate: 1021g / 36.01oz

b. Without Mount Plate: 847g / 29.88oz

15. Operating Power:

a. With IR: IEEE 802.3af Type 1 PoE

b. Without IR: IEEE 802.3af Type 1 PoE

c. Extended temperature range: IEEE 802.3at Type 2 PoE+

16. Operating Temperature:

a. PoE 802.3af: -20°C to 50°C / -4°F to 122°F

b. PoE 802.3at: -40°C to 50°C / -40°F to 122°F

17. Operating Humidity: 0% to 90%

18. Connectivity: Ethernet 10/100Mbps RJ-45 cable connector for Network/PoE connection

C. CD52-E Outdoor Dome Camera by Verkada Inc.

1. Onboard Storage: 768GB

2. Sensor Resolution: 5MP (2688 x 1944 pixels)
3. Lens Type: 3x Optical Zoom
4. Image Sensor: 1/2.8” Progressive CMOS
5. Focal Length: 2.8 to 8mm
6. Iris: P-Iris
7. Aperture: F1.3 to F2.4
8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.
9. Field of View (FoV after LDC):
    a. Horizontal: 41° to 93° (37° to 84°)
    b. Vertical: 31° to 76° (28° to 68°)
    c. Diagonal: 50° to 107° (45° to 97°)
10. IR Range: 30m / 98ft in low light
11. Audio: Yes
12. Resistance Rating:
    a. IK10
    b. IP67
    c. FCC
    d. IEC60950-1
13. Dimensions:
    a. With Mount Plate:
        1) Length: 155mm / 6.1in
        2) Width: 155mm / 6.1in
        3) Height: 114.6mm / 4.51in
    b. Without Mount Plate:
        1) Length: 155mm / 6.1in
        2) Width: 155mm / 6.1in
        3) Height: 107.6mm / 4.24in
14. Weight:
    a. With Mount Plate: 1244g / 43.88oz
    b. Without Mount Plate: 1070g / 37.74oz

15. Operating Power:
    a. With IR: IEEE 802.3af Type 1 PoE
    b. Without IR: IEEE 802.3af Type 1 PoE
    c. Extended temperature range: IEEE 802.3at Type 2 PoE+
16. Operating Temperature:
    a. PoE 802.3af: -20°C to 50°C / -4°F to 122°F
    b. PoE 802.3at: -40°C to 50°C / -40°F to 122°F
17. Operating Humidity: 0% to 90%
18. Connectivity: Ethernet 10/100Mbps RJ-45 cable connector for Network/PoE connection

D. CD62-E Outdoor Dome Camera by Verkada Inc.
1. Onboard Storage: 768GB
2. Sensor Resolution: 4K (3840 x 2160 pixels)
3. Lens Type: 3x Optical Zoom
4. Image Sensor: 1/2.8” Progressive CMOS
5. Focal Length: 2.8 to 8mm
6. Iris: P-Iris
7. Aperture: F1.3 to F2.4
8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.
9. Field of View (FoV after LDC):
    a. Horizontal: 44° to 97° (40° to 87°)
    b. Vertical: 26° to 63° (23° to 57°)
    c. Diagonal: 50° to 106° (45° to 95°)
10. IR Range: 30m / 98ft in low light
11. Audio: Yes
12. Resistance Rating:
    a. IK10
    b. IP67
    c. FCC
    d. IEC60950-1
13. Dimensions:

a. With Mount Plate:

1) Length: 155mm / 6.1in

2) Width: 155mm / 6.1in

3) Height: 114.6mm / 4.51in

b. Without Mount Plate:

1) Length: 155mm / 6.1in

2) Width: 155mm / 6.1in

3) Height: 107.6mm / 4.24in

14. Weight:

a. With Mount Plate: 1168g / 41.2oz

b. Without Mount Plate: 994g / 35.06oz

15. Operating Power:

a. With IR: IEEE 802.3af Type 1 PoE

b. Without IR: IEEE 802.3af Type 1 PoE

c. Extended temperature range: IEEE 802.3at Type 2 PoE+

16. Operating Temperature:

a. PoE 802.3af: -20°C to 50°C / -4°F to 122°F

b. PoE 802.3at: -40°C to 50°C / -40°F to 122°F

17. Operating Humidity: 0% to 90%

18. Connectivity: Ethernet 10/100Mbps RJ-45 cable connector for Network/PoE connection

2.6 MINI SERIES

A. CM41 Interior Mini Dome Camera by Verkada Inc.

1. Onboard Storage: 768GB

2. Sensor Resolution: 5MP (2688 x 1944 pixels)

3. Lens Type: Fixed

4. Image Sensor: 1/2.8” Progressive CMOS

5. Focal Length: 2.8mm

6. Iris: Fixed

7. Aperture: F1.6

8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.

9. Field of View (FoV after LDC):
    a. Horizontal: 86° (77°)
    b. Vertical: 69° (62°)
    c. Diagonal: 100° (90°)
10. IR Range: 15m / 49ft in low light
11. Audio: Yes
12. Resistance Rating: IK08
13. Dimensions:
    a. Length: 100mm / 3.94in
    b. Width: 100mm / 3.94in
    c. Height: 63mm / 2.48in
14. Weight: 228g / 8.04oz
15. Operating Power: 6W (IEEE 802.3af PoE)
16. Operating Temperature: -10°C to 50°C / 14°F to 122°F
17. Operating Humidity: 0% to 90%
18. Connectivity: Ethernet 10/100Mb RJ-45 Cable Connector for Network/PoE Connection

B. CM41-E Exterior Mini Dome Camera by Verkada Inc.

1. Onboard Storage: 768GB
2. Sensor Resolution: 5MP (2688 x 1944 pixels)
3. Lens Type: Fixed
4. Image Sensor: 1/2.8” Progressive CMOS
5. Focal Length: 2.8mm
6. Iris: Fixed
7. Aperture: F1.6
8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.
9. Field of View (FoV after LDC):
    a. Horizontal: 86° (77°)
    b. Vertical: 69° (62°)
    c. Diagonal: 100° (90°)
10. IR Range: 15m / 49ft in low light

11. Audio: Yes
12. Resistance Rating:
    a. IK10
    b. IP67
    c. IP6K9K
13. Dimensions:
    a. Length: 121mm / 4.76in
    b. Width: 121mm / 4.76in
    c. Height: 72mm / 2.83in
14. Weight: 401g / 14.14oz
15. Operating Power: 12W (IEEE 802.3af PoE)
16. Operating Temperature: -40°C to 55°C / -40°F to 131°F
17. Operating Humidity: 0% to 90%
18. Connectivity: Ethernet 10/100Mb RJ-45 Cable Connector for Network/PoE Connection

C. CM41-S Modular Mini Dome Camera by Verkada Inc.

1. Onboard Storage: 768GB
2. Sensor Resolution: 5MP (2688 x 1944)
3. Lens Type: Fixed
4. Image Sensor: 1/2.8” Progressive CMOS
5. Focal Length: 2.8mm
6. Iris: Fixed
7. Aperture: F1.6
8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.
9. Field of View (FoV after LDC):
    a. Horizontal: 86° (77°)
    b. Vertical: 69° (62°)
    c. Diagonal: 100° (90°)
10. IR Range: N/A
11. Audio: No
12. Resistance Rating: N/A

13. Dimensions:

    a. Camera Head

        1) Length: 35.22mm / 1.39in

        2) Width: 55.22mm / 2.17in

        3) Height: 47.9mm / 1.89in

    b. Base:

        1) Length: 94.18mm / 3.71in

        2) Width: 94.18mm / 3.71in

        3) Height: 27.64mm / 1.09in

14. Weight:

    a. With Mount Plate: 254g / 8.96oz

    b. Without Mount Plate: 199g / 7.02oz

15. Operating Power: 4.5W (IEEE 802.3af PoE)

16. Operating Temperature: -10°C to 50°C / 14°F to 122°F

17. Operating Humidity: 0% to 90%

18. Connectivity: Ethernet 10/100Mb RJ-45 Cable Connector for Network/PoE Connection

2.7 BULLET SERIES

A. CB52-E Wide View Exterior Bullet Camera by Verkada Inc.

1. Onboard Storage: 768GB

2. Sensor Resolution: 5MP (2688 x 1944 pixels)

3. Lens Type: Varifocal; Motorized Zoom

4. Image Sensor: 1/2.8” Progressive CMOS

5. Focal Length: 2.8mm to 8mm

6. Iris: P-Iris

7. Aperture: F1.5 to F2.8

8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.

9. Field of View (FoV after LDC):

    a. Horizontal: 41° to 99° (39° to 95°)

    b. Vertical: 30° to 74° (30° to 74°)

    c. Diagonal: 50° to 125° (48° to 110°)

10. IR Range: 30m / 98ft in low light
11. Audio: No
12. Resistance Rating:
    a. IK10
    b. IP67
13. Dimensions:
    a. Length: 254mm / 10in
    b. Width: 85mm / 3.35in
    c. Height: 85mm / 3.35in
14. Weight
    a. With Mount Plate: 1497g / 52.81oz
    b. Without Mount Plate: 1464g / 51.64oz
15. Operating Power:
    a. With IR: IEEE 802.3at Type 2 PoE+
    b. Without IR: IEEE 802.3af Type 1 PoE
    c. Extended temperature range: IEEE 802.3at Type 2 PoE+
16. Operating Temperature: -40°C to 50°C / -40°F to 122°F
17. Operating Humidity: 0% to 90%
18. Connectivity: Ethernet 10/100Mb RJ-45 Cable Connector for Network/PoE Connection

B. CB52-TE Narrow View Exterior Bullet Camera by Verkada Inc.

1. Onboard Storage768GB
2. Sensor Resolution: 5MP (2688 x 1944 pixels)
3. Lens Type: Varifocal; Motorized Zoom
4. Image Sensor: 1/2.8” Progressive CMOS
5. Focal Length: 2.8mm to 8mm
6. Iris: P-Iris
7. Aperture: F1.5 to F2.8
8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.
9. Field of View (FoV after LDC):
    a. Horizontal: 16° to 38° (16° to 37°)

b. Vertical: 12° to 28° (12° to 27°)

c. Diagonal: 19° to 48° (19° to 44°)

10. IR Range: 50m / 164ft in low light

11. Audio: No

12. Resistance Rating:

a. IK10

b. IP67

13. Dimensions:

a. Length: 254mm / 10in

b. Width: 85mm / 3.35in

c. Height: 85mm / 3.35in

14. Weight:

a. With Mount Plate: 1511g / 53.3oz

b. Without Mount Plate: 1478g / 52.13oz

15. Operating Power:

a. With IR: IEEE 802.3at Type 2 PoE+

b. Without IR: IEEE 802.3af Type 1 PoE

c. Extended temperature range: IEEE802.3at Type 2 PoE+

16. Operating Temperature: -40°C to 50°C / -40°F to 122°F

17. Operating Humidity: 0% to 90%

18. Connectivity: Ethernet 10/100Mb RJ-45 Cable Connector for Network/PoE Connection

C. CB62-E Wide View Exterior Bullet Camera by Verkada Inc.

1. Onboard Storage768GB

2. Sensor Resolution: 4K (3840 x 2160 pixels)

3. Lens Type: Varifocal; Motorized Zoom

4. Image Sensor: 1/2.8” Progressive CMOS

5. Focal Length: 2.8mm to 8mm

6. Iris: P-Iris

7. Aperture: F1.5 to F2.8

8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.

9. Field of View (FoV after LDC):
    a. Horizontal: 43° to 107° (41° to 106°)
    b. Vertical: 24° to 62° (24° to 62°)
    c. Diagonal: 49° to 126° (48° to 119°)
10. IR Range: 30m / 98ft in low light
11. Audio: No
12. Resistance Rating:
    a. IK10
    b. IP67
13. Dimensions:
    a. Length: 254mm / 10in
    b. Width: 85mm / 3.35in
    c. Height: 85mm / 3.35in
14. Weight
    a. With Mount Plate: 1497g / 52.81oz
    b. Without Mount Plate: 1464g / 51.64oz
15. Operating Power:
    a. With IR: IEEE 802.3at Type 2 PoE+
    b. Without IR: IEEE 802.3af Type 1 PoE
    c. Extended temperature range: IEEE 802.3at Type 2 PoE+
16. Operating Temperature: -40°C to 50°C / -40°F to 122°F
17. Operating Humidity: 0% to 90%
18. Connectivity: Ethernet 10/100Mb RJ-45 Cable Connector for Network/PoE Connection

D. CB62-TE Narrow View Exterior Bullet Camera by Verkada Inc.
1. Onboard Storage: 768GB
2. Sensor Resolution: 4K (3840 x 2160 pixels)
3. Lens Type: Varifocal; Motorized Zoom
4. Image Sensor: 1/2.8” Progressive CMOS
5. Focal Length: 2.8mm to 8mm
6. Iris: P-Iris
7. Aperture: F1.5 to F2.8

8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.

9. Field of View (FoV after LDC):

   a. Horizontal: 17° to 42° (17° to 41°)

   b. Vertical: 9° to 23° (9° to 23°)

   c. Diagonal: 19° to 48° (19° to 46°)

10. IR Range: 50m / 164ft in low light

11. Audio: No

12. Resistance Rating:

   a. IK10

   b. IP67

13. Dimensions:

   a. Length: 254mm / 10in

   b. Width: 85mm / 3.35in

   c. Height: 85mm / 3.35in

14. Weight:

   a. With Mount Plate: 1511g / 53.3oz

   b. Without Mount Plate: 1478g / 52.13oz

15. Operating Power:

   a. With IR: IEEE 802.3at Type 2 PoE+

   b. Without IR: IEEE 802.3af Type 1 PoE

   c. Extended temperature range: IEEE802.3at Type 2 PoE+

16. Operating Temperature: -40°C to 50°C / -40°F to 122°F

17. Operating Humidity: 0% to 90%

18. Connectivity: Ethernet 10/100Mb RJ-45 Cable Connector for Network/PoE Connection

2.8 FISHEYE SERIES

A. CF81-E Fisheye Camera by Verkada Inc.

1. Onboard Storage: 1TB

2. Sensor Resolution: 12MP (4056 x 3040 pixels)

3. Lens Type: Fixed Zoom

4. Image Sensor: 1/2.3” Progressive CMOS

5. Focal Length: 1.18mm
6. Iris: Fixed
7. Aperture: F2.18
8. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.
9. Field of View after LDC:
    a. Horizontal: 180°
    b. Vertical FoV: 180°
    c. Diagonal: 180°
10. IR Range: 20m / 66ft in low light
11. Audio: Yes
12. Resistance:
    a. FCC
    b. CE - EN55035
    c. IK10
    d. IP67
13. Dimensions
    a. With Mount Plate:
        1) Length: 155mm / 6.1in
        2) Width: 155mm / 6.1in
        3) Height: 71.62mm / 2.82in
    b. Without Mount Plate:
        1) Length: 155mm / 6.1in
        2) Width: 155mm / 6.1in
        3) Height: 64.42mm / 2.54in
14. Weight:
    a. With Mount Plate: 1202g / 42.4oz
    b. Without Mount Plate: 1023g / 36.1oz
15. Operating Power:
    a. With IR: IEEE 802.3af Type 1 PoE/IEEE 802.3at Type 2 PoE+
    b. Extended temperature range: IEEE802.3at Type 2 PoE+

16. Operating Temperature: -40°C to 50°C / -40°F to 122°F

17. Operating Humidity: 0% - 90%

18. Connectivity: Ethernet RJ-45 cable connector for network/PoE connection; 10/100 Mbps

2.9 MULTISENSOR SERIES

A. CH52-E Multisensor Camera by Verkada Inc.

1. Onboard Storage: 4TB

2. Sensor Resolution: 4 x 5MP (2688 x 1944 pixels)

3. Lens Type: Varifocal; motorized zoom

4. Image Sensor: 4 x 1 / 2.8” Progressive CMOS

5. Focal Length: 3.7-7.7mm

6. Iris: N/A

7. Aperture: F1.9 - F2.9

8. Sensor Movement:

   a. Tilt: +0°-105° for each lens from horizon

   b. Pan: +/- 90° for each lens

   c. Rotation: +/- 90° for each lens

9. Lens Distortion Correction (LDC): LDC crops the sensor field of view to deliver a rectified, undistorted output image.

10. Field of View (FoV after LDC):

    a. Horizontal: 37° to 89° (35° to 82°)

    b. Vertical: 29° to 65° (26° to 60°)

    c. Diagonal: 46° to 99° (43° to 92°)

11. IR Range: 30m / 98ft

12. Audio: Not supported

13. Resistance:

    a. FCC

    b. CE - EN55035

    c. IK10

    d. IP67

14. Dimensions

    a. With Mount Plate:

1) Length: 275mm / 10.83in

2) Width: 275mm / 10.83in

3) Height: 118mm / 4.65in

b. Without Mount Plate:

1) Length: 267mm / 10.51in

2) Width: 267mm / 10.51in

3) Height: 114mm / 4.49in

15. Weight:

a. With Mount Plate: 3436g / 121.2oz

b. Without Mount Plate: 2900g / 102.29oz

16. Operating Power:

a. With IR: IEEE 802.3bt Type 3 PoE++

b. Without IR: IEEE 802.3at Type 2 PoE+

c. Extended temperature range: IEEE 802.3bt Type 3 PoE++

17. Operating Temperature: -40°C to 50°C / -40°F to 122°F

18. Operating Humidity: 0% to 90%

19. Connectivity: Ethernet RJ-45 cable connector for network/PoE connection; 10/100 Mbps

2.10 VIEWING STATION

A. VX52 Video Surveillance Viewing Station by Verkada Inc.

1. Description:

a. The VX52 is a dedicated device that streams up to 300 camera feeds (30 cameras per page, up to 10 pages) to any display with ultra-low latency, crisp video playback, customizable Smart Tiles and layouts. Built on the powerful Apple TV 4K platform, the VX52 is the viewing platform of choice for customers with mission-critical real-time viewing requirements.

b. Administrator Managed Device – Admins can remotely manage the VX52, select video feeds and Smart Tiles to display as well as customize layouts. Non-admin viewers do not need accounts, cannot access historical footage, and cannot modify display settings.

c. Plug-and-Play by Design – Simply connect the device to your network via ethernet or WiFi and project on a display. The VX52 is ready to stream in minutes with zero configuration needed.

d. Stable and Resilient – Streams play continuously without interruption for both local and remote streaming. There is no need to reset the device or relaunch a browser or application, streams restart automatically after a power outage.

e. Supported by Verkada – Admins configure the VX52 in Command, just like their cameras. The VX52 is backed by our industry-leading 10-year warranty and the dedicated Verkada customer support team.

2. Key Features

    a. Stream up to 300 cameras across 10 pages on a single display

    b. Ultra-low latency with crisp video playback

    c. Administrator managed device without requiring additional accounts

    d. Plug-and-play with zero local configuration needed

    e. Easily configure Smart Tiles and layout display from Command

    f. Automatically restarts after a power outage

    g. 10-year warranty

3. Technical Specifications

    a. Supported Displays: One display per station

    b. Number of Streams:

        1) 30 streams per page

        2) 300 streams total

    c. Processor: A12 Bionic chip

    d. Dimensions:

        1) Length: 99.1mm / 3.9in

        2) Width: 99.1mm / 3.9in

        3) Height: 35.6mm / 1.4in

    e. Weight: Weight: 425g / 15oz

    f. Operating Temperature: 0° to 35° C / 32°F to 95°F

    g. Operating Humidity: 0% to 95%

    h. Operating altitude: Up to 3,000m / 10,000ft

    i. Display Resolution Supported: Up to 4096 x 2160 pixels

    j. Included accessories:

        1) HDMI cord

        2) setup guide

        3) power cord

        4) Apple TV remote

    k. Connectors:

        1) HDMI 2.1 port

        2) Gigabit Ethernet

l. Connectivity: 10/100/1000BASE-T Gigabit Ethernet (RJ-45), 802.11 ax WiFi 6

2.11 POE INJECTORS

A. INJ-POE-PLUS Power over Ethernet+ Injector by Verkada Inc.

1. Description: Verkada's INJ-POE-PLUS is a single port, high-power solution for remote powering of PoE enabled hardware, including Verkada security cameras, access control, and environmental sensors. Generating up to 30W, the INJ-POE-PLUS enables remote power for a new range of applications including 802.11n Access Points and pan-tilt-zoom (PTZ) cameras. It complies to IEEE 802.3at PoE standard and is backward compatible to IEEE802.3af. It can power both existing 10/100Base-T network devices and emerging wireless 1000Base-T devices such as WiMAX and wireless IEEE 802.11n access points.

2. Key Features:

a. IEEE 802.3at compliant with 2-event classification

b. IEEE 802.3af backward compatible

c. Output power of 30W is guaranteed

d. Supports 10/100/1000Base-T applications

e. Compatible with IEEE 802.3af devices

f. Safe – low power devices receive only the power they need

g. Automatic Detection and Protection of non-standard Ethernet terminals

h. Compact design fits easily in WLAN Access Point and IP Cameras installations

3. Technical Specifications

a. Data Rates: 10/100/1000 Mbps

b. Power over Ethernet Output:

c. Pin Assignment and Polarity: Spare Pairs 7/8 (-) and 4/5 (+)

d. Output Power Voltage: 55 VDC

e. User Port Power: 30W (Guaranteed)

f. Input Power Requirements:

1) AC Input Voltage: 100VAC to 240VAC (±10%)

2) AC Input Current: 0.67A @ 100VAC to 240VAC

3) AC Frequency: 50 to 60Hz

g. Dimensions:

1) Length: 160.5mm / 6.32in

2) Width: 51.8mm / 2.04in

3) Height: 34.8mm / 1.37in

h. Weight: 200g / 7.05oz

i. Connectors:

1) Shielded RJ-45

2) EIA 568A

3) EIA 568B

j. Environmental Conditions:

1) Operating Ambient Temperature:

a) -4°F to 104°F (-20 °C to 40°C) @30W

a) -4°F to 131°F (-20 °C to 55°C) @22.5W

k. Operating Humidity: 0% to 90%

l. Operating Altitude: -304.8m to 3,048m / -1,000ft to 10,000 ft

m. MTBF: 100,000 hrs @ 25°C

n. Thermal Rating: 20 BTU/Hr (@240VAC)

o. Regulatory Compliance:

1) IEEE 802.3af (PoE)

2) RoHS Compliant

3) WEEE Compliant

4) CE

p. Electromagnetic Emission and Immunity:

1) FCC Part 15, Class B

2) EN 55032 Class B (Emissions)

3) EN 55024 (Immunity)

4) VCCI

q. Safety: UL/EN/IEC 60950-1 (Ed.2)

B. ACC-POE-60W Power over Ethernet++ Injector by Verkada Inc.

1. Description: Verkada's ACC-POE-60W converts two inputs – a power cable and an Ethernet cable – to a single PoE ++ port (IEEE 802.3bt standard, type 3 compliant) with up to 60W of power. The ACC-POE-60W is designed to power the CH52-E Multisensor camera, but it is also backwards compatible and safe to use with any IEEE 802.3af/at terminals in other Verkada devices. The ACC-POE-60W comes with a US power cord (for US customers) and a UK power cord (for Europe customers) and is wall mountable.

2. Key Features

a. IEEE 802.bt Type 3 compliant

b. IEEE 802.3af/at backward compatible

c. Output power of 60W over 4–pairs

d. Supports 10/100/1000 Base–T applications

e. Safe: low–power devices receive only the power they need

f. Automatic detection and protection of non–standard Ethernet terminals

g. Compact design fits easily in WLAN access point and IP camera installations

3. Technical Specifications

a. Data Rates: 10/100/1000 Mbps

b. Power over Ethernet Output:

1) Data Pairs:

a) 1/2 (-)

b) 3/6 (+)

2) Spare Pairs:

a) 7/8 (-)

b) 4/5 (+)

3) Output Voltage: 55 V nominal

c. Output Power Voltage: 55 VDC

d. User Port Power: 30W (Guaranteed)

e. Input Power Requirements:

1) AC Input Voltage: 100 to 240V

2) AC Input Current: 1.5A

3) AC Frequency: 50 / 60Hz

f. Dimensions:

1) Length: 151mm / 5.94in

2) Width: 62mm / 2.44in

3) Height: 38mm / 1.5in

g. Weight: 500g / 17.64oz

h. Connectors:

1) Shielded RJ-45

2) EIA 568A

3) EIA 568B

i. Environmental Conditions:

1) Operating Ambient Temperature:

a) -20°C to 40°C / 14°F to 104°F @ 60W

b) -20°C to 55°C / 14°F to 131°F @ 30W

j. Operating Humidity: 0% to 90%

k. Operating Altitude: -400m to 3,048m / -1,312ft to 10,000 ft

l. MTBF: 240,000 hrs @ 25°C

m. Thermal Rating: 34 BTU/Hr

n. Regulatory Compliance: IEEE 802.3bt

o. Electromagnetic Emission and Immunity:

1) FCC Part 15, Class B

2) EN 55032 Class B

3) EN 55024

4) VCCI

p. Safety: CE/UL/IEC/EN 62368-1

2.12 ACCESSORIES

A. ACC-MNT-2 Mounting Arm Kit by Verkada Inc.

1. Description: Wall mounted extender arm with built-in 1.5” female NPT thread.

2. Material: Aluminum Alloy

3. Dimensions:

a. Length: 230.5mm / 9.07in

b. Width: 86mm / 3.39in

c. Height: 117mm / 4.61in

4. Color: White

5. Weight: 700g / 24.69oz

B. ACC-MNT-3 Wall Mounted L-Shaped Bracket Kit by Verkada Inc.

1. Description: Compact bracket for mounting camera perpendicular to wall.

2. Material: Aluminum Alloy

3. Dimensions:

a. Length: 170mm / 6.69in

b. Width: 150mm / 5.91in

c. Height: 110mm / 4.33in

4. Color: White

5. Weight: 577g / 20.35oz

C. ACC-MNT-5 Mini Pendant Cap Mount Kit by Verkada Inc.

1. Description: Two-piece threaded cap for mounting a Mini camera to 3/4” NPT threaded drop pipe. Cap piece can be removed and mounted independently with its 1.5” male NPT thread.

2. Material: Aluminum Alloy

3. Dimensions:

a. Length: 100mm / 3.94in

b. Width: 100mm / 3.94in

c. Height: 102.8mm / 4.05in

4. Color: Dark grey

5. Weight: 240g / 8.47oz

6. Included Accessories:

a. Fasteners

b. Set screw

c. Hex key

D. ACC-MNT-6 Mini Camera Junction Box Mount Adapter by Verkada Inc.

1. Description: For mounting a Mini camera to a standard junction box.

2. Material: Steel Mount Plate, Plastic Cover

3. Dimensions:

a. Length: 130mm / 5.12in

b. Width: 130mm / 5.12in

c. Height: 7.5mm / 0.3in

4. Color: Grey Mount Plate, White Plastic Cover

5. Weight: 160g / 5.64oz

6. Included Accessories:

a. Fasteners

E. ACC-MNT-7 Angle Mount by Verkada Inc.

1. Description: Mounts fisheye and dome cameras 30° from wall for improved field of view.

2. Material: Aluminum Alloy

3. Dimensions:
    a. Length: 155mm / 6.1in
    b. Width: 149mm / 5.87in
    c. Height: 82mm / 3.23in
4. Color: White
5. Weight: 390g / 13.76oz
6. Included Accessories:
    a. Metal mount ring
    b. 3x countersink screws
    c. 3x thumbscrews
    d. Rubber plug

F. ACC-MNT-8 Pendant Cap Mounting Adapter Kit by Verkada Inc.

1. Description: Threaded cap adapter enables mounting of Indoor Dome Series, Outdoor Dome Series, Fisheye Series, and Multisensor Series cameras to hardware with 3/4" female NPT and 1.5" male NPT threads, including ACC-MNT-2 Mounting Arm Kit by Verkada Inc.
2. Material: Aluminum Alloy
3. Dimensions:
    a. Length: 155mm / 6.1in
    b. Width: 155mm / 6.1in
    c. Height: 42mm / 1.65in
4. Color: White
5. Weight: 300g / 10.58oz
6. Included Accessories:
    a. Set screw
    b. 3x thumbscrews.

G. ACC-MNT-9 Pole Mount Adapter by Verkada Inc.

1. Description: For mounting a camera to a circular pole.
2. Mounting Pole Diameter: 32mm to 152.4mm / 1.25in to 6in
3. Material: Steel
4. Dimensions:
    a. Length: 160mm / 6.3in

b. Width: 160mm / 6.3in

c. Height: 68mm / 2.68in

5. Color: White

6. Weight: 742g / 26.17oz

7. Included Accessories:

a. Adapter plate

b. 2x Metal strap set

c. Fasteners for compatible mounts

H. ACC-MNT-10 Corner Mount by Verkada Inc.

1. Description: Versatile bracket for mounting a range of accessories and cameras on corners.

2. Material: Steel

3. Dimensions:

a. Length: 190mm / 7.48in

b. Width: 263mm / 10.35in

c. Height: 170mm / 6.69in

4. Color: White

5. Weight: 1,890g / 66.67oz

I. ACC-MNT-11 Square Junction Box

1. Description: Square junction box for mounting Bullet Series cameras.

2. Material: Aluminum alloy

3. Dimensions:

a. Length: 128mm / 5.04in

b. Width: 128mm / 5.04in

c. Height: 40mm / 1.57in

4. Color: White

5. Weight: 303g / 10.69oz

6. Included Accessories:

a. 2x ¾in NPT plugs

b. 4x buttonhead screws

J. ACC-CAM-SHIELD-1

1. Description: Weather shield for protecting Dome Series and Fisheye Series cameras.
2. Material: Steel mount plate, polycarbonate visor
3. Dimensions:
    a. Length: 192mm / 7.56in
    b. Width: 185mm / 7.28in
    c. Height: 78mm / 3.07in
4. Color:
    a. Black mount plate
    b. White and black visor
5. Weight: 173g / 6.1oz
6. Included Accessories:
    a. Mounting fasteners

PART 3 - EXECUTION

3.1 INSTALLERS

A. Installation shall be performed by technicians that have successfully completed the Verkada Certified Engineer (VCE) program. For more information, visit www.verkada.com/partners/trainings.

3.2 EXAMINATION

A. Installation surfaces shall be clean and free from dust, dirt, and obstructions.

B. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

C. Examine rough-in for LAN and control cable conduit systems to server, PCs, controllers, cameras, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Refer to the Verkada Quick Start Guide applicable to each product.

B. Pre-Installation Conference: Prior to installation arrange conference between supplier, Owner, and related trades to review materials, procedures, and coordinating related work.

C. Furnish or coordinate any inserts required for building into concrete, masonry, and other work, to support and attach work of this Section. Furnish or coordinate in ample time to comply with schedule of work into which inserts are built.

D. Verify that power and outlets are in correct locations.

E. Verify that building structure is properly prepared for mounting, attachment, and support of equipment.

F. Prior to installation of systems components and devices, verify all required preparations have been properly performed and that substrates are acceptable for installation.

1. Verify all rough-ins and field dimensions.

G. Report in writing to the Owner's representative any prevailing conditions that will adversely affect satisfactory execution of work in this Section.

1. Owner or their representative reserves the right to review proposed methods of construction and installation, reject proposed methods, and have the installation done in a satisfactory method at the Contractor's cost.

3.4 INSTALLATION

A. Refer to the Verkada Quick Start Guide applicable to each product.

B. For support, proceed to www.verkada.com/support.

C. Sequencing: The work shall be performed in the following sequence, unless directed otherwise by Owner or their representative:

1. Installation of cables and network.

2. Installation of new cameras.

3. Installation of front-end equipment.

4. Commissioning of the new system components.

5. End User training

D. Install work in accordance with manufacturer's recommendations and instructions as well as final shop drawings. All components should be installed so as to allow easy access for service in the future.

E. Anchor components securely in place, plumb, level, and accurately aligned.

F. For solution products located in equipment traffic areas, and that are exposed to damage due to collision or impact from forklifts, or manually moved carts, carriers, or other equipment used by the Owner, provide protective bollards, railings, coverings etc. to ensure that all products installed are properly protected from such damage.

G. Provide fastenings, plates, and other incidental items required for complete and operational installation.

H. Provide required electrical work in accordance with Code requirements.

I. Security and protection:

1. Maintain strict security during the installation of equipment and software. Rooms housing the control station, and workstations that have been powered up shall be locked and secured during periods when a qualified operator in the employ of Contractor is not present.

2. Equipment protection: Provide protective covers, fenders, and barriers as necessary to maintain work of this Section in same condition as installed until time of substantial completion.

J. Cable requirements:

1. Twisted, shielded, plenum-rated type cable shall be used.

2. All exposed cables shall be in rigid conduit, electrical metallic tubing (EMT) raceway, or wire mold as approved by the Owner.

3. All concealed cables routed in j-hook pathways shall be fastened to the structure at least every four feet.

3.5 LABELING

A. Equipment and product labels shall be printed on self-adhesive labels. Handwritten labels or writing directly on the equipment enclosures is not acceptable.

B. Label equipment and products with the device address as programmed into the security systems and as reflected on the “As-Built” Record Drawings.

C. Label networked equipment enclosures with the IP address.

D. Cables shall be individually labeled at origin and termination.

3.6 PROGRAMMING

A. Complete all Verkada Command configuration programming.

B. Add all Verkada Cameras to Command via serial number.

C. Contract will coordinate with the Owner to ensure that new components have appropriate network connections.

D. Coordinate with the Owner to ensure that new components will be properly programmed into the system.

E. Change default passwords to new custom secure passwords as directed by the Owner.

3.7 ACCEPTANCE TESTING

A. Final Test and Acceptance Plan

1. Develop a final test and acceptance plan to identify each new system component, intent of test, test method, and expected results.

2. Each component listed in the plan shall include space for test part signatures, brief comments, time of test and pass/fail check boxes.

3. Test all equipment, products, and devices in accordance with the plan to ensure completely operational and fully functional security systems. Submit a written final test and acceptance report for review and approval.

4. The report shall be submitted to the Owner’s representative at least 30 days prior to the scheduled system acceptance test.

5. System acceptance of the access control system shall be conditioned upon successful completion and operational demonstration of all system functions and components as documented in the final test and acceptance report.

B. System Acceptance

1. System acceptance shall not occur until after the following activities have been successfully completed:

    a. Correction of all deficiencies and punch list items noted on the final test and acceptance report.

    b. Acceptance of final test and acceptance report.

    c. Acceptance of all project close-out submittals.

    d. Delivery of final project close-out documentation.

    e. Successful training and demonstration, including operation of systems, systems administration, and system management.

    f. Purging of Contractor user privileges and return of all credentials.

3.8 OWNER PERSONNEL TRAINING

A. On-site operator training:

1. Instruct operating staff in proper operation, including hands-on training.

2. Minimum of two, four-hour sessions covering the operations for each system installed.

3. Training sessions shall be provided to supervisors, end-user staff, security staff, maintenance personnel, IT personnel, and any other personnel designated by the Owner.

4. Provide training sessions on all work shifts, including day, evening, and night shifts.

B. On-site administrator training:

1. Instruct security system administrators for each system installed, including hands-on training.

2. Minimum of two, four-hour sessions covering the operations for each system installed.

3. Training shall cover all administrative and management functions, including features and controls, for each system.

END OF SECTION

SECTION 28 31 11 – FIRE ALARM WITH VOICE ALARM SYSTEM

PART 1 GENERAL

1.1 SCOPE

A. This specification document provides the requirements for the installation, programming and configuration of a complete Silent Knight 6820EVS digital protocol addressable fire alarm system with voice alarm.

B. This system shall include, but not be limited to, system cabinet, power supply, built in Signaling Line Circuit (SLC), 160-character LCD annunciator, six programmable Flexputs™, built in dual line, IP and optional cellular digital communicator associated peripheral devices, batteries, wiring, conduit and other relevant components and accessories required to furnish a complete and operational life safety system.

C. The 6820EVS has the interconnection capability for up to 17 panels with one panel acting as the communicator for panels in a link.

1.2 WORK INCLUDED

A. General Requirements

1. The contractor shall furnish and install a complete 24 VDC, electrically supervised, analog addressable fire alarm system as specified herein and indicated on the drawings. The system shall include but not be limited to all control panels, power supplies, initiating devices, audible and visual notification appliances, alarm devices, and all accessories required to provide a complete operating fire alarm system.

B. Listings

1. All fire alarm system equipment shall be listed for it’s intended purpose and be compatibility listed to assure the integrity of the complete system.

1.3 STANDARDS

A. The fire alarm equipment and installation shall comply with the current provisions of the following standards and shall be listed for it’s intended purpose and be compatibility listed to insure integrity of the complete system.

B. National Electric Code, Article 760

C. National Fire Protection Association Standards:

1. NFPA 70 National Electrical Code
2. NFPA 72 National Fire Alarm Code
3. NFPA 101 Life Safety Code

D. Local and State Building Codes

1. BOCA, National Building Code, Mechanical Code, Fire Prevention Code

E. Local Authorities Having Jurisdiction

1. City of Bellingham and Whatcom County Fire Marshal – This building will be reviewed by both Jurisdictions

F. Underwriters Laboratories Inc.

1. All equipment shall be approved by Underwriters Laboratories, Inc. for its intended purpose, listed as power limited by Underwriters Laboratories, Inc., for the following standards as applicable:

a. UL 864 UOJZ Control units for Fire Protective Signaling Systems

1) Local Signaling Unit

2) Central Station Signaling Protected Premises Unit

3) Remote Signaling Protected Premises Unit.

4) Water Deluge Releasing Unit

b. UL 268 Smoke Detectors for Fire Protective Signaling systems.

c. UL 268A Smoke Detectors for duct applications

d. UL 217 Smoke Detectors for Single Stations

e. UL 521 Heat Detectors for Fire Protective Signaling systems.

f. UL 228 Door Holders for Fire Protective Signaling systems.

g. UL 464 Audible Signaling appliances

h. UL 1638 Visual Signaling appliances

i. UL 38 Manually Activated Signaling Boxes

j. UL 346 Waterflow indicators for Fire Protective Signaling systems.

k. UL 1481 Power Supplies for Fire Protective Signaling systems.

l. UL 2572 Control and Communication Units for Mass Notification systems.

G. Americans with Disabilities Act (ADA).

1. All visual Notification appliances and manual pull stations shall comply with the requirements of the Americans with Disabilities Act.

1.4 GENERAL REQUIREMENTS

A. Manufacturers/Distributors Services:

1. The following supervision shall be provided by a factory trained service technician from the distributor of the fire alarm equipment. The technician shall be trained and shall have a minimum of two (2) years of service experience in the fire alarm industry. The technicians name shall appear on equipment submittals and a copy of his manufactures trained shall be sent to the project engineer. The technician shall be responsible for the following items:

a. A pre installation visit to the job site to review equipment submittals and to verify the method by which the system is to be wired.

b. During the installation the certified technician shall be on site or make periodic visits to verify installation and wiring of the system. He shall also supervise the completion of conduit rough, wires pulled into conduit and wiring rough, and ready for trim.

c. Upon completion of wiring, final checkout and certification of the system shall be made under the supervision of this technician.

d. At the time of the formal checkout, technician shall give operational instructions to the owner and or his representative on the system.

B. Submittals

1. The contractor shall submit complete sets of documentation within thirty (30) calendar days after award of the purchase order. Indicated in the document will be the type, size, rating, style, catalog number, manufacturers names, photos, and /or catalog data sheets for all items proposed to meet these specifications. The proposed equipment shall be subject to the approval of the Architect/Engineer and no equipment shall be ordered or installed on the premises without that approval.

2. NOTE: DOCUMENTATION - Submittal of shop drawings shall contain at least three (3) copies of original manufacturer specification and installation instruction sheets. Subsequent information may be copies. All equipment and devices on the shop drawings to be furnished under this contract shall be clearly marked in the specification sheets.

3. Suppliers qualifications shall be submitted indicating years in business, service policies, warranty definitions, NICET Level 4 certification, and completion of factory training program and a list of similar installations.

4. Contractor qualifications shall be supplied indicating years in business and prior experience with installations that include the type of equipment that is to be supplied.

5. The contractor shall provide hourly Service Rates, performed by a factory trained technician for this installed Life Safety System with the submittal. Proof of training and authorization shall be included with the submittal. These hourly service rates shall be guaranteed for a 1-year period.

6. Contract close-out Submittals

a. Deliver two (2) copies of the following to the owner’s representative within Thirty (30) days of system acceptance. The closeout submittals shall include:

b. Installation and Programming manuals for the installed Life Safety System.

c. Point to point diagrams of the entire Life Safety System as installed. This shall include all connected Smoke Detectors and addressable field modules.

d. All drawings must reflect device address as verified in the presence of the engineer and/or end user.

C. Warranty

1. Warranty all materials, installation and workmanship for a one (1) year period, unless otherwise specified. A copy of the manufacturer warranty shall be provided with the close out documentation.

D. Products

1. This Life Safety System Specification must be conformed to in its entirety to ensure that the installed and programmed Life Safety System will accommodate all of the requirements and operations required by the building owner. Any specified item or operational feature not specifically addressed prior to the bid date will be required to be met without exception.

E. General Equipment and Materials Requirements

1. All equipment furnished for this project shall be new and unused. All components shall be designed for uninterrupted duty. All equipment, materials, accessories, devices and other facilities covered by this specification or noted on the contract drawings and installation specification shall be best suited for the intended use and shall be provided by a single manufacturer. If any of the equipment provided under this specification is provided by different manufacturers, then that equipment shall be "Listed" as to its compatibility by Underwriters Laboratories (UL), if such compatibility is required by UL standards.

F. Satisfying the Entire Intent of these Specifications

1. It is the contractor's responsibility to meet the entire intent of these specifications.

2. Deviations from the specified items shall be at the risk of the contractor until the date of final acceptance by the architect, engineer, and owner's representative.

3. All costs for removal, relocation, or replacement of a substituted item shall be at the risk of the electrical contractor.

1.5 SYSTEM OPERATION

A. Alarm

1. When a device indicates any alarm condition the control panel must respond within 3 seconds. The General Alarm or Supervisory Alarm LED on the annunciator(s) should light and the LCD should prompt the user as to the number of current events. The alarm information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.

2. When the alarmed device is restored to normal, the control panel shall be required to be manually reset to clear the alarm condition, except that the alarms may be silenced as programmed.

3. An alarm shall be silenced by a code or Firefighter key at the main or remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur (subsequent alarm feature). When alarms are silenced the silenced LED on the control panel, and on any remote annunciators shall remain lit, until the alarmed device is returned to normal

B. Troubles

1. When a device indicates a trouble condition, the control panel System Trouble LED should light and the LCD should prompt the user as to the number of current events. The trouble information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators.

2. When the device in trouble is restored to normal, the control panel shall be automatically reset, The trouble restore information must be stored in event memory for later review. Event memory must be available at the main and all remote annunciators. A trouble shall be silenced by a code or Firefighter key at the main or remote annunciators. When silenced, this shall not prevent the resounding of subsequent events if another event should occur.

3. Supervision methods

   a. Each SLC loop shall be electrically supervised for opens and ground faults in the circuit wiring, and shall be so arranged that a fault condition on any loop will not cause an alarm to sound. Additionally, every addressable device connected to the SLC will be supervised and individually identified if in a fault condition. The occurrence of any fault will light a trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.

   b. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults, on the circuit wiring, and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.

4. The FACP shall support the following devices on the RS-485 data bus:

   a. 5815XL Signaling Line Circuit Expander (SLC) Module
   b. 5824 Printer Interface Module
   c. 5860 LCD Remote Annunciator
   d. 5865-3 LED Remote Annunciator
   e. 5865-4 LED Remote Annunciator with reset and silence switches
   f. 5880 LED I/O module
   g. 5895XL Intelligent Distributed Power Module
   h. 5496 Intelligent Remote Power Supply 6.0 Amp

PART 2 PRODUCTS

2.1 GENERAL

A. fire alarm control panel with emergency voice communications

1. The fire alarm control panel (FACP) shall be the Silent Knight 6820EVS analog addressable fire alarm control panel with emergency communication system. The audio amplifiers shall be the Silent Knight EVS-50W, EVS-125W, EVS-INT50W or EVS-DUAL50W units. The FACP must have a 6-amp power supply and be capable of expansion to a minimum of 384 total amps via bus connected expander modules that supervise low battery, loss off AC and loss of communication.

2. The system must contain at least one (1) Silent Knight ECS-50W, ECS-125W, ECS-INT50W or ECS-DUAL-50W amplifier and shall be expandable from 50 to 500 watts utilizing up to 3 additional amplifiers. The ECS-50W and ECS-125W amplifiers shall be able to support a 4-zone splitter (Silent Knight EVS-CE4) to distribute the audio

information to different locations in the installation. The system shall have the capability of controlling up to 32 notification zones. The amplifiers must contain the capability of being remotely located through a four-wire SBUS communications circuit and a two-wire VBUS voice circuit. The system shall have the capability of adding up to 4 EVS-LOCs local operating consoles.

3. The emergency communication system must have the capability of downloading fifteen (15) 60 second messages and utilize DSP technology for higher audio intelligibility.

4. The emergency communication system shall be capable of operating at 25vrms or 70.7vrms (EVS-50W and EVS-INT50W) and must be field selectable at the amplifier level. Systems that require additional modules for voltage conversion shall not be accepted.

5. The FACP must be able to support 159 detectors and 159 analog addressable modules and expandable to a maximum of 1,110 analog addressable points per FACP. This shall be accomplished via a maximum of 63 signaling line circuits (SLC) capable of supporting up to 159 detectors and 159 addressable module devices each.

6. The FACP must have Drift Compensation sensitivity capabilities on detectors and be able to support 159 detectors and 159 analog addressable modules. The communication protocol on the SLC loop must be digital.

7. The FACP must support a minimum of six programmable Flexput™ circuits. The panel must have a built in 160-character LCD annunciator with the capability of having additional supervised remote annunciators connected in the field.

8. The FACP must have a built in UL approved IP and digital communicator with the option of adding a cellular module for communications. The communicator must allow local and remote up/downloading of system operating options, event history, and detector sensitivity data.

9. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose.

10. The FACP must compensate for the accumulation of contaminants that affect detector sensitivity. The FACP must have day/night sensitivity adjustments, maintenance alert feature (differentiated from trouble condition), detector sensitivity selection, auto-programming mode (Jumpstart) and the ability to upgrade the core programming software on site or over the telephone.

11. The main communication bus (SBUS RS485) shall be capable of class A or class B configuration with a total SBUS length of 6,000 feet.

12. The FACP shall have a Jumpstart feature that can automatically enroll all properly connected accessories into a functional system.

13. The FACP must have the ability to upgrade the firmware revision from a laptop where the FACP is installed.

14. Panels that do not have these capabilities will not be accepted.

B. System Wiring

1. The Signaling Line Circuit (SLC) and Data Communication Bus (SBUS) shall be wired with standard NEC 760 compliant wiring. No twisted, shielded or mid capacitance wiring is required for standard installations. All FACP screw terminals shall be able to accept 14-18 AWG wire. All system wiring shall be in accordance with the requirements of NFPA 70, the National Electrical Code (NEC), and also comply with article 760 of the NEC.

C. Signaling Line Circuits

1. Each SLC shall be capable of a wiring distance of 5,000 feet from the SLC driver module (6815) and be able to support127 addressable module devices. The communication protocol to SLC devices must be digital. Any SLC loop device, which goes into alarm, must interrupt the polling cycle for priority response from the FACP. The FACP must respond consistently to a device that goes into alarm on an SLC in under 10 seconds. The auxiliary 6815 SLC loop module must be capable of being located up to 6000 feet from the FACP on an RS-485 bus, which is separate from the SLC bus. The SLC shall be capable of functioning in a class A or class B configuration.

D. SLC Loop Devices

1. Devices supported must include photoelectric smoke detectors, heat detectors, combination fire and CO detectors, contact monitoring modules and relay output modules. There is to be no limit to the number of any particular device type, up to the maximum of 159 detectors and 159 modules that can be connected to the SLC.

2. Addressable detector functions

a. The products of combustion detectors must communicate analog values using a digital protocol to the control panel for the following functions:

3. Automatic compliance with NFPA 72 standards for detector sensitivity testing

a. Drift compensation to assure detector is operating correctly

4. Maintenance alert when a detector nears the trouble condition

a. Trouble alert when a detector is out of tolerance

5. Alert control panel of analog values that indicate fire.

E. Programmable Flexputs

1. The FACP shall support six programmable Flexput™ circuits that are capable of being programmed as supervised reverse polarity notification circuits or supervised auxiliary power circuits that can be programmed as continuous, resettable or door holder power. The circuits shall also be programmable as input circuits in Class A or B configurations to support dry contact or compatible two wire smoke detectors.

F. Addressable Notification Module

1. The contractor shall furnish and install where indicated on the plans, addressable notification modules, Honeywell Silent Knight Model SK-CONTROL. The modules shall be U.L. listed compatible with Honeywell Silent Knight 6820EVS fire alarm control panel. The notification module must provide one class A (Style Z) or class B (Style Y) notification output with one auxiliary power input. The notification module must be suitable for mounting in a standard 4 square electrical box and must include a plastic

cover plate. The notification module must provide an LED that is visible from the outside of the cover plate. The notification module must be fully programmable for such applications as required by the installation. The SK-CONTROL shall reside on the SLC loop and can be placed up to 5,000 feet from the control or 6815 SLC loop module.

G. Built-in Annunciators

1. The main control must have a built-in annunciator with a 160-character LCD display and feature LEDs for Alarm, Supervisory, Trouble, Silenced and Power. When in the normal condition the LCD shall display time and date based on a 200-year clock which is capable of automatic daylight savings time adjustments. All controls and programming keys are silicone mechanical type with tactile and audible feedback. Keys have a travel of .040 in. No membrane style buttons will be permissible. The annunciator must be able to silence and reset alarms. The annunciators must have twenty levels of user codes that will allow the limitation of operating system programming to authorized individuals.

H. Remote Annunciators

1. The project shall include a Kirkland Graphic annunciator at the front door with integral LCD annunciator. The annunciator shall use a CAD background and include LED alarm lights for sprinkler waterflow, main pull station, smoke detection by wing, a yellow light by mechanical room for duct detection and shall include a system trouble light. In addition combine a Silent Knight EVS-LOC at the annuciator location

2. The fire system shall be able to support remote annunciators. All annunciators must have an 80 - 160-character LCD/LED displays and must feature five LEDs for Alarm, Supervisory, Trouble, Silenced, and Power. All controls and programming keys are silicone mechanical type with tactical and audible feedback. Keys shall have a travel of .040 inches. No membrane style buttons will be permitted.

3. The annunciator must be able to silence and reset alarms. The annunciator must have twenty levels of user codes that will limit the operating system programming to authorized individuals. The control panel must allow all annunciators to accommodate multiple users input simultaneously. Remote annunciators shall be capable of operating at a distance of 6,000 feet from the main control panel on unshielded, non-twisted cable.

4. The fire system shall be able to support up to 16 remote annunciators. The exact number will be determined by type, LCD or LED. LED Remote annunciators shall have individually mapped LEDs and reset and silence input.

I. I/O LED Driver Module

1. The fire system shall be able to support up to eight I/O modules on the SBUS that shall be used to drive remote LED graphic style displays and accommodate up to eight dry contact type switch inputs. The I/O modules shall each drive up to 40 LEDs without requiring external power connections. The I/O module inputs shall be supervised and shall be suitable for alarm and trouble circuits as well as reset and silence switches. These driver boards shall contain 80 LED outputs that are powered by an external power source.

J. Serial/Parallel Interface

1. The fire system shall able to support up to two serial / parallel interfaces that drive standard computer-style printers (line printers only). The interface shall be programmable as to what information is sent to it and shall include the ability to print out Detector Status, Event History and System Programming.

K. Distributed Power Module

1. The contractor shall supply power modules, Models 5496 and 5895XL, compatible with the model 6820EVS fire alarm control panel. The power module must have 6 amps of output power, six Flexput® circuits rated at 3 amps each, and two Form C relay circuits rated at 6 amps at 24 volts DC. The six Flexput circuits shall be capable of being programmed as supervised reverse polarity notification circuits or supervised auxiliary power circuits that can be programmed as continuous, resettable or door holder power. The circuits shall also be programmable as input circuits in Class A or B configurations to support dry contact or compatible two wire smoke detectors.

2. The power module shall be capable of being connected via an RS-485 system bus (SBUS) at a maximum distance of 6,000 feet from the main control panel. It shall contain an additional RS-485 system bus that is completely compatible with all 6820EVS add-on SBUS modules, annunciators, serial/parallel modules and addressable devices. The power module will also act as a bus repeater so that additional RS-485 (modules) devices can be connected at a maximum distance of 6,000 feet from the power module.

3. The 5496 and 5895XL power modules must have 6 amps of output power and four circuits rated at 3 amps each. The four circuits can be programmed as notification outputs or auxiliary power outputs of door holder, constant, resettable and sounder base synchronization types.

4. The 6820EVS shall be able to support up to eight (8) of the Distributed Power Modules in any combination.

5. The power module’s RS-485 bus shall be electrically isolated providing ground loop isolation and transient protection.

L. Digital Communicator

1. The digital/IP communicator must be an integral part of the control panel and be able to report all zones or points of alarm, supervisory, and trouble as well as all system status information such as loss of AC, low battery, ground fault, loss of supervision to any remote devices with individual and distinct numeric codes to a central station or remote station. The communicator must also be able to up/download all system programming options, event history and detector sensitivity compliance information to a PC on-site through a USB or Ethernet cable. It shall transmit the information by one or more of the following means of communication – internet, cellular or standard telephone lines.

2. The communicator must be capable of reporting via SIA and Contact ID formats. The communicator shall have a delayed AC loss report function which will provide a programmable report delay plus a 10-25 min random component to help ease traffic to the central station during a power outage. No controls that use external modems for remote programming and diagnostics shall be accepted.

M. Dry Contacts

1. The FACP shall have three Form “C” dry contacts, one will be dedicated to trouble conditions, the other two will be programmable for alarm, trouble, supervisory, notification, pre-alarm, waterflow, manual pull, aux. 1 or aux. 2 conditions. The trouble contact shall be normal in an electrically energized state (fail-safe) so that any total power loss (AC and Backup) will cause a trouble condition. If the microprocessor on the FACP fails, the trouble contacts shall also indicate a trouble condition.

N. Ground Fault Detection

1. A ground fault detection circuit shall be employed which can detect a ground fault on both the positive and negative side of each circuit. The ground fault detector shall operate the general trouble devices as specified but shall not cause an alarm to be sounded. Ground faults shall not interfere with normal operation, such as alarm, or other trouble conditions.

O. Over-current Protection

1. All low voltage circuits will be protected by microprocessor controlled power limiting or have self-restoring polyswitches for the following: smoke detector power, main power supply, indicating appliance circuits, battery standby power and auxiliary output.

P. Test Functions

1. A “Lamp Test” mode shall be a standard feature of the fire alarm control panel and shall test all LEDs and the LCD display on the main panel and remote annunciators.

2. A “Walk Test” mode shall be a standard feature of the fire alarm control panel. The walk test feature shall function so that each alarm input tested will operate the associated notification appliance for six seconds. The fire alarm control panel (FACP) will then automatically perform a reset and confirm normal device operation. The event memory shall contain the information on the point tested, the zone tripped, the zone restored, and the individual points return to normal.

3. A “Fire Drill” mode shall allow the manual testing of the fire alarm system notification circuits. The “Fire Drill” shall be capable of being controlled at the main annunciator, remote annunciators and via a remote contact input.

4. A “Disable Mode” shall allow for any zone, point, group, or NAC circuit to be disabled without affecting the operation of the total fire system.

Q. Remote Input Capabilities

1. The control panel shall have provisions for supervised switch inputs, for the purpose of Alarm reset and Alarm and Trouble silence.

R. Notification Appliance Mapping Structure

1. All notification circuits and modules shall be programmable via a mapping structure that allows for a maximum of 999 output groups. Each of these groups shall be able to be triggered by any of the panels 999 zones. A group may be triggered from a zone individually, or may contain a global trigger for manual pull stations, fire drills and two different system alarms.

2. Each zone will individually control the cadence pattern of each of the groups that it is “Mapped” to so that sounders can indicate a variety of conditions. The zone shall able

to issue a different cadence pattern for each of the groups under its control. The mapping structure must also allow a group to be designated to “ignore cadence” for use with strobes and other continuous input devices.

3. Zones shall have eight different output categories; Detector alarm, Trouble, Supervisory, Pre-alarm, Waterflow, Manual pull, Zone auxiliary one and Zone Auxiliary two. Each of the categories shall be able to control from 1 to 8 output groups with a cadence pattern. The patterns are; March code, ANSI 3.41, Single Stroke Bell Temporal, California code, Zone 1 coded, Zone 2 coded, Zone 3 coded, Zone 4 coded, Zone 5 coded, Zone 6 coded, Zone 7 coded, Zone 8 coded, Custom output pattern 1, Custom output pattern 2, Custom output pattern 3, Custom output pattern 4 and Constant.

4. Each NAC circuit can also be configured to produce one of four synchronization patterns: AMSECO synchronization, Gentex synchronization, System Sensor synchronization, and Wheelock synchronization. This mapping/cadence pattern shall be supported by all system power supplies and Notification Expander Modules. This mapping/cadence pattern shall be supported by all system power supplies and Notification Expander Modules.

5. In addition, synchronization is built-in for Amseco®, Gentex®, System Sensor®, and Wheelock® devices. This mapping/cadence pattern shall be supported by all system power supplies and Notification Expander Modules.

S. Downloading Software

1. The fire alarm control panel must support up/downloading of system programming from a PC under Windows or NT environments. The FACP must also be able to upload the detector sensitivity test results and a 1000 event system event buffer to the PC.

2. Communication shall take place over a direct connection to the PC through a USB or Ethernet cable and shall not require an external modem to be connected to the panel. The downloading software shall contain a code that will block unauthorized persons from accessing the panel via direct connection or ethernet.

T. English Language Descriptions

1. The FACP shall provide the ability to have a text description of each system device input zone and output group on the system. The use of individual lights to provide descriptions will not be acceptable.

U. System Cabinet

1. Mounting

a. The system cabinet shall be red and can be either surface or flush mounted. The cabinet door shall be easily removable to facilitate installation and service.

2. Audible System Trouble Sounder

a. An audible system trouble sounder shall be an integral part of the control unit. Provisions shall also be provided for an optional supervised remote trouble signal.

3. Power Supply and Charger:

a. The entire system shall operate on 24 VDC, filtered switch mode power supply with the rated current available of 6 amps. The FACP must have a battery charging circuit capable of complying with the following requirements:

b. Twenty-four (24) hours of battery standby with five (5) minutes of alarm signaling at the end of this twenty-four (24) hour period (as required per NFPA 72 central station signaling requirements) using rechargeable batteries with automatic charger to maintain gel-cell batteries in a fully charged condition.

c. The power supply shall comply with UL Standard 864 for power limiting.

4. The FACP will indicate a trouble condition if there is a loss of AC power or if the batteries are missing or of insufficient capacity to support proper system operation in the event of AC failure. A “Battery Test” will be performed automatically every minute to check the integrity of the batteries. The test must disconnect the batteries from the charging circuit and place a load on the battery to verify the battery condition.

5. If it is necessary to provide additional power one or more of the model 5496 or 5895XL distributed power modules shall be used to accomplish this purpose.

V. Connections and Circuits

1. Connections to the light and power service shall be on a dedicated branch circuit in accordance with the National Electrical Code (NEC) and the local authority having jurisdiction (AHJ).

2. The circuit and connections shall be mechanically protected.

W. A circuit disconnecting means shall be accessible only to authorized personnel and shall be clearly marked “FIRE ALARM CIRCUIT CONTROL”.

2.2 DEVICES

A. Manual Fire Alarm Stations

1. Manual Fire Alarm Stations shall be non-coded, break glass, single or double action type, with a key operated test-reset lock in order that they may be tested, and so designed that after actual emergency operation, they cannot be restored to normal except by use of a key. The reset key shall be so designed that it will reset manual station and open FACP without use of another key.

2. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of fifty feet, front or side. Manual stations shall be constructed of LEXAN® with clearly visible operating instructions on the front of the stations in raised letters.

3. Stations shall be suitable for surface mounting on matching backbox, or semi-flush mounting on a standard single-gang box, and shall be installed within the limits defined by the Americans with Disabilities Act (ADA) dependent on manual station accessibility or per local requirements. Manual stations shall be Model SK-Pull. If using conventional pull stations they must be installed in conjunction with an Addressable Input Module (SK-Monitor) or Mini Input Module (SK-Minimon). Manual stations shall be Silent Knight Model PS-DATK, PS-SATK, PS-DA or PS-SA and Underwriters Laboratories listed when used with addressable modules.

B. Remote Power Supplies

1. The Remote Power Supplies for Notification appliances shall be the Silent Knight Models 5496 and/or 5895XL. The 5496 and 5895XL Intelligent Power Supplies shall hang on the main S-Bus and be programmed through the 5820XL control. The 5496 will support 6 amps of 24 volt DC power with 4 notification circuits rated at 3 amps each. The 5895XL will support 6amps of 24 volt DC power, with 6 Flexput circuits, rated at 3amps each. Two additional 5815 SLC loop expanders shall be capable of being installed in the cabinet, to allow an additional 396 points. The power supply will also regenerate the S-Bus for an additional 6000'.

2. The remote power supply model 5495 or 5499 may also be used on the system. These power supplies support 6amps or 9amps of 24VDC power with 4 notification circuits rated at 3amps each. These power boosters may also be activated from another notification circuit from either the fire alarm control or the Distributed Power Modules.

C. Smoke Detectors

1. Smoke detectors shall be Silent Knight model SK-Photo ceiling mounted, addressable photoelectric smoke detectors,. The combination detector head and twist lock base shall be U.L. listed compatible with the Silent Knight 5820XL fire alarm control panel.

2. The base shall permit direct interchange with Silent Knight's SK-Ion ionization smoke detector, SK-Acclimate multi-criteria smoke detector or the SK-Heat detector. The base shall be the appropriate twist lock base B210LP. The smoke detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch. The sensitivity of the detector shall be capable of being selected and measured by the control panel without the need for external test equipment. The vandal security-locking feature shall be used in those areas as indicated on the drawing. The locking feature shall be field selectable when required. It shall be possible to perform a sensitivity test of the detector without the need of generating smoke. The test method shall simulate the effects of products of combustion in the chamber to ensure testing of the detector circuits. Detectors shall have completely closed back to restrict entry of dust and air turbulence and have a 30 mesh insect screen. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

D. Heat Detectors

1. Furnish and install analog/addressable heat detectors, Silent Knight model SK-Heat. The combination heat detector and twist lock base shall be U.L. listed compatible with the Silent Knight 5820XL fire alarm control panel. The base shall permit direct interchange with the Silent Knight SK-Ion smoke detector, SK-Acclimate smoke detector and the SK-Photo photoelectric smoke detector. The base shall be appropriate twist lock base B210LP. The heat detector shall have a flashing status LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady at full brilliance. The detector may be reset by actuating the control panel's reset switch. The vandal security-locking feature shall be used in those areas as indicated on the drawings. Electronics of the unit shall be shielded to protect against false alarms from E.M.I. and R.F.I.

E. Duct Detectors

1. Duct Detector shall be Silent Knight Model SK-Duct Housing with the Model SK-Photo Smoke detectors.

F. Speaker/Strobes and Strobes

1. The visual and audio/visual signaling devices shall be compatible with the 5820XLEVS, 5495, 5496, 5499, or 5895XL as stated in the installation manuals and be listed with Underwriters Laboratories Inc. per UL 1971 and/or 1638. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults on the circuit wiring and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition. The notification appliance (combination audio/visual units only) shall produce a peak sound output of 90 dba or greater as measured in an anechoic chamber. The appliance shall be capable of meeting the candela requirements of the blueprints presented by the Engineer and ADA. The appliance shall be polarized to allow for electrical supervision of the system wiring. The unit shall be provided with terminals with barriers for input/output wiring and be able to mount a single gang or double gang box or double workbox with the use of an adapter plate. The unit shall have an input voltage range of 16-33 volts

2. 24 VDC with wide UL “Regulated Voltage” using filtered DC or unfiltered VRMS input voltage

3. Synchronize with Wheelock DSM, Wheelock Power Supplies or other manufacturers panels, incorporating the Wheelock Patented Sync Protocol

4. Provide exterior type for outdoor installations. Provide wireguard on all gym devices.

G. Exterior Bell

1. Wheelock Series 43T AC Vibrating Fire Bells provide durable operation and dependable performance for indoor and outdoor installations. Wheelock Fire Bells are perfect for industrial uses including schools, hospitals, and commercial building

2.3 AES RADIO

A. Contractor shall provide an AES radio for remote monitoring of the system. Coordinate with owner and owner’s monitoring agency. AES#7707 UL listed

B. Provide remote antenna to roof to guarantee good radio reception.

2.4 ACCESSORY DEVICES

A. Provide relay for connecting all fire smoke dampers in the building. Upon any alarm in the building all dampers close

B. Provide relay to AV systems, connect to DSP to deliver Fire Alarm signal to allow system to be muted.

C. On panic lockdown button the fire alarm panel shall receive signals from the security and intercom systems

1. Upon receipt of lockdown signal fire alarm shall play a panic message for 15 seconds. After the 15 seconds send signal to the intercom system which will handle following lockdown messages.

PART 3 EXECUTION

3.1 CONNECTIONS AND CIRCUITS

A. Connections to the light and power service shall be on a dedicated branch circuit in accordance with the National Fire Alarm Code NFPA 72, National Electrical Code (NEC) NFPA 70, and the local authority having jurisdiction (AHJ).

B. The circuit and connections shall be mechanically protected.

C. A circuit disconnecting means shall be accessible only to authorized personnel and shall be clearly marked “FIRE ALARM CIRCUIT CONTROL”.

3.2 INSTALLER’S RESPONSIBILITIES

A. The installer shall coordinate the installation of the fire alarm equipment.

B. All conductors and wiring shall be installed according to the manufacturer’s recommendations.

C. It shall be the installer’s responsibility to coordinate with the supplier, regarding the correct wiring procedures before installing any conduits or conductors.

3.3 INSTALLATION OF SYSTEM COMPONENTS

A. System components shall be installed in accordance with the latest revisions of the appropriate NFPA pamphlets, the requirements contained herein, National Electrical Code, local and state regulations, the requirements of the fire department and other applicable authorities having jurisdiction (AHJ).

B. All wire used on the fire alarm system shall be U.L. Listed as fire alarm protection signaling circuit cable per National Electrical Code, Articles 760.

3.4 WARRANTY

A. The contractor shall warrant all equipment and wiring free from inherent mechanical and electrical defects for one year (365 days) from the date of final acceptance.

3.5 FINAL TEST

A. Before the installation shall be considered completed and acceptable by the awarding authority, a test of the system shall be performed as follows:

B. The contractor’s job foreman, a representative of the owner, and the fire department shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel.

C. At least one half of all tests shall be performed on battery standby power.

D. Where application of heat would destroy any detector, it may be manually activated.

E. The communication loops and the indicating appliance circuits shall be opened in at least two (2) locations per circuit to check for the presence of correct supervision circuitry.

F. When the testing has been completed to the satisfaction of both the contractor's job foreman and owner, a notarized letter cosigned by each attesting to the satisfactory completion of said testing shall be forwarded to the owner and the fire department.

G. The contractor shall leave the fire alarm system in proper working order, and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance by the awarding authority.

H. Prior to final test the fire department must be notified in accordance with local requirements.

3.6 AS BUILT DRAWINGS, TESTING, AND MAINTENANCE INSTRUCTIONS

A. As Built Drawings

1. A complete set of reproducible "as-built" drawings showing installed wiring, color coding, and wire tag notations for exact locations of all installed equipment, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of system.

B. Operating and Instruction Manuals

1. Operating and instruction manuals shall be submitted prior to testing of the system. Three (3) complete sets of operating and instruction manuals shall be delivered to the owner upon completion. User operating instructions shall be provided prominently displayed on a separate sheet located next to the control unit in accordance with U.L. Standard 864.

C. "Provide record as-built lock box" Possible part # Space age electronics SSU00625

3.7 ADDITIONAL MATERIALS

A. Provide an additional (5) smoke detectors with bases, (5) speaker/strobes each with 50 feet of EMT and appropriate fire alarm wire. Locate where directed by owner. Turn over any not used as spare at project completion.

3.8 WIRING

A. Wiring in EMT when in walls and above non-accessible ceilings

B. Cabling per manufacturer, plenum rated where passing through plenum

END OF SECTION

SECTION 31 00 00 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not limited to:

1. Site grading, excavation, trenching, embankment, fill and backfill material and placement, and stabilization of areas.
2. Importing required materials.
3. Removing and disposing materials from the site that are either:
   a. Not approved for use, or;
   b. Are in excess of that required.
4. Moisture conditioning
5. Stockpiling and protection of materials.
6. Geotechnical information for the project site.

1.2 REFERENCES

A. Reference the following standards:

AHJ	Public Authority Having Jurisdiction AHJ is an abbreviation for public Authorities Having Jurisdiction. For this project the AHJ denotes Island County.
WSDOT	Washington Department of Transportation 2025 Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction
WISHA	Washington Industrial Safety and Health Act. Revised Code of Washington (RCW) Chapter 49.17
WAC 296-155	Washington Administrative Code (WAC) 296-155 Standards for Construction Work
RCW 39.04.180	Public Works/Trench Excavations – Safety Systems Required

1.3 SUBMITTALS

A. Submit the following documents in accordance with submittal procedures noted in Division 01:

1. Gradation and moisture-density relation test results for each type of fill and backfill material at least 10 working days prior to their delivery at the site. Test results shall demonstrate that materials meet the criteria defined in Part 2 of this Section.
2. Samples of materials proposed for use as fill or backfill and the source location of each material. Coordinate sample delivery location with Owner.
3. Field compaction test results to the Owner’s Representative at the end of each day.

4. Manufacturer certification that the organic compost material meets the Specifications in Part 2 of this Section, including certified laboratory test results dated within 90 days of submittal.
5. Organic content test results demonstrating the organic soil mixture meets the requirements specified.
6. Topographic survey of stormwater facility. Submit an AutoCAD file of the topography of stormwater detention pond including the invert elevations of pipes and other features of the pond facility.

1.4 NOTIFICATIONS

A. Notify the Owner's Geotechnical Engineer Representative five working days in advance of delivering fill and/or backfill materials to the site.

1.5 QUALITY ASSURANCE

A. Testing:

1. Contractor shall provide their own testing service to confirm compliance with Specifications and provide measures for confirming Quality Control at Contractor's expense. The Contractor is responsible for verifying the quality of the work to check compliance with these specifications. Contractor shall submit reports conducted by their own independent testing service to the Owner's Representative indicating observations and results of the tests, and indicating compliance or non-compliance with Contract Documents. A copy of Contractor's tests shall be furnished to the Owner within 1 calendar week of testing.
2. Owner's Geotechnical Engineer Representative will take samples and perform moisture content, gradation, compaction and density tests during placement of backfill materials to check compliance with these Specifications. Contractor shall coordinate with Owner's Geotechnical Engineer on schedule of Work and timing of testing.
3. The Contractor shall remove surface material at locations designated by the Owner's Geotechnical Engineer and provide such assistance as necessary for sampling and testing. The Owner's Geotechnical Engineer may direct the Contractor to construct inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these Specifications.
4. Testing by the Owner's Geotechnical Engineer does not relieve the Contractor of responsibility to determine, to Contractor's own satisfaction, when and if Contractor's Work meets the Specification.
5. The minimum amount of testing to be performed and submitted by the Contractor, unless determined otherwise by Owner's Geotechnical Engineer, shall be as follows:

Item	Frequency of Tests
Utility Trenches	One density test per 200 cubic yards of backfill, OR one test for each lift of backfill for each 200 hundred lineal feet of utility trench, whichever results in the greater number of tests.

Backfilling and Paved Areas	One density test in every three hundred cubic yards of fill or backfill, OR one test for each lift of compacted fill over 1,000 square feet of compacted fill or backfill surface, whichever results in the greater number of tests.

Compaction tests are required to be performed the same day that the compaction effort is performed regardless of the volume or area of material.

This minimum amount of testing does not relieve the Contractor of responsibility to determine, to Contractor's own satisfaction, when and if Contractor's Work meets the Specifications.

6. The frequency of tests shown above shall govern the actual quantity of tests. Any re-testing that is required due to failure of initial test to show compliance with these Contract Documents shall be provided and paid for at the Contractor's sole expense.
7. Contractor shall submit reports (three copies) conducted by an independent firm to the Owner's Representative indicating observations and results of the tests, and indicating compliance or non-compliance with Contract Documents.
8. Coordinate testing requirements and scheduling with the Owner's Geotechnical Engineer Representative, and assist independent testing firm during field testing and sampling at no additional cost to Owner.

1.6 DIMENSIONS AND LAYOUTS

A. Contractor shall provide all dimensioning and layout required for construction.

B. Furnish, set and mark line and location stakes, including offsets and general construction staking. There shall be onsite at all times when Work requiring control is being performed, necessary equipment, supplies and instruments related thereto. A qualified layout engineer, professional Washington State Licensed Land Surveyor, or technical specialist must be assigned to the Contractor's crew for this Work. This equipment and personnel must be available, at no additional cost to the Owner, for the purpose of verifying layout and certifying the accuracy of Work on the site.

C. Preserve benchmarks and stakes, and replace any that are displaced or missing.

D. Review all utility purveyor, Owner and State records relative to the existing underground utilities. Avoid damage to these facilities and restore utilities at no cost to Owner.

E. Notify Owner's Representative immediately if underground utilities not shown on Plans or Record Documents are encountered.

F. Verify existing location and elevation at connection points of existing utility structures (including pipes) prior to construction of new system. If discrepancies are found, notify Owner's Representative.

1.7 GEOTECHNICAL REPORT

A. Contractor is responsible for reviewing available data for the site, including but not limited to Geotechnical Reports.

1. “Geotechnical Report, South Whidbey Aquatic and Recreation Center”, Palmer Geotechnical Consultants, January 9, 2024.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Fill:

1. Imported Structural Fill per Geotechnical Report shall conform to WSDOT Section 9-03.14(2) - Select Borrow.

B. Common Fill: Conform to WSDOT Section 9-03.14(3) Common Borrow.

C. Gravel Backfill for Drains: Conform to WSDOT Section 9-03.12(4) Gravel Backfill for Drains with AASHTO grading No. 57.

D. Crushed Surfacing:

1. Crushed Surfacing Base Course shall conform WSDOT Section 9-03.9(3).
2. Crushed Surfacing Top Course shall conform to WSDOT Section 9-03.9(3).

E. Pipe Bedding shall conform to:

1. WSDOT Section 9-03.12(3) for flexible sanitary sewer and storm drain pipe.
2. WSDOT Section 9-03.12(3) for ductile iron water main and water service pipe.
3. WSDOT Section 9-03.12(3) for ductile iron sanitary sewer and storm drain pipe.
4. WSDOT Section 9-03.12(3) for flexible water service pipe.

F. Pipe Backfill shall conform to:

1. Trench Backfill shall conform to WSDOT Section 9-03.19, except in landscape areas trench backfill shall be WSDOT Section 9-03.19 or Structural Fill.
2. Initial backfill for overexcavated trenches in wet conditions shall conform to WSDOT Section 9-03.9(1)] or Shoulder Ballast in conformance with WSDOT Section 9-03.9(2).

G. Gravel Backfill for walls shall conform to WSDOT Section 9-03.12(2).

H. Conductive Warning Tape: Shall be manufacturer’s standard, permanent, brightly colored, continuous printed plastic tape with aluminum backing; intended for burial in pipe backfill; and not less than six inches wide and four mils thick. Tape schedule shall be:

Pipe Type	Color	Wording
Domestic Water	Blue	Caution Domestic Water
Irrigation Water	Blue	Caution Irrigation Water

Storm Drain	Green	Caution Storm Drain
Sanitary Sewer	Green	Caution Sanitary Sewer

I. Geotextile:

1. Geotextile for Separation shall be nonwoven and conform to WSDOT Section 9-33.2(1) Table 3.
2. Geotextile Liner at stormwater facility shall conform to WSDOT Section 9-33.2(2) Table 7 Nonwoven.

J. Cobbles: Conform to 8-inch cobbles per WSDOT Section 9-03.11(2). Use four-inch minimum to 8 inch maximum well-graded washed cobblestone rock or an approved equivalent product. Cobbles shall not be procured from natural stream bed channels.

K. Quarry Spalls: Conform to WSDOT 9-13.1(5).

L. Sand Medium: Conform to gradation on Plan and per Ecology SWMMWW Volume V, Chapter 6, BMP T8.10, Table V-6.1.

PART 3 - EXECUTION

3.1 GENERAL

A. Furnish, set and mark all alignments, line and location stakes, including offsets and other construction staking.

1. Assign a licensed surveyor to complete this work and certify the accuracy of work.
2. Have necessary equipment, supplies and instruments onsite at all times when work requiring control is being performed.

B. During the performance of earthwork, the Contractor may encounter unanticipated obstructions including but not limited to boulders, glacial erratics, concrete, masonry or other subsurface obstructions. No changes in the Contract Sum or the Contract Time are authorized for mitigating procedures performed by the Contractor to address unanticipated obstructions in performance of the Work if mitigation can be accomplished with the use of mechanical equipment, such as shovels, loaders, bulldozers, graders, rippers, excavators, etc. Should mitigation require drilling and blasting or drilling and line breaking changes to the Contract Sum or the Contract Time will be considered by the Owner.

3.2 EXCAVATION

A. Excavate to the lines and grades and at the locations shown on the drawings, including trenches for piping.

1. Conform to elevations and dimensions shown within a tolerance of 0.10-foot.
2. Properly prepare subgrade by removing unstable, soft, weak, or loose debris, clods, and other deleterious materials from excavations to expose firm soil. Replace with compacted Structural Fill unless otherwise specified by the Owner's Representative.
3. Slope and/or shore the sides of excavations and trenches to comply with WISHA, WAC 296-155 and local codes and ordinances having jurisdiction. Maintain sides and slopes of excavations in a safe manner until backfilling is complete.

B. Trench Subgrade Preparation:

1. Grade and smooth bottoms of trenches to provide uniform bearing and support of pipe.
2. Remove rocks and other materials that could cause point loads on the pipes.
3. Form bell holes and depressions sized only as needed to fit the particular type of pipe joint.

C. Catch basins, maintenance holes/manholes, and similar embedded structures:

1. Excavate a minimum 12 inches between excavation walls and sides of structures and, if prefabricated, four inches below the base of structures to allow for leveling.
2. Remove unsuitable material as described in this Section.
3. Backfill overexcavations in the subgrade with compacted Structural Fill.

D. Trench excavations for water main pipe installation pipe per WSDOT Section 7-09.3(7).

E. Trench excavations for storm drain and sanitary sewer pipe per WSDOT Section 7-17.3.

F. Dewater as necessary to keep excavations and construction areas in a dry condition. Promptly remove water to prevent softening or disturbance of subgrade surfaces.

G. Where final excavation grades are disturbed by construction activities, overexcavate disturbed material and backfill to grade using compacted Structural Fill at no additional cost to the Owner.

H. Remove and properly dispose of excess excavated material and debris offsite at no additional cost to Owner.

I. Backfill excavations as promptly as construction work allows and after the Owner's Geotechnical Engineer Representative has viewed the prepared subgrade surfaces.

J. Form stormwater facility cell and pond per grading plan, geotechnical recommendations in report, and per Owner's Geotechnical Engineer on site.

K. Protect infiltrative surfaces of stormwater facility cell and pond from compaction and sedimentation. If areas become compacted and/or contaminated, remediate and till soil in accordance with Owner's Geotechnical Engineer's requirements.

L. Provide infiltration pond bottom area and presettling cell areas per Plan. Provide topographic survey of installed pond and cell to verify areas and volumes. Revise grading as required until minimum areas and volumes are formed.

M.

3.3 FILL AND BACKFILL PLACEMENT

A. General:

1. Lightly scarify properly prepared subgrade surfaces that will receive backfill or fill, except for trenches. Moisture-condition the scarified soil to obtain soil moisture near optimum moisture content.

2. Do not place backfill or fill material on surfaces that are soft, muddy, frozen, or containing frost, ice or loose debris or soil.
3. Place backfill and fill in controlled layers of the thickness that is compatible with the type of compaction equipment used.
4. The loose thickness of each fill or backfill layer shall not exceed 12 inches.
5. Compact each layer to the minimum relative compaction as listed in this Section.
6. When placing fill on sloped surfaces, notch fill lifts into subgrade and work thoroughly to destroy interfaces that may otherwise develop.

B. Pipe Bedding:

1. Place and compact pipe bedding in accordance with WSDOT to provide uniform support along the entire pipe barrel, without load concentrations at joint collars or bells. Do not use blocking to adjust the pipe to grade except when the pipe is embedded in concrete.
2. Form bell holes and depressions in the bedding only as needed to provide uniform support along the pipe barrel.
3. Take special care to provide uniform and adequate bedding support at pipe connections and adjacent to manholes or other structures to avoid inducing stresses that could damage the pipe or adjacent manhole or other structure.
4. Recompact, or replace and recompact if necessary, bedding that is disturbed or contaminated by removal of temporary shoring, trench boxes or other construction activity at no additional cost to the Owner.

C. Pipe Backfill:

1. Backfill utility pipe trenches as soon as possible after pipe installation.
2. Place and compact pipe backfill in accordance with WSDOT Section 7 for the specific type of pipe and conditions.
3. Protect the pipe from damage or shifting alignment during backfill placement.
4. Do not backfill near catch basins, manholes or similar structures until mortar has thoroughly hardened.
5. Carefully place backfill over the pipe to a depth of two feet above the pipe crown before beginning compaction.
6. Subsequent lifts shall not exceed 12 inches loose thickness. Each lift shall be compacted with mechanical equipment.
7. Do not walk on the pipe until the backfill has reached a uniform depth of one-foot above the crown of the pipe.
8. Pipe damaged during backfill placement shall be replaced at no additional cost to the Owner.
9. Place conductive warning tape continuously along the alignment of the pipe crown at a depth no less than two feet above the pipe and embedded in backfill at least one-foot below finished grade.

D. Moisture Conditioning

1. Shall be performed for fill and backfill materials as needed to meet the compaction requirements specified in this Section. Moisture conditioning includes drying and wetting of fill and backfill materials as needed, and it shall be performed at no additional cost to the Owner.
2. Chemical soil amending such as soil cements, fly ash, lime, etc. shall not be used to moisture condition.

3. Apply water uniformly to soil where subgrade or fill material is moisture conditioned before compaction. Prevent free water from appearing on surface during or subsequent to compaction operations.
4. Remove, replace, scarify or air dry soil material too wet to permit compaction to specified density.
5. Removed soil material that is too wet for compaction may be temporarily stockpiled until removed from site, or spread to allow for drying. However, if material cannot be adequately moisture conditioned, the Contractor shall be responsible for removing material from site at no additional cost to Owner.

E. POND EMBANKMENT

1. Pond embankment as required shall be placed and compacted in accordance with WSDOT 2-03.3(14)B and per Owner's Geotechnical Engineer.

F. Compaction:

1. Compact fill and backfill using compaction equipment that can achieve the specified compaction criteria and that is appropriate to the soil type being compacted.
2. Water settling or jetting is not permitted as a means of compaction.
3. Around foundation and subgrade drains, compact backfill to a non-yielding condition without damaging the filter fabric or pipe. Repair damaged filter fabric or pipe at no additional cost to the Owner.
4. Within five feet of retaining walls or foundations, use hand-operated equipment to avoid overstressing the walls. Repair or replace walls damaged by improper compaction or other construction activities at no cost to the Owner and as directed by the Owner's Geotechnical Engineer Representative.
5. Compact fill and backfill to a dense and unyielding condition and to the following minimum relative compaction based on the percentage of maximum dry density as determined in accordance with ASTM D 1557, unless otherwise specified.

Locations	Relative Compaction
Pipe bedding	95%
Pipe backfill (non-vehicle areas)	90%
Pipe backfill (in vehicle and/or paved areas)	95%
Under slabs-on-grade	95%
Under foundations	95%
Retaining Walls and foundations (beyond 5 feet of wall face)	95%
Under driveways, aprons and vehicle areas	95%
Under walks	92%
Landscape areas	80-85%*
Other structural-bearing areas	95%

* For landscape areas the relative compaction shall be within the range noted above and not exceed the maximum.

3.4 SOIL STOCKPILES

A. Maintain separate stockpiles for various soil materials. Label each stockpile with weatherproof sign as to material type.

B. Shape and arrange soil stockpiles to promote drainage.

C. Use TESC measures to filter sediment from stormwater runoff from stockpiles and implement flow diversion and energy dissipation measures to safely direct water downstream to TESC treatment system. Runoff from stockpiles shall under no circumstances sheet-flow or direct-flow to existing trees to remain, to adjacent offsite properties, and to new and existing facilities to remain.

D. Cover temporary stockpiles in accordance with Section 01 57 13 – Temporary Erosion and Sediment Control. Material that becomes unsuitable due to lack of protection measures being installed by Contractor shall be hauled and legally disposed of offsite and replaced with suitable material at no additional expense to the Owner.

E. Unsuitable material stockpiles shall be removed, hauled and properly disposed of offsite.

3.5 GRADING

A. Shape surface of site to match contours, grades, spot elevations, profiles and slopes shown on the Contract Documents to a tolerance of 0.05-foot plus or minus over a 10-foot horizontal distance and to maintain positive drainage.

1. Should indicated figures conflict with actual conditions, notify Owner's Representative and obtain direction before proceeding with grading of affected area.
2. In landscaped areas, leave final surfaces rough or scarified to a depth of at least four inches to prepare for topsoil placement. Coordinate with landscape planting soil preparation requirements.
3. Remove all concrete, rocks, rubble and debris larger than four inches from finished surfaces.
4. Finish grades flush with adjacent surfaces unless otherwise specified.
5. Adjust finished grades as necessary to provide depth for soil amendments and other components of landscaping.
6. Construct finish grades adjacent to sidewalks to be ½-inch below elevation of sidewalk unless otherwise specified.
7. Grade transition areas to provide a smooth surface free of discontinuities.
8. Do not allow grades to exceed maximum slopes in ADA accessible routes and areas.

B. Protect finished surfaces.

1. Where finished surfaces are disturbed (e.g. loosened soil, ruts, holes, etc.) by construction activities, over-excavate disturbed material and backfill to final grade at no additional cost to the Owner.
2. Overexcavate to the depth and extent as directed by the Owner's Geotechnical Engineer's Representative.
3. Backfill with Structural Fill or other material as directed by the Owner's Representative, and in lift thickness and to the compaction criteria established by the Owner's Geotechnical Engineer's Representative.
4. Repair areas showing settlement at no cost to Owner.
5. Repair areas with any obstructions to positive drainage.

3.6 WET WEATHER PROVISIONS

A. Schedule earthwork operations to minimize the potential for erosion, siltation, and disturbance of site soils.

B. Perform earthwork operations in discrete areas to minimize the exposure of disturbed soils to wet weather.

C. Protect exposed subgrade for utility trenches, structures and paving.

1. Compact exposed soil to reduce the infiltration of rainwater.
2. Implement measures to protect suitable exposed road, paving and structure subgrade from wet and/or rainy weather. If exposed subgrade is left unprotected to wet and/or rainy weather and becomes unsuitable as determined by Owner's Geotechnical Engineer's Representative, unsuitable material shall be over-excavated and properly hauled and disposed of offsite and replaced with Structural Fill at no additional expense to the Owner.

D. Direct surface water away from fill areas, protected trees, structure, trench excavations, buildings, excavations, adjacent properties and public right-of-way.

E. Protect and cover soil stockpiles with plastic or other measures to prevent infiltration and erosion.

F. Dewater as needed to keep excavations and construction areas free of water.

G. Replace or rework soil that has not been protected in accordance with the requirements of these Contract Documents; and remove and replace, as specified in this Section, soil that becomes too wet for compaction, as directed by the Owner's Geotechnical Engineer's Representative and at no additional cost to the Owner

3.7 DISPOSAL OF EARTH MATERIALS

A. Remove all excavated material not acceptable for use as fill onsite. Legally dispose of excess material offsite at Contractor's expense.

END OF SECTION 31 00 00

SECTION 31 10 00 – SITE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes, but is not limited to:

1. Verification of project limits.
2. Clearing and grubbing.
3. See Landscape for Tree Protection.
4. Protection of existing features and structures.
5. Remove and dispose of materials from site per Plan.
6. Identify, disconnect, cap and remove utilities as required.

1.2 REFERENCES

A. Reference the following standards:

AHJ	Public Authority Having Jurisdiction AHJ is an abbreviation for public Authorities Having Jurisdiction. For this project the AHJ denotes Island County.
WSDOT	Washington Department of Transportation 2025 Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction

1.3 SUBMITTALS

A. Submit the following documents in accordance with submittal procedures noted in Division 01:

1. Copies of permits for transport and disposal of debris as required.

1.4 COORDINATION

A. Protection of existing conditions: Provide, erect, and maintain barricades, coverings and other types of protection measures necessary to prevent damage to existing trees, structures, utilities, and other features to remain in place. Restore any improvements damaged by this Work to their original condition or better, as acceptable to the Owner.

B. Verify existing utility locations and elevations at least 10 working days in advance of construction and demolition.

1. Contact the underground location center to locate and mark utilities not less than four business days, and not more than ten business days before beginning demolition or Earthwork.
2. Compare existing utility locations and elevations with drawings and new utilities.

3. Immediately notify Owner's Representative of potential conflicts to allow for mitigation without down time.

C. Construct temporary erosion and sediment control (TESC) plan in accordance with Section 01 57 13 – Temporary Erosion and Sedimentation Control.

PART 2 - PRODUCTS

PART 3 - NOT APPLICABLEEXECUTION

3.1 GENERAL

A. Obtain required permits and permission from AHJ, local governing authorities and Owner prior to commencing Work.

B. Before construction and mobilizing to the site, meet with the Owner's Representative and review Contract Documents on site.

1. Identify existing trees, utilities, and other site improvements that may be affected by construction.

C. Provide, erect and maintain barricades, coverings, flagging or other types of protection necessary to prevent damage to existing structures, areas, utilities, vegetation, and other facilities or features.

D. Install temporary erosion and sediment control in accordance with Section 01 57 13 - Temporary Erosion and Sediment Control and the Contract Documents.

E. Verify that clearing, grubbing, stripping and demolition and site improvements may safely and appropriately begin.

F. Locate existing utilities within the project limits.

G. Maintain hauling routes clean and free of debris resulting from Work on this Project.

H. Sprinkle water as necessary to limit dust to the lowest practicable level. Do not use water to such an extent to cause flooding or icing.

I. Properly recycle and dispose of refuse, debris and excess materials resulting from work in accordance with applicable federal, state, and local regulations and requirements. Do not leave these materials on the project site, unless authorized in writing by Owner's Representative.

3.2 PROTECTION OF INFILTRATION FACILITIES

A. Do not stockpile materials, vehicles and equipment within footprint of proposed infiltration facilities.

B. Do not locate haul routes within footprint of infiltration facility. See Section 01 57 13 - Temporary Erosion and Sedimentation Control.

3.3 EROSION CONTROL

A. Construct and maintain the TESC system in accordance with Section 01 57 13 Temporary Erosion and Sedimentation Control.

3.4 CLEARING AND GRUBBING

A. Remove surface debris, vegetation, underbrush and other deleterious material within areas to be graded, as required for new construction in accordance with WSDOT 2-01.3.

1. Disposal Method shall not include open burning.

B. Protect all offsite trees along adjacent roadways and on surrounding properties.

C. Do not strip and grub within tree protection areas or areas to remain undisturbed.

3.5 DISPOSAL OF MATERIALS

A. The Contractor, in a manner consistent with all government regulations, shall dispose of the refuse resulting from clearing, stripping and grubbing. In no case shall refuse material be left on the Project Site, shoved onto abutting private properties, or be buried in embankments or trenches on the Project Site. Debris shall not be deposited in any stream or body of water, stormwater facility, infiltration facility or in any street or alley, or upon any private property except by written consent of the private property owner. Maintain hauling routes clean and free of any debris resulting from Work of this Section.

END OF SECTION 31 10 00

31 05 16 – AGGREGATES FOR EARTHWORK (SANITARY SEWER)

PART 1 - GENERAL

1.1 DESCRIPTION

A. The WORK under this Section includes Scope providing and installing aggregate materials of the types and sizes noted in this section where required by applicable codes, good standard engineering practice, and the approved site design.

B. This WORK includes Coarse aggregate materials and fine aggregate materials for use throughout the site as indicated on plans.

1.2 REFERENCES

A. Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction (2025 Edition).

1.3 SUBMITTALS

A. Pipe Zone Material (Bedding): Name and location of source, and sieve test results.

B. Trench Backfill: Name and location of source, and sieve test results.

C. Structural Backfill: Name and location of source, and sieve test results.

D. Other Aggregates: Name and location of source, and applicable test results.

E. Excavation Procedure: Submit a layout drawing or detailed outline of intended excavation procedure for Owner’s information. This submittal will not relieve the Contractor of responsibility for the successful performance of intended excavation methods.

PART 2 - PRODUCTS

2.1 AGGREGATE MATERIALS (FLEXIBLE PIPE)

A. Gravel backfill for pipe zone bedding shall consist of crushed, processed, or naturally occurring granular material. It shall be free from various types of wood waste or other extraneous or objectionable materials. It shall have such characteristics of size and shape that it will compact and shall meet the following Specifications for grading and quality:

Sieve Size	Percent Passing
1-1/2”	99-100
1”	75-100
5/8"	50-100

No. 4	20-80
No. 40	55-75
No. 200	3-24
Sand Equivalent	35 min.

B. Native Material for Trench Backfill: Trench backfill outside the roadway prism may be excavated material free of wood waste, debris, clods or rocks greater than 6 inches in any dimension when approved by the Owners representative.

C. Bank Run Gravel for Trench Backfill: Gravel backfill shall consist of granular material, either naturally occurring or processed. It shall be essentially free from various types of wood waste or other extraneous or objectionable materials. It shall have such characteristics of size and shape that it will compact readily, and the maximum particle size shall not exceed ⅔ of the depth of the layer being placed. Gravel backfill shall meet the following requirements for grading and quality:

Sieve Size	Percent Passing
2”	100
No. 4	22-100
No. 200	0-10
Dust Ratio	2/3 max.
Sand Equivalent	30 min.

2.2 AGGREGATE MATERIALS (SEPTIC TANK)

A. Bedding: Bedding material shall be primarily sand and gravel, having a plasticity index less than 6. Gradation shall limit the amount passing the No. 200 sieve to 10 percent maximum. Bedding material must comply with the grading requirements for the sieve sizes shown in the following table:

Sieve Size	Percent Passing
1 1/2”	99-100
1"	75-100
5/8”	50-100
No. 4	20-80
No. 40	3-4
No. 200	10 Max
Sand Equivalent	35 Min

B. Primary Backfill: Primary backfill must be clean, fee flowing, and free of dirt, sand, large rocks, roots, organic materials, debris, ice and snow and consist of one of the following:

1. Course aggregate – Rounded Stone

2. Course aggregate – Crushed Stone

Aggregate must comply with the grading requirements for the sieve sizes shown in the following table:

Rounded Stone			
ASTM C 33 Size #	#6 Stone	#67 Stone	#7 Stone
1" (25 mm)	100	100	-
3/4" (19 mm)	90–100	90–100	100
1/2" (12.5 mm)	10 - 55	-	90 - 100
3/8" (9.5 mm)	0 - 15	20 - 55	40 - 70
No. 4 .0187” (4.75 mm)	0 - 5	0 - 10	0 - 15
No. 8 .094” (2.36 mm)	-	0 - 5	0 - 5

Crushed Stone		
ASTM C 33 Size #	#7 Stone	#8 Stone
1" (25 mm)	-	-
3/4" (19 mm)	100	-
1/2" (12.5 mm)	90 - 100	100
3/8" (9.5 mm)	40 - 70	85 - 100
No. 4 .0187” (4.75 mm)	0 - 15	10 - 30
No. 8 .094” (2.36 mm)	0 - 5	0 - 10

C. Secondary Backfill: Secondary Backfill shall consist of granular material, either naturally occurring or processed (native material shall be used as available and appropriate prior to importing material), and shall be free draining and meet the following requirements for grading and quality:

Sieve Size	Percent Passing
6"	75 - 100
3"	100
No. 40	50 max
No. 200	10 max
Sand Equivalent	30 min

2.1 SOURCE QUALITY CONTROL

A. All Aggregates shall be from a borrow pit approved by the Owner.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Stockpile excavated material meeting requirements for aggregate materials.

B. Remove excess excavated materials not intended for reuse from site.

C. Place aggregate at locations approved by Owner's representative.

3.2 STOCKPILING

A. Stockpile materials at locations designated by Owner's representative.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.3 STOCKPILE CLEANUP

A. Remove stockpile; leave area in clean and neat condition. Grade site surface to prevent Free-standing surface water.

END OF SECTION 31 05 16

SECTION 31 10 00 – SITE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes, but is not limited to:

1. Verification of project limits.
2. Clearing and grubbing.
3. See Landscape for Tree Protection.
4. Protection of existing features and structures.
5. Remove and dispose of materials from site per Plan.
6. Identify, disconnect, cap and remove utilities as required.

1.2 REFERENCES

A. Reference the following standards:

AHJ	Public Authority Having Jurisdiction AHJ is an abbreviation for public Authorities Having Jurisdiction. For this project the AHJ denotes Island County.
WSDOT	Washington Department of Transportation 2025 Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction

1.3 SUBMITTALS

A. Submit the following documents in accordance with submittal procedures noted in Division 01:

1. Copies of permits for transport and disposal of debris as required.

1.4 COORDINATION

A. Protection of existing conditions: Provide, erect, and maintain barricades, coverings and other types of protection measures necessary to prevent damage to existing trees, structures, utilities, and other features to remain in place. Restore any improvements damaged by this Work to their original condition or better, as acceptable to the Owner.

B. Verify existing utility locations and elevations at least 10 working days in advance of construction and demolition.

1. Contact the underground location center to locate and mark utilities not less than four business days, and not more than ten business days before beginning demolition or Earthwork.
2. Compare existing utility locations and elevations with drawings and new utilities.

3. Immediately notify Owner's Representative of potential conflicts to allow for mitigation without down time.

C. Construct temporary erosion and sediment control (TESC) plan in accordance with Section 01 57 13 – Temporary Erosion and Sedimentation Control.

PART 2 - PRODUCTS

PART 3 - NOT APPLICABLEEXECUTION

3.1 GENERAL

A. Obtain required permits and permission from AHJ, local governing authorities and Owner prior to commencing Work.

B. Before construction and mobilizing to the site, meet with the Owner's Representative and review Contract Documents on site.

1. Identify existing trees, utilities, and other site improvements that may be affected by construction.

C. Provide, erect and maintain barricades, coverings, flagging or other types of protection necessary to prevent damage to existing structures, areas, utilities, vegetation, and other facilities or features.

D. Install temporary erosion and sediment control in accordance with Section 01 57 13 - Temporary Erosion and Sediment Control and the Contract Documents.

E. Verify that clearing, grubbing, stripping and demolition and site improvements may safely and appropriately begin.

F. Locate existing utilities within the project limits.

G. Maintain hauling routes clean and free of debris resulting from Work on this Project.

H. Sprinkle water as necessary to limit dust to the lowest practicable level. Do not use water to such an extent to cause flooding or icing.

I. Properly recycle and dispose of refuse, debris and excess materials resulting from work in accordance with applicable federal, state, and local regulations and requirements. Do not leave these materials on the project site, unless authorized in writing by Owner's Representative.

3.2 PROTECTION OF INFILTRATION FACILITIES

A. Do not stockpile materials, vehicles and equipment within footprint of proposed infiltration facilities.

B. Do not locate haul routes within footprint of infiltration facility. See Section 01 57 13 - Temporary Erosion and Sedimentation Control.

3.3 EROSION CONTROL

A. Construct and maintain the TESC system in accordance with Section 01 57 13 Temporary Erosion and Sedimentation Control.

3.4 CLEARING AND GRUBBING

A. Remove surface debris, vegetation, underbrush and other deleterious material within areas to be graded, as required for new construction in accordance with WSDOT 2-01.3.

1. Disposal Method shall not include open burning.

B. Protect all offsite trees along adjacent roadways and on surrounding properties.

C. Do not strip and grub within tree protection areas or areas to remain undisturbed.

3.5 DISPOSAL OF MATERIALS

A. The Contractor, in a manner consistent with all government regulations, shall dispose of the refuse resulting from clearing, stripping and grubbing. In no case shall refuse material be left on the Project Site, shoved onto abutting private properties, or be buried in embankments or trenches on the Project Site. Debris shall not be deposited in any stream or body of water, stormwater facility, infiltration facility or in any street or alley, or upon any private property except by written consent of the private property owner. Maintain hauling routes clean and free of any debris resulting from Work of this Section.

END OF SECTION 31 10 00

SECTION 31 23 33 – RESTORATION OF SURFACES (WATER SUPPLY)

PART 1 – GENERAL

1.1 DESCRIPTION

A. The work covered by this Section includes restoration to all types of surfaces disturbed, damaged or destroyed during the performance of the work under or as a result of the operations of the contract.

B. This work does not include water main and service work within the Aquatic Center site. Water piping work within the Aquatic Center site shall be in accordance with Section 33 10 00 – Water Service.

1.2 RELATED SECTIONS

A. Section 31 00 00 – Earthwork

B. Section 32 12 16 – Hot Mix Asphalt Pavement

1.3 SCHEDULE OF RESTORATION

A. A schedule of restoration operations shall be submitted by the Contractor for review.
   1. After an accepted schedule has been agreed upon it shall be adhered to unless otherwise revised with the approval of the Contracting Officer Representative (COR).

B. The replacement of surfaces at any time, as scheduled or as directed, shall not relieve the Contractor of responsibility to repair damages by settlement or other failures.

1.4 SUBMITTALS

A. Schedule of Restoration Operations

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. The quality of materials and the performance of work used in the restoration shall produce a surface or feature equal to or better than the condition of each before the work began.

3.2 NATIVE UNDEVELOPED AREAS

A. All native undeveloped areas disturbed shall be replaced with material to match the existing surface unless otherwise specified.
   1. The depth of the soil, stone or gravel shall be at least equal to the existing.
   2. After compaction the surface shall conform to the slope and grade of the area being replaced.

3.3 OTHER TYPES OF RESTORATION

A. Watercourses shall be reshaped to the original grade and cross-section and all debris removed. Where required to prevent erosion, the bottom and sides of the watercourse shall be protected.

B. Flow lines indicated on the topographical survey shall not be altered by construction activity except where indicated on the Drawings. The Contractor is responsible for re-establishing flow lines that have been affected by construction equipment or personnel under the supervision of the Contractor.

C. Trails and slopes shall be restored to their original condition upon completion of construction activity at a given area. The Contractor must ensure that no new channel flow lines or watercourses have been created as a result of construction activity except where indicated on the Drawings.

D. Gravel roadways shall be shaped to the original grade and cross-section and all debris removed. Utility trench sections within the existing asphalt or gravel roadway corridors, or their shoulders, shall be repaired in accordance with the project Drawings and applicable specifications.

E. Asphalt pavement shall be restored in accordance with the Drawings and Section 32 12 16 – Hot Mix Asphalt Pavement.

END OF SECTION 31 23 33.10

SECTION 32 12 16 - HOT MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Work includes but is not limited to the following:

1. New hot mix asphalt (HMA) pavement including crushed surfacing courses.
2. Temporary and permanent pavement patching.

1.2 REFERENCES

A. Reference the following standards:

AHJ	Public Authority Having Jurisdiction AHJ is an abbreviation for public Authorities Having Jurisdiction. For this project the AHJ denotes Island County.
MUTCD	Manual on Uniform Traffic Control Devices, current edition
WSDOT	Washington Department of Transportation 2025 Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction

1.3 SUBMITTALS

A. Submit the following information in accordance with Division 01:

1. Product information.
2. Documentation verifying mixing plant shall be a member of the Washington Asphalt Pavement Association (WAPA).
3. Certified test results that demonstrate conformance with specifications. Tests shall have been performed within twelve months of anticipated use of materials.

PART 2 - PRODUCTS

2.1 CRUSHED SURFACING TOP COURSE

A. Crushed Surfacing Top Course in accordance with Section 31 00 00 – Earthwork.

2.2 CRUSHED SURFACING BASE COURSE

A. Crushed Surfacing Base Course in accordance with Section 31 00 00 – Earthwork.

2.3 HOT MIX ASPHALT (HMA)

A. HMA Class ½" conforming to WSDOT Section 5-04.

2.4 TACK COAT

A. Tack Coat shall conform to WSDOT 5-04.3(4).

2.5 CRACK SEALING

A. Crack sealing shall conform to WSDOT 5-03 and 5-04.3(4).

PART 3 - EXECUTION

3.1 GENERAL

A. Verify site conditions are suitable to receive the work covered in this Section.

B. Weather limitations for placement of HMA shall conform to WSDOT Section 5-04.3.

C. Conform to the details, dimensions and grades specified on the plans.

1. Prepare subgrade in all areas to be paved in accordance with Section 31 00 00 Earthwork, and WSDOT 2-06.
2. Maximum allowable slope in Accessible Routes parking stalls and access aisles is two-percent in any direction (zero tolerance for maximum allowable slopes). The finished slope and cross slope in Accessible Routes and areas shall not exceed the maximum slope allowed by Americans with Disability Act (ADA) and U.S. Access Board's Public Rights-of-Way Accessibility Guidelines.
3. Maximum variations in finished grade of all paving except Accessible parking and Accessible Routes and areas shall be in accordance with WSDOT 5-04.3(13).
4. Slope all paved surfaces to prevent standing water.

D. Protect surrounding areas, structures, features, and surfaces from damage.

1. Should any defacement or damage occur, repair or replace damaged areas or structures at no cost to the Owner.

3.2 CRUSHED SURFACING COURSES

A. Place crushed surfacing courses in accordance with WSDOT Section 4-04 and compact to a minimum of 95-percent of maximum dry density as determined in accordance with ASTM D1577 and as measured in the field using ASTM D2922.

B. Prior to placing the HMA, treat the prepared surface in accordance with WSDOT Section 5-04.3.

3.3 HOT MIX ASPHALT

A. Spread, finish and compact HMA in accordance with WSDOT Section 5-04.3.

1. HMA three inches or thicker shall be placed in layers not exceeding two inches in thickness. HMA less than three inches thick may be placed in one layer.
2. Do not pave in rain or when subgrade or base is wet or frozen. Weather limitations per WSDOT Section 5-04.3(1).

B. Construct joints and connections with existing facilities in accordance with WSDOT Section 5-04.3.

3.4 TACK COAT

A. Apply tack coat per WSDOT Section 5-04.3. Do not apply tack coats when temperature is below 50 degrees Fahrenheit or when base is wet.

3.5 RIGHT-OF-WAY RESTORATION

A. Restore pavement in public right-of-way in accordance with AHJ requirements. Pavement extents shown on plans are approximate only for permitting purposes. Confirm extents with AHJ Inspector.

3.6 CLEANING

A. After paving operations, clean surfaces of excess or spilled asphaltic materials.

B. Do not permit vehicular traffic on asphalt paving until it has cooled and hardened, and in no case sooner than six hours after placing.

C. Provide barricades and warning devices as required and in accordance with MUTCD.

END OF SECTION 32 12 16

32 13 13 – SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Concrete Paving (Pedestrian)
   2. Concrete Paving (Vehicular)
   3. Extruded Concrete Curbs
   4. Cast-in-Place Concrete Steps

B. Related Requirements:
   1. 05 52 00 Exterior Metal Railings
   2. WSDOT Standard Specification for Road, Bridge, and Municipal Construction.
   3. WSDOT Standard Plans
   4. Civil Engineering Plans, Notes, and Details
   5. International Building Code (IBC), Section 1011 – Stairways
   6. Americans with Disabilities Act (ADA) – Accessibility Guidelines

1.3 DEFINITIONS

A. *Cementitious Materials:* Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated:
   1. Joint Filler.
   2. Joint Sealant.
   3. Curing Compound.

B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, product conditions, weather test results, or other circumstances warrant.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C94M-19a requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section 'Project Meetings'.
1. Require representatives of each entity directly concerned with concrete pavement to attend, including the following:
a. Contractor's superintendent.
b. Concrete subcontractor.

1.6 Concrete Mock-Up: Provide 6’ x 6’ concrete mock-up indicating all finishes, sawcuts, joints, and sealant for approval prior to construction to become standard for all concrete paving. Approved mock-up to remain on site until all concrete work is accepted.

1.7 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
1. Use flexible or curved forms for all curved pavement edges.

B. Formwork for Vertical Surfaces: Use well-braced vertical forms for curbs and concrete steps. Forms shall be aligned, tight, and capable of resisting movement or deformation during placement and consolidation.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 CONCRETE PAVING (PEDESTRIAN)

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

B. Portland Cement: ASTM C150, Type I or Type II.

C. Aggregate: ASTM C33, uniformly graded, from a single source, with coarse aggregate as follows:
1. Maximum Aggregate Size: Three-quarter inch (¾”) nominal.
2. Do not use fine or coarse aggregates containing substances that cause spalling.

D. Water: Potable and in conformance with ASTM C94.

E. Fiber Reinforcement:
   1. Synthetic Fibers: ASTM C116C/C116M, Type III

2.3 CONCRETE PAVING (VEHICULAR)

A. Refer to Civil Drawings and WSDOT Standard Specifications.

B. Jointing and mix for vehicular concrete paving are governed by the Civil Engineering plans and WSDOT Standard Specifications. Refer to landscape drawings to align with the jointing layout.

2.4 EXTRUDED CONCRETE CURBS

A. Refer to Civil Drawings and WSDOT Standard Specifications.

B. Jointing and mix for extruded concrete curbs are governed by the Civil Engineering plan and WSDOT Standard Specifications.

2.5 CAST-IN-PLACE CONCRETE STEPS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

B. Portland Cement: ASTM C150, Type I or Type II.

C. Aggregate: ASTM C33, uniformly graded, from a single source, with coarse aggregate as follows:
   1. Maximum Aggregate Size: Three-quarter inch (¾") nominal.
   2. Do not use fine or coarse aggregates containing substances that cause spalling.

D. Water: Potable and in conformance with ASTM C94.

E. Steel Reinforcement:
   1. Reinforcement bars: ASTM A615M-18e1, Grade 60, Deformed

F. Finish: Smooth trowel finish with uniform risers / treads per IBC Section 1011

2.6 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than one-tenth percent (0.1%) water-soluble chloride ions by mass of cement and to be compatible with other admixtures.

B. Air-Entraining Admixture: ASTM C260.

C. Synthetic Fiber Reinforcement: Master Fiber M100 or approved equal meeting the requirements of ASTM C1116 / C1116M 4.1.3. Type III and ICC ES AC 32 3.1.1.

2.7 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

B. Water: Potable.

C. Clear Waterborne Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B.

2.8 RELATED MATERIALS

A. Expansion and Isolation Joint Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber three-eighths inch (3/8") thick. Premolded expansion joint filler shall be of sufficient size to cover the full depth of the concrete section.

B. Joint Sealant: ASTM C920, Type S, Class 35, Grade NS. Sikaflex-1A or approved equal.

C. Provide gray joint sealant, and coat with silica sand.

D. Carefully apply sealant. Any joints not fully covered with sealant and/or flowing beyond the joint will require the sealant to be removed and reapplied across the entirety of the joint.

2.9 CONCRETE MIXES

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
   1. Do not use Owner's field quality-control testing agency as the independent testing agency.

C. Proportion mixes to provide concrete with the following properties:
   1. Compressive Strength (28 Days): 4000 psi
   2. Slump Limit: Four (4) inches.

D. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows:
   1. Air Content: No less than four point five percent (4.5%) and no more than seven point five percent (7.5%) for three-quarter inch (¾”) maximum aggregate.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C94.

B. Admixtures: Add admixtures within an accuracy of three percent (3%). Where two (2) or more admixtures are used in the same batch, they shall be added separately and must be compatible. Approved admixtures must be added at the appropriate time in strict compliance with manufacturer’s directions. Concrete that shows evidence of total collapse or segregation caused by the use of admixture shall be removed from the site.

C. Synthetic Fiber: Add one-half (½) pound per cubic yard.

2.11 CRUSHED SURFACING BASE

A. Refer to plans and geotechnical report.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION AND CRUSHED SURFACING BASE

A. Verify the subgrade is correct to line and grade before beginning subsequent work.

B. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

C. Remove loose material from compacted subbase surface immediately before placing crushed surfacing base.

D. Place crushed surfacing base in one (1) lift and compact.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. All curved edges shall be formed with flexible forms and formwork shall be approved by the Owner's Representative prior to placing any concrete.

B. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least twenty-four (24) hours after concrete placement.

C. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's *"Manual of Standard Practice"* for fabricating reinforcement and with recommendations in CRSI's *"Placing Reinforcing Bars"* for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

3.4 JOINTS

A. General: Place joints where shown on Contract Drawings. Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
   1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half (½) hour, unless pavement terminates at isolation or expansion joints.
   1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least one and one-half inches (1½") into concrete.
   2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.

3. Provide tie bars at sides of pavement strips where indicated.
4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Isolation and Expansion Joints: Form isolation and expansion joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. Locate expansion joints at intervals indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler no less than one-half inch (½") nor more than one inch (1") below finished surface if joint sealant is indicated.
4. Furnish joint fillers in one-piece lengths. Where more than one (1) length is required, lace or clip joint-filler sections together.
5. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints:
1. Provide one-eighth inch (1/8") sawcut to one-quarter (¼) of slab depth. Sawcut within four (4) to twelve (12) hours of pouring slab.
2. Fill with mastic where required.

E. Edging: Tool edges of joints in concrete after initial floating with an edging tool to the radius indicated on the Contract Drawings. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

F. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.

G. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations.

I. Cold-Weather Placement: Comply with ACI 306.1 and as follows when cold weather conditions exist:
   1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   2. When air temperature has fallen to or is expected to fall below forty (40) degrees F uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than fifty (50) degrees F and not more than eighty (80) degrees F at point of placement.
   3. Do not use frozen materials or materials containing ice or snow.
   4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

J. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement below ninety (90) degrees F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture. Finishes to be approved on mock-up prior to construction.

   1. Medium-to-Light-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

C. Vertical Surfaces: Class 1 sack finish on all exposed vertical surfaces in accordance with WSDOT Standard Specifications – Section 602.3(14)A.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven (7) days with the following materials:
      a. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with twelve-inch (12") lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least twelve inches (12"), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
   1. Elevation: One-quarter inch (¼").
   2. Thickness: Plus three-eighths inch (3/8"), minus one-quarter inch (¼").
   3. Surface: Gap below ten foot (10') long, unleveled straightedge not to exceed one-quarter inch (¼").
   4. Lateral Alignment and Spacing of Tie Bars and Dowels: One inch (1").
   5. Vertical Alignment of Tie Bars and Dowels: One-quarter inch (¼").
   6. Joint Spacing: As shown on Contract Drawings.
   7. Joint Width: Plus one-eighth inch (1/8"), minus zero (0) inch.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Section.

B. Test results shall be reported in writing to Owner's Representative, concrete manufacturer, and Contractor within twenty-four (24) hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at twenty-eight (28) days, concrete mix proportions and materials, compressive breaking strength, and type of break for both seven (7-) and twenty-eight (28-) day tests.

C. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Owner's Representative. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

B. Drill test cores where directed by Owner's Representative when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least fourteen (14) days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two (2) days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

32 14 43 – POROUS UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Porous Pavement System

B. Related Requirements:
   1. 32 80 00 – Irrigation System
   2. 32 91 13 – Soil Preparation
   3. 32 92 23 – Hydroseed
   4. 32 93 00 – Plants

1.3 SUBMITTALS

A. Shop Drawings: Submit design detail showing proper cross section.

B. Samples: Submit manufacturer's sample 10inch x 10inch section.

C. Installation Instructions: Installation instructions and maintenance methodology.

D. Manufacturer's Product Information: Product manufacturers shall have a minimum of twenty (20) years of experience producing products for porous pavement systems.

E. Sieve Analysis

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened package until ready for installation.

B. Protect units / rolls from damage during delivery and store rolls uprights, under tarp, to protect from sunlight, when time for delivery to installation exceeds one (1) week.

C. Handling: Protect materials during handling and installation to prevent damage.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions within limits recommended by manufacturer for optimum results.

B. Do not begin installation of porous pavements until all hard surface paving adjacent to porous pavement areas is complete.

C. Install turf when ambient air temperatures is at least fifty-five (55) degrees F.

D. In cold weather, do not use frozen materials or materials mixed or coated with ice or frost, and do not build on frozen, wet, saturated, or muddy subgrade.

E. Protect partially completed paving against damage from other construction traffic when work is in progress.

F. Adequately water sod or grass seed to assure germination of seed and growth of root system.

G. Grass coverage on the sand-filled rings must be completed within one (1) week.

H. DO NOT DRIVE, PARK ON, or use Grasspave system for two (2) or three (3) mowing cycles until grass root system has matured (6-8 weeks for seeded areas)

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Invisible Structures, Inc, www.invisiblestructures.com, 302.233.8383, or equal.

2.2 GRASSPAVE2

A. Composition:
1. High density polyethylene (HDPE): 100 percent recycled materials.
2. Color: Black
3. Color Uniformity: Uniform color throughout all units rolls.
4. Carbon Black for ultraviolet light stabilization.
5. Hydrogrow soil amendment and fertilizer, provided with Grasspave2.

B. Performance Properties:
1. Maximum Loading Capability: 15,940 psi when filled with sand.
2. Tensile Strength: 458 lbf/in from ASTM D638 Modified.
3. System Permeability: 2.63 to 38.55 inches of water per hour.
4. Effective Imperviousness: 10%

C. Dimensions (individual units are assembled and distributed into rolls):
1. Roll Area: From 108 sq ft to 538 sq ft, in 108 sq ft increments.
2. Roll Width: From 3.3 ft to 8.2 ft in 1.6ft increments.
3. Roll Lengths: From 32.8 ft to 65.6 ft in 3.3 ft increments.
4. Roll Weights: From 41 lbs to 205lbs in 41 lb increments.
5. Unit Nominal Width by Length: 20 inches by 20 inches or 40 inches by 40 inches.
6. Nominal Depth: 1 inch for rolls and individual units.
7. Unit Weight: 18 oz or 5 lbs.
8. Volume Solid: 8 percent.

2.3 SYSTEM MATERIALS

A. Base Course: Sandy gravel material from local sources commonly used for road base construction (recycled materials such as crushed concrete or crushed asphalt are not acceptable).
1. Conforming to the following sieve analysis and requirements:
a. 100 percent passing – sieve size 1 inch
b. 80-100 percent passing – sieve size ¾ inch.

c. 60-80 percent passing – sieve size 3/8 inch
d. 40-60 percent passing – sieve size #4.
e. 25-40 percent passive – sieve size #10.
f. 5-25 percent passing – sieve size #40.
g. 0-5 percent passive – sieve size #200.

2. Provide a base course material nearly neutral in PH (range 6.5 to 7.2) to provide adequate root zone development for turf.
3. Material may be either “pit run” or “crusher run”. Avoid using clay-based crusher run/pit run. Crusher run material will generally require coarse, well-draining sand conforming to AASHTO M6 to be added to mixture (20 to 30 percent by volume) to ensure long-term porosity.

B. Sand Fill for Rings and Spaces Between Rings:
1. Coarse, well-draining sand, such as washed concrete sand conforming to AASHTO M6 or ASTM C33.

C. Turf Conditioner:
1. Hydrogrow a proprietary soil amendment manufactured by Invisible Structures, Inc. and provided with Grasspave, or equal.

D. Grass:
1. Seed: Refer to Contract Dreawings. Seed shall be provided in containers clearly labeled to show seed name, lot number, net weight, % weed seed content, and guaranteed % of purity and germination. Pure Live Seed types and amount shall be as shown on plans.
a. Mulch – Wood or paper cellulose commercial mulch materials compatible with hydroseeding operations. Mulch depth according to mulch manufacturer’s recommendations. DO NOT use mulch of straw, pine needles, etc, because of their low moisture holding capacity.
b. Topsoil – Obtain topsoil for a light “dusting” (no more than ½ inch) above rings filled with sand for seeding germination.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine subgrade and base course conditions. Do not start porous paving installation until unsatisfactory conditions are corrected. Check for improperly compacted trenches, debris, and improper gradients.

B. Start of installation constitutes acceptance of existing conditions and responsibility for satisfactory performance. If existing conditions are found unsatisfactory report to Owner’s Representation.

3.2 PREPARATION

A. Subgrade Preparation:
1. Prepare subgrade to 90% compaction. Verify subgrade in accordance with porous paving system manufacturer’s instructions.
2. Proper subgrade preparation will enable the Grasspave2 rolls/units to connect properly and remain level and stationary after installation.
3. Excavate area allowing for unit thickness, the engineered base depth (where required), and 0.5 inch for depth of sod root zone or topsoil germination area (when applicable).

4. Provide adequate drainage from excavated area if area has potential to collect water, when working in-place soils that have poor permeability.
5. Ensure in-place soil is relatively dry and free from standing water.
6. Uniformly grade base.
7. Level and clear base of large objects, such as rock and pieces of wood.

B. Base Preparation:
1. Provide six-inch (6”) compacted sandy gravel road base in alignment with porous paving system manufacturer’s instructions to ninety-five percent (95%) compaction.
2. Provide geotextile separation layer between the natural ground and engineered base.
3. Coordinate base installation and preparation with irrigation lines.
4. Pace engineered base in lifts not to exceed six inches (6”), compacting each lift separately to ninety-five percent (95%) Modified proctor.
5. Leave one-inch (1”) of depth below final grade for porous paver unit and sand fill and one-half inch (½”) for depth of root zone or topsoil germination (when applicable).

3.3 HYDROGROW INSTALLATION

A. Spread all Hydrogrow mix provided (spreader rate = 10 lbs per 1076 ft2) evenly over the surface of the base course with a hand-held, or wheeled rotary spreader.

B. The Hydrogrow mix should be placed immediately before installing the Grasspave2.

3.4 GRASSPAVE2 INSTALLATION

A. Install the Grasspave2 units by placing units with rings facing up, and using snap-fit connectors, pegs and holes, provided to maintain proper spacing and interlock the units. Units can be easily shaped with pruning shears or knife. Units placed on curves, slopes, and high traffic areas shall be anchored to the base course, using 40d common nails with fender washer, as required to secure units in place. Tops of rings shall be between one-quarter inch (¼”) to one-half inch (½”) below the surface of adjacent hard surface pavements.

B. Install sand in rings as they are laid in section by “back-dumping” directly from a dump truck, or from buckets mounted on tractors, which then exit the site by driving over rings filled with sand. The sand is then spread laterally from the pile using flat bottomed shovels and/or wide “asphalt rakes” to fill the rings. A stiff bristled broom should be used for final “finishing” of the sand. The sand must be “compacted” by using water from hose, irrigation heads, or rainfall, with the final grade no less than the top of rings and no more than one-quarter inch (¼”) above top of rings.

3.5 HYDROSEED INSTALLATION

A. Grass coverage on the sand-filled rings must be completed within one (1) week. Sand must be re-installed and leveled and Grasspave2 check for integrity if rings become exposed due to wind, rain, traffic, or other factors.
1. Hydroseeding – Spray seed mixture onto site at rates shown on Contract Drawings and per hydroseeding manufacturer’s recommendations. Coverage must be uniform and complete. Following germination of the seed, areas lacking germination larger than 8in x 8in must be reseeded immediately. Seeded areas must be fertilized and kept moist during development of turf plants. DO NOT DRIVE ON SYSTEM: Hydroseeded areas must be protected from all traffic for a period of six (6) to eight (8) weeks, or until the root system has penetrated and established well below the Grasspave2 units.

B. Adequately water sod or grass seed to assure germination of seed and growth of root system.

3.6 PROTECTION

A. Seeded areas must be protected from any traffic, other than emergency vehicles, for a period of four (4) to eight (8) weeks, or until the grass is mature to handle traffic.

3.7 FIELD QUALITY CONTROL

A. Remove and replace segments of Grasspave2 units where three or more adjacent rings are broken or damaged, reinstalling as specified, so no evidence of replacement is apparent.

B. Perform cleaning during the installation of work and upon completion of the work. Remove all excess materials, debris, and equipment from site. Repair any damage to adjacent materials and surfaces resulting from installation of this work.

3.8 MAINTENANCE

A. Maintain grass in accordance with manufacturer's instructions and as specified in Section 32 92 23 Hydroseed.

B. Lawn Care: Normal turf care procedures should be followed, including de-thatching.

C. DO NOT AERATE: Aerator will damage the Grasspave2 units. Aeration is not necessary in a sand root zone.

D. When snow removal is required, keep a metal edged plow blade a minimum of one-inch (1") above the surface during plowing operations to avoid causing damage to the Grasspave2 units.

END OF SECTION 32 33 00

32 15 40 – SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Crushed Surfacing Base Course (CSBC)
   2. Crushed Surfacing Top Course (CSTC)
   3. Geotextile fabric.

B. Related Requirements:
   1. WSDOT Standard Specification for Road, Bridge, and Municipal Construction.
   2. Civil Engineering Plans, Notes, and Details

1.3 REFERENCE STANDARDS

A. Standard Specifications: All construction shall be in accordance with the Standard Specification for Road, Bridge, and Municipal Construction, prepared by the Washington State Department of Transportation (WSDOT) and the American Public Works Association, Washington State Chapter.

1.4 SUBMITTALS

A. Provide one-half (½) cubic foot sample and sieve analysis for:
   1. Crushed Surfacing Base Course (CSBC)
   2. Crushed Surfacing Top Course (CSTC)

B. Submit product data sheets on Geotextile Fabric.

PART 2 - PRODUCTS

2.1 CRUSHED SURFACING

A. Base Course: Crushed Surfacing Base Course (CSBC) shall meet the requirements as outlined in Section 9.03.9(3) of the WSDOT Standard Specifications.

B. Top Course: Crushed Surfacing Top Course (CSTC) shall meet the requirements as outlined in Section 9.03.9(3) of the WSDOT Standard Specifications.

C. Compacted Depth: See details on Contract Drawings.

2.2 NONWOVEN GEOTEXTILE FABRIC

A. Nonwoven geotextile meeting or exceeding mullen burst of 220 psi (ASTM D3786 / D3786M), trapezoidal tear of 40lbs. (ASTM D4533 / D4533M), and puncture strength of 65lbs. (ASTM D4833 / D4833M). Mirafi 140N or approved equal.

PART 3 - EXECUTION

3.1 SUBGRADE

A. Prepare subgrade in conformance with Section __ __ __ – Earthwork.

B. Verify that the subgrade is completed to correct line and grade before starting work.

3.2 CRUSHED SURFACING

A. Crushed Surfacing Base Course (CSBC)
   1. Compaction: Compact the CSBC to at least ninety-five percent (95%) of the maximum dry density as determined by ASTM D698 (Standard Proctor Test).

B. Crushed Surfacing Top Course (CSTC)
   1. Compaction: Compact the CSTC to at least ninety-two percent (92%) of the maximum dry density as determined by ASTM D698 (Standard Proctor Test).

END OF SECTION 32 15 40

SECTION 32 17 00 - PAVEMENT MARKINGS AND SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not limited to:

1. Furnishing and installing painted striping and symbols on pavement surfaces.
2. Furnishing and installing posts, poles, sign supports, signs and accessories.
3. Furnishing and installing all permanent traffic signs specified on the Contract documents.
4. Coordination with AHJ for traffic channelization restoration in the public right of way.
5. Furnishing and installing wheelstops.

1.2 REFERENCES

A. Reference Standards:

AHJ	Public Authority Having Jurisdiction AHJ is an abbreviation for public Authorities Having Jurisdiction. For this project the AHJ denotes Island County.
WSDOT	Washington State Department of Transportation 2025 Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction.
MUTCD	Manual on Uniform Traffic Control Devices

1.3 SUBMITTALS

A. Submit the following information in accordance with submittal procedures noted in Division 01.

1. Product data, specifications and application instructions for materials listed in Part 2 Products and/or noted on Plans.

PART 2 - PRODUCTS

2.1 PAINT

A. Paint for pavement marking shall conform to WSDOT Section 9-34. The paint shall be homogeneous, easily stirred to a smooth consistency, and shall show no hard settlement or other objectionable characteristics.

2.2 SIGNS

A. Signage materials and posts shall conform to Section 9-28 and the details shown on the drawings.

2.3 WHEELSTOPS

A. Wheelstops shall be per details shown on the drawings.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

B. Place warning signs to alert approaching traffic. Place traffic cones, markers or other measures along newly installed paint and thermoplastic markings to control traffic and prevent damage to newly installed markings in accordance with AHJ traffic control requirements.

3.2 PREPARATION

A. Thoroughly clean pavement surfaces to be marked before application of the paint to remove dust, dirt, rubber deposits, surface laitance, and other coatings or deposits.

3.3 APPLICATION OF PAINT

A. Apply pavement markings in accordance with WSDOT Section 8-22.3.

1. Provide guidelines and templates as necessary to control paint application. Sharply outline edges of marking.
2. Apply paint to clean, dry surfaces, and unless otherwise approved, only when air and pavement temperatures are above 40 degrees and less than 95 degrees Fahrenheit. Maintain paint temperature within these same limits.
3. Complete two full applications of paint for pavement markings.

B. Do not allow traffic or other disturbance until markings have thoroughly dried in accordance with the manufacturer’s recommended maximum drying time.

1. Discontinue application of markings if drying times exceed the recommended manufacturer’s drying times. Determine and correct the cause before restarting work.
2. Correct deficient or disturbed markings as directed by the Owner’s Representative at no additional cost to the Owner.

3.4 INSTALLATION OF SIGNS

A. Signage and posts: Install, relocate and/or reinstall signs and posts per WSDOT Section 8-21.3.

B. Wheelstops: Install per manufacturer's recommendation and per the Drawings.

3.5 CLEANING

A. Remove excess materials and debris and leave premises clean and free of residue in accordance with the requirements of Division 01 of this Project Manual.

END OF SECTION 32 17 00

32 21 39 – WOOD FENCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 REFERENCES

A. AWPA (American Wood Preservers Association) Book of Standards.

B. WCLIB (West Coast Lumber Inspection Bureau).

1.3 DELIVERY, STORAGE, AND PROTECTION

A. See Section 01 60 00 – Product Requirements. Transport, handle, store, and protect from damage all products.

1.4 SUBMITTALS

A. Product Data: Material and equipment composite data sheets shall be submitted for the following:
   1. Pressure Treated Posts
   2. Cedar Fence Planks
   3. Galvanized Fence Post Bases
   4. Galvanized Fence Brackets
   5. Site Applied Wood Treatment
   6. Stain

B. Submit manufacturer’s certification that all lumber meets the specified grading and standards.

PART 2 - PRODUCTS

2.1 LUMBER MATERIALS

A. Lumber Grading Rules: WCLIB.

B. Fence Posts and Rails: Lumber shall be #1 and better Hem Fir. Each piece of lumber shall bear stamp of West Coast Lumber Inspection Bureau (WCLIB) and/or Western Wood Products Association (WWPA) showing grade mark. Treat all wood in accordance with AWPA specifications for the pressure treatment of Western Woods, latest edition. Where possible, pre-cut material before treatment. All field cuts and drilled holes shall be field treated in accordance with AWPA M-4.

C. Fence Planks: Shall be #3 or better grade Western Red Cedar, four-inch (4”) wide planks with a nominal thickness of one-inch (1”) and a length of six feet (6’). Planks shall not have any open or loose knots holes, cracks, stains, warps, or other visible defects.

2.2 ACCESSORIES

A. Fasteners: Use hot-dipped galvanized steel.

B. Fence Post Bases: Simpson MPB44Z galvanized steel or approved equal.

C. Fence Brackets: Simpson FB24Z galvanized steel or approved equal.

D. Steel straps, screws, bolts, nuts, and washers shall conform to ASTM A307, hot-dipped galvanized.

2.3 PRESERVATIVE TREATMENT

A. All lumber shall be pressure treated as follows:

Species/Type	Treatment	Retention
Hem / Fir	ACQ	0.25 lbs per CF (rails)
Hem / Fir	ACQ	0.40 lbs per CF (posts)

AWPA Standards C2 & C16

B. All treatment shall be in accordance with AWPA C2 & C16 and all lumber shall bear the appropriate AWPA quality mark designation. After treatment, dry all wood to a maximum moisture content of nineteen percent (19%).

C. ACQ treated lumber shall not be stained brown with factory-applied stain.

2.4 CONCRETE FOOTINGS

A. Class 3000 psi (see Concrete specification section).

PART 3 - EXECUTION

3.1 PREPARATION

A. Locate and mark all existing buried utilities near fence location and adjust post locations as required to avoid damage to utilities.

3.2 VERIFICATION OF FINISH GRADE & ALIGNMENT

A. Prior to beginning excavation for post footings, verify that the finish grade is correct and alignment is approved.

3.3 CONCRETE FOOTING

A. Construct as detailed on Contract Drawings.

3.4 FENCE

A. Set posts plumb, in approved galvanized fence post bases. Attach posts to post bases per base manufacturer’s recommendations.

B. Set rails parallel, and parallel with the ground slope. Affix rails to posts using approved galvanized steel fence brackets. Attach fence brackets to posts and rails per bracket manufacturer's recommendations.

C. Attach cedar fence planks to rails with two (2) galvanized wood screws per plank at each rail. Tighten all screws so that heads are flush with the face of the plank.

D. Retighten all nuts and bolts after fence construction is complete.

3.5 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Treat all site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.6 TOLERANCES

A. Faces of Rails: Flush alignment with plank-side face of post.

B. Posts: One-eighth inch (1/8") maximum from true position.

3.7 STAINING

A. Stain all fence lumber "Cedarcolor" as shown on the Contract Drawings.

END OF SECTION 32 21 39

32 31 00 – FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Chain Link Fencing and Gates
   2. Welded Wire Mesh Fencing and Gates

B. Related Requirements:
   1. 03 30 00 – Cast-In-Place Concrete
   2. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   3. ASTM A641/A641M – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire (for Galvanized Before Welding wire)
   4. ASTM F2453/F2453M – Standard Specification for Welded Wire Mesh Fence Fabric
   5. ASTM D3359 – Standard Test Methods for Rating Adhesion by Tape Test
   6. ASTM D2794 – Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
   7. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus (for corrosion resistance testing)
   8. ASTM D714 – Standard Test Method for Evaluating Degree of Blistering of Paints
   9. ASTM D1654 – Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
   10. ASTM D2244 – Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates
   11. ASTM D523 – Standard Test Method for Specular Gloss
   12. ASTM D6695 – Standard Practice for Xenon-Arc Exposure of Paint and Related Coatings (for UV resistance/weatherability)

1.3 SUBMITTALS

A. Product Data & Shop Drawings: Material descriptions, construction details, dimensions of individual components and profiles, and finishes for the following:
   1. Fence and gateposts, rails, and fittings.
   2. Chain link fabric, reinforcements, and attachments.
   3. Welded wire mesh, and attachments.
   4. Submit shop drawings. Include confirmation of panel height, layout, and fabrication method per Contract Drawings.

B. Product Certificates: Signed by manufacturers of chain link fences and gates certifying that products furnished comply with requirements.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Part to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed chain link fencing similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. All welding shall be by a WABO certified welder.

C. American Made Steel Products: All products shall be American made.

1.5 PROJECT CONDITIONS

A. Existing Utilities: Locate all buried utilities prior to beginning work. Exercise caution in the vicinity of the buried utilities.

B. Field Measurements: Verify layout information shown on Contract Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.6 MANUFACTURER

A. Welded Wire Mesh Fencing System: Ameristar WireWorks Anti-Climb, or approved equal meeting the performance specifications herein. System shall be custom-fabricated to match height and configuration indicated on the Contract Drawings. www.ameristarfence.com, 1.888.333.3422

PART 2 - PRODUCTS

2.1 CHAIN LINK FENCE FABRIC

A. Steel Chain Link Fabric: Provide fabric fabricated in one-piece widths. Comply with Chain Link Fence Manufacturers Institute "Product Manual" and with requirements indicated below:
1. Mesh and Wire Size: 1¾" inch mesh, 9 gauge (0.148 inch diameter) core wire.
2. Knuckle selvage top and bottom.
3. Fabric galvanizing thickness:
   a. 0.30 oz per SF on vinyl coated wire.

2.2 WELDED WIRE MESH FABRIC

A. Welded Wire Mesh: Provide factory-fabricated, one-piece welded mesh panels from pre-galvanized steel wire welded at every intersection.
1. Mesh: 3” x 0.5” (nominal) openings.
2. Wire Size: 10.5 gauge (0.128 inches)
3. Wire Tensile Strength: 74,000 psi
4. Wire Shear Strength: 68,000 psi
5. Wire Coating: Galvanized Before Welding (GBW), zinc-coated at 0.50 oz/ft² in accordance with ASTM A641.
6. Finish:
   a. Pre-galvanized per ASTM A653/A653M, G90 Minimum Coating
   b. Thermal stratification coating system:
      1) Epoxy powder base coat (minimum 2 mils thickness)
      2) Polyester TGIC powder coat finish (minimum 2 mils thickness)
      3) Coating performance to meet ASTM D3359 (adhesion), ASTM B117 (corrosion resistance > 3,500 hours), ASTM D2794 (impact resistance > 60 in-lbs), ASTM D2244 (color retention), and ASTM D523 (gloss retention).
7. Color: Black

2.3 CHAIN LINK FENCE FRAMEWORK

A. Round Steel Pipe: Standard weight, Schedule 40, galvanized steel pipe complying with ASTM F1083. Comply with ASTM F1043, Material Design Group IA, external and internal coating Type A, consisting of not less than 1.8-oz./sq. ft. zinc; and the following strength and stiffness requirements:
   1. Posts:
      a. All posts shall be standard hot-dip galvanized steel pipe; straight, true as to section and unspliced.
      b. Line posts shall be 2.375 inch outside diameter, Schedule 40 pipe, and 5.79 pounds per linear foot.
      c. Terminal and Corner Posts shall be 2.875” outside diameter, Schedule 40 pipe, and 7.58 pounds per linear foot.
      d. All post finials shall be standard moisture proof, heavily galvanized, malleable iron securely fastened to posts.
   2. Rails:
      a. Fences shall have top and bottom rails. See Contract Drawings for rail height.
      b. Rails shall be 1.66 inch outside diameter, Schedule 40 pipe, and 2.27 pounds per linear foot.
      c. Top rail shall be securely fastened to terminal posts and pass through tops of line post fittings, forming a continuous rail for the full length of fence. Top rail shall be furnished in random lengths from 18 to 20 feet long and with standard hot-dip galvanized steel expansion couplings not less than six inches (6") in length. Short lengths shall not be used adjacent to terminal posts. Couplings shall not be further than twelve inches (12") from a post. No exceptions.
   3. Brace Assembly:
      a. All terminal pull posts, corner posts, and gate posts shall be furnished with double adjustable brace assembly as specified by the fence manufacturer.
   4. Tension Bars & Wire Ties:
      a. Tension bars shall be used at all terminal posts and both sides of pull posts, corner posts, and gates. Tension bars shall be of full height of fabric 3/16" x ¾".
      b. Wire ties shall be 11-gauge steel with a minimum of 0.9 oz per sf of zinc coating.
   5. Tension Wire:
      a. Galvanized steel wire, 7 gauge (0.177 inch diameter) core.
   6. Swing Gates:
      a. Gates shall be provided where shown on Contract Drawings and hinged to swing 90º each way. Frames shall be 1.9 inch outside diameter, Schedule 40 pipe, and 2.72 pounds per linear foot.
      b. All joints shall have welded corner fittings to make a rigid frame. Welded frames shall be galvanized after welding. Gate, hinges, latches, keepers, brace, and all other fittings shall be heavy duty as specified by the fence manufacturer and approved.
      c. Provision shall be made for padlocking all gates in an open (full open to the inside) and closed position. The device shall be subject to approval.

2.4 WELDED WIRE MESH FENCE FRAMEWORK

A. SQUARE STEEL PIPE
   1. Posts:
      a. Fabricate from 2.5" square steel tube, 16 gauge minimum wall thickness.
      b. Posts shall be continuously welded or joined per manufacturer’s recommendations.
   2. Rails
      a. Fabricate from 2" square steel tube, 16 gauge minimum wall thickness.

b. Rails shall be continuously welded or mechanically joined to posts with brackets and tamper-resistant fasteners at all panel attachment points.

3. Fasteners:
   a. Provide tamperproof fasteners for mesh panel attachment at maximum eighteen inches (18”) on center.
   b. All fasteners shall be stainless steel or coated for corrosion resistance.
4. Swing Gates:
   a. Fabricate swing gate frames from 2" square steel tube, 16 gauge minimum wall thickness.
   b. Weld all frame intersections fully around the perimeter unless otherwise indicated by manufacturer standard practices.
   c. Provide hardware and attachments allowing gates to be secured in both the fully open and fully closed positions.
   d. Provide lockable latch hardware capable of accepting Owner’s padlock.
5. Finish:
   a. Framework shall be pre-galvanized per ASTM A653/A653M, minimum G90 coating weight.
   b. Framework shall receive a polyester powder coat finish over an epoxy base coat as specified for welded wire mesh panels.
   c. Color shall be black, matching the welded wire mesh panels

2.5 CHAIN LINK FENCE COATING

A. Vinyl Coating:
   1. Chain link fabric shall be hot dipped galvanized prior to vinyl coating.
   2. Vinyl coating shall be thermally fused and bonded, Class 2B.
   3. Thickness of vinyl coating fabric shall be 6-10 mil.
   4. Color: Black.

B. TGIC Polyester Coating:
   1. All chain link fencing components other than fabric shall also be vinyl-coated or be polymer coating, PVC, or polyolefin elastomer 10-mils (0.254-mm) minimum or polyester 3-mils (0.0076-mm) minimum coating can be applied to the exterior surface of tubular shapes. Color of the coating shall be in accordance with ASTM F934 and Black to match fabric.

C. Paint
   1. All nuts, bolts, and washers not coated shall be painted to match vinyl coating.

2.6 CAST-IN-PLACE CONCRETE FOOTINGS

A. General: Comply with ACI 301 for cast-in-place concrete.

B. Materials: Portland cement complying with ASTM C150 / C150M aggregates complying with ASTM C33 / C33M, and potable water.
   1. Concrete Mixes: Normal-weight concrete air entrained with not less than 3000-psi compressive strength (28 days), three-inch (3”) slump, and one-inch (1”) maximum size aggregate.

C. Materials: Dry-packaged concrete mix complying with ASTM C387 / C387M for normal-weight concrete mixed with potable water according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 SEQUENCING

A. Layout all fence lines and gates for approval by Owner's Representative prior to beginning any work.

3.2 CHAIN LINK FENCE

A. Posts:
   1. Space line posts uniformly and plumb as shown.

B. Top Rail: Install alignment. Run rail continuously on top of posts.

C. Bottom Rails: Install, spanning between posts, attaching at posts.

D. Chain Link Fabric: Apply fabric to inside of framework. Leave the space showing on the Contract Drawings between finish grade or surface and bottom selvage. Pull fabric taut and tie to posts, rails, and stretcher rod. Anchor to framework so fabric remains under tension after pulling force is released.

E. Tension or Stretcher Rod: Thread through fabric and secure.

F. Tie Wires: Use wire of proper length to double wrap both ends and firmly secure fabric to line posts and rails as follows:
   1. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of one-hundred eighty (180) degrees, and attach other end to chain-link fabric per ASTM F626 using standard round wire ties with either a preformed hook or pigtail at one end, designed to engage on picket of the chain link fabric at the preformed end.
   2. Wrap around the rail and wrap around one (1) picket of the chain link fabric at least two (2) full turns at the other end in a manner that will draw up tightly around the rail or post.
   3. Both ends shall be double wrapped with at least two (2) full turns.
   4. Bend ends of wire to minimize hazard to individuals and clothing.
   5. Maximum Spacing: Tie fabric to line posts, rails and stretcher rod at twelve inches (12") o.c. maximum.

G. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.

3.3 WELDED WIRE MESH FENCE

A. Posts:
   1. Set line, end, corner, and gate posts plumb and aligned as shown on the Contract Drawings.
   2. Posts shall be installed in concrete footings to minimum depth indicated on Contract Drawings or twenty-four inches (24”) minimum unless otherwise noted.
   3. Space line posts at six-foot (6’) maximum centers (or as recommended by manufacturer).
   4. Posts shall not deviate more than one-quarter inch (¼”) from plumb or alignment.

B. Rails:
   1. Install top and bottom rails level and aligned between posts.
   2. Secure rails to posts with manufacturer’s brackets or predrilled fittings using tamper proof fasteners.
   3. Welded or bracketed joints shall be tight and uniform.

C. Welded Wire Mesh Panels:
   1. Attach panels to rails and posts using tamperproof fasteners at eighteen inches (18”) maximum on center.
   2. Install panels on secure side of framework unless otherwise indicated.
   3. Panels shall be installed taut without bowing, sagging, or deformation.
   4. Maintain panel height above grade as shown on Contract Drawings; panels shall not touch finish grade unless specifically detailed.

D. Swing Gates:
   1. Install swing gates plumb, level, and aligned with adjacent fence.
   2. Gate frames shall be fabricated of square tube with welded intersections, and attached to posts using manufacturer’s approved hinges and latch hardware.
   3. Install gates to allow smooth opening and closing without binding.
   4. Set gates to provide uniform clearances per manufacturer’s instructions.
   5. Provide gates with means to secure them in both the fully open and fully closed positions.
   6. Provide gates with locking latches capable of Owner-supplied padlock installation.

E. Fasteners:
   1. Tighten all nuts, bolts, and tamper proof fasteners securely.
   2. Install all nuts and bolt heads on secure side of fence unless otherwise indicated.
   3. Install tamper proof security fasteners per manufacturer’s recommendations.

F. Field Touch-Up:
   1. After installation, clean and field touch-up all minor nicks, scratches, or exposed steel caused during handling and installation using manufacturer-supplied zinc-rich primer and matching powder coat touch-up paint.
   2. Follow manufacturer's three-step repair process:
      a. Remove all metal shavings and burrs.
      b. Apply zinc-rich primer to all cut or abraded surfaces.
      c. Apply two coats of matching color finish paint.

G. Cleaning and Final Alignment:
   1. Clean the fence and gate system of all dirt, dust, and construction debris.
   2. Adjust and align fence and gates to ensure tight, uniform installation.
   3. Protect fence from damage until final acceptance.

3.4 CLEANUP

A. Contractor shall leave grounds in good condition, remove all sand, gravel, debris, dirt, and leave fence complete and workable in all details.

B. Contractor shall resolve any safety issues related to protruding bolts, sharp edges, tripping hazards, or similar conditions that are deemed a safety risk to public park users.

3.5 WARRANTY

A. GENERAL WARRANTY
   1. The Contractor shall guarantee the workmanship and installation of all fencing and gate systems for a period of one (1) year from the date of final acceptance.
   2. Any defects which develop within the warranty period shall be repaired or replaced at the Contractor’s sole expense.

B. CHAIN LINK FENCING AND GATES

1. Chain link fence framework, fabric, fittings, and gates shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of final acceptance.
2. Warranty shall cover failure of structural integrity, corrosion of framework, loosening of fittings, and improper gate operation.

C. WELDED WIRE MESH FENCING AND GATES

1. Welded wire mesh panels, framework, coatings, fasteners, and gates shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of final acceptance.
2. Warranty shall cover failures including, but not limited to, panel detachment, structural failure, excessive corrosion, and failure of powder coating (i.e., peeling, cracking, or significant fading).
3. Warranty shall be contingent upon proper installation and field touch-up of any cuts or abrasions in accordance with manufacturer recommendations.

END OF SECTION 32 31 00

32 33 00 – SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Bike Racks
   2. Bollards

B. All items are to be provided complete ‘in-place’

C. Related Requirements:
   1. 03 30 00 – Cast-In-Place Concrete

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, field-assembly requirements, and installation details.

PART 2 - PRODUCTS

2.1 BIKE RACKS

A. Description:
   1. Frame: 2” Schedule 40 Steel Tubing
   2. Finish: Stainless Steel Finish
   3. Dimensions: 40” Diameter, 32.5” Height
   4. Mounting: Fixed, in-ground mounting, provide 12” dia x 18” deep concrete footing min.

B. Quantity: Eight (8)

C. Approved Manufacturers:
   1. Wabash Valley, wabashvalley.com, 1.800.253.8619
   2. Reliance Foundry, reliance-foundry.com, 1.877.789.3245
   3. Uline, uline.com, 1.800.295.5510
   4. Or approved equal.

D. Warranty:
   1. Minimum five (5) year manufacturer’s warranty covering finish, defects, and corrosion.

2.2 BOLLARDS

A. Description:
   1. Model: Reliance Foundry; R-8464-30

2. Height: 30 1/8 inches
3. Diameter: 4 1/2 inches body, 6 1/2 inches base
4. Weight: 17 lbs
5. Material: Stainless Steel
6. Pipe: ASTM A312, Grade TP 316
7. Plate: ASTM A959, Grade TP 316
8. Installation: Removable, new concrete, receiver with key

B. Quantity: Two (2)

C. Approved Manufacturers:
1. Reliance Foundry, reliance-foundry.com, 1.877.789.3245
2. Or approved equal.

D. Warranty:
1. Minimum five (5) year manufacturer’s warranty covering finish, defects, and corrosion.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions, unless more stringent requirements are indicated. Complete field assembly of site furnishings, where required.

B. Install ground mounted site furnishings and footings prior to paving.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on the Contract Drawings.

D. Contractor shall resolve any safety issues related to protruding bolts, sharp edges, tripping hazards, or similar conditions that are deemed a safety risk.

3.3 CLEANING

A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION 32 33 00

32 80 00 – IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes, but is not limited to the following:
   1. To furnish and install a new, complete and electronically operated irrigation system, as indicated on the Contract Drawings and specified herein including, but not limited to, piping, valves, sprinklers, specialties, controls, and wiring.
   2. The irrigation system will be supplied with potable water. The water source is the irrigation point of connection to the domestic water line location as indicated on the Contract Drawings.
   3. Coordinate work with other trades as applicable to avoid conflicts and to maintain schedule.

B. Related Requirements:
   1. Section 32 92 23 – Lawn and Hydroseed
   2. Section 32 93 00 – Plants

C. References:
   1. Island County Standards.
   2. American Society for Testing and Materials (ASTM).
   3. American Water Works Association (AWWA).
   4. State of Washington Standards
   5. National Electrical Code (NEC).
   6. Standard Specifications for Municipal Public Works Construction - Washington State Chapter (latest edition).
   7. State of Washington - Department of Health.
   8. Water District Standards.

1.3 DEFINITIONS

A. Mainline Piping: Downstream from point of connection to water distribution piping up to and including the control valves and quick couplers. Piping is under constant pressure when the system is activated.

B. Lateral Line Piping: Downstream from control valves and quick couplers to sprinklers and specialties. Piping is under pressure during individual zone operation.

C. The "Owner" may be the actual project owner or an owner-selected representative.

D. The following are industry abbreviations for plastic materials:
   1. ABS: Acrylonitrile butadiene styrene plastic
   2. FRP: Fiberglass reinforced plastic
   3. PA: Polyamide (nylon) plastic
   4. PP: Polypropylene plastic

5. PE: Polyethylene plastic
6. PTFE: Polytetrafluoroethylene plastic
7. PVC: Polyvinylchloride plastic
8. TFE: Tetrafluoroethylene plastic

1.4 QUALITY ASSURANCE

A. Prior to construction of this project, Contractor shall provide the Owner's Representative with written evidence that all Contractor staff assigned to solvent welding duties of PVC pipe or fittings are in possession of an up-to-date certification card issued by manufacturer representative of specified solvent cement. If Contractor's staff are not in possession of current certification cards, the Contractor shall schedule and complete a training seminar (conducted by solvent cement manufacturer representative) and provide written evidence of training completion for each staff member, to the Owner's Representative prior to construction. Only staff that are certified shall be permitted to solvent weld pipe and fittings.

1.5 PERFORMANCE REQUIREMENTS

A. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments as required to avoid obstructions such as site furnishings, signs, and light standards. Maintain the overlap coverage designated by the sprinkler spacing shown on the Contract Drawings. Avoid overspray onto walks and structures as practical.

B. The Contractor shall perform all system layout. The Owner’s Representative may or may not inspect the system layout prior to installation. System components not properly located shall be reinstalled by the Contractor at no additional cost to the Owner.

C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties, unless otherwise indicated:
1. Mainline Piping: 300 psi.
2. Lateral Line Piping: 200 psi.

1.6 SUBMITTALS

A. Product Data: Material and equipment composite data sheets shall be submitted for the following:
1. Solvent Weld Certification per Part 1.4 A. above
2. PVC pipe
3. Primer and Pipe Cement
4. Detectable Marking Tape
5. Gate valves
6. Pressure gauges
7. Manual drain valve
8. Quick coupling valves (incl. key and hose swivel)
9. Irrigation Controller
10. Rain sensor
11. Remote control valves
12. Control and trace wire
13. Wire splices (all types)
14. Swing joints (for both shrub sprays and turf rotors)
15. Sprinkler heads / nozzles
16. Valve boxes

B. Submit the number of copies required by the Contract Documents. Clearly index, label, and highlight products to be utilized.

C. Operation and Maintenance Manuals: The Contractor shall provide four (4) sets of the following:
   1. Guarantee/warranty certificates for all equipment used.
   2. Contractors written one (1) year guarantee/warranty for the entire system.
   3. List of authorized distributors and service centers for all products installed on the project. Include contact names, addresses, and phone numbers.
   4. Instruction manuals for all equipment used.
   5. Parts lists and "exploded" view drawings showing part numbers for each item.
   6. Detail drawings of all areas that were unable to be shown clearly on the "as-builts".
   7. Reduced and laminated zone chart.

   Provide the above information in three ring binders, clearly indexed, tabbed, and highlighted, with the project title, location, address, and date clearly typed in bold lettering (minimum 24 pt. Arial) on the front cover.

D. The Contractor shall submit the following items to the Owner's Representative prior to final acceptance:
   1. Warranty Cards on all equipment so warranted.
   2. Contractor's "As-Built" plans as detailed in these Specifications.
   3. Operations and Maintenance Manuals per Part 1.6 C. above.
   4. Extra Materials per Part 1.9 A. below.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect stored PVC piping from direct sunlight. Support pipe as necessary to prevent sagging and bending.

B. Provide safe and secure storage of all material required for system installation.

1.8 PROJECT CONDITIONS

A. Contractor shall bear all costs to locate and verify all underground utility locations within the site. Avoid damage to existing utilities, plant material, and structures. Contact Utility Locate Services at 1-800-424-5555 and/or a private locating service prior to any work, to have existing utilities located and marked on site. Contractor is responsible for any damage that is caused.

B. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
   1. Notify Owner no fewer than two (2) working days in advance of any proposed interruption of water service. Do not proceed with interruption of water service without Owner's written permission.

C. Utilities and Existing Structures: The exact location of existing structures, equipment, and overhead or underground utilities, shall be solely the responsibility of the Contractor. Contractor shall conduct all work so as to prevent interruption of service or damage to them. Protect existing structures, equipment, and utility services and repair any damages.

D. Finish Grades: Verify the correctness of all finish grades within the work area to insure the proper soil-coverage depth over pipe lines and the finished elevations of all sprinkler heads, valve boxes, and irrigation equipment.

E. Adjustments: Make minor adjustments to avoid fixed obstructions and to ensure the overlap coverage designated by the sprinkler spacing on the Contract Drawings.

F. Product Storage: During construction and storage, protect materials from damage and prolonged exposure to sunlight.

G. Keep premises free from rubbish, debris, and excavated trench material, at all times. Store materials so as not to interfere with the operation of the Project.

H. System Operation: Irrigation system shall be under fully automatic operation for three (3) days prior to the start of grassing operations.

I. Timing and Scheduling: The Contractor shall determine application rates and timer cycling. Adjustments, repairs, etc., other than programming, are the responsibility of the Irrigation Contractor.

J. Provide hand watering of all existing and proposed planting areas as required at any time during the project at Contractor's expense.

1.9 EXTRA MATERIALS

A. Prior to final acceptance, the Contractor shall provide to the Owner (at no additional cost to the Owner), the keys and/or other tools necessary to activate, operate, and drain the irrigation system, including:
1. Two (2) quick coupling valve keys w/ hose swivels.
2. Two (2) controller enclosure padlock keys.
3. One (1) manual gate valve key.
4. Two (2) of each type of rotor head body and nozzles installed.
5. Five (5) of each type of spray head body and nozzles installed.
6. All extra nozzle sets not utilized during the installation.
7. Two (2) valve box cover keys.

1.10 CONTRACTOR AS-BUILT DRAWINGS

A. The Contractor shall maintain a current record of all facilities / equipment installed and record any deviations (including horizontal and vertical dimensions) on the Contract Drawings (all deviations to the Contract Drawings shall be pre-approved by the Owner’s Representative).

B. Upon completion of the irrigation system installation and prior to final acceptance, the Contractor shall provide the Owner’s Representative with a NEAT, CLEAN, and LEGIBLE, reproducible set of Contractor "As-Built" drawings of the completed irrigation system. Any irrigation system pipe or components not installed in accordance with the Contract Drawings, shall be dimensioned to a permanent structure for location after burial. Locations of all quick coupling valves, automatic control valves, manual valves, electrical splice boxes, etcetera, shall be dimensioned on the Contractor "As-Builts" to two (2) permanent monuments (preferably buildings or hardscapes).

C. Contractor "As-Built" records shall be updated daily and shall be available daily for review by the Owner's Representative.

D. At the irrigation controller, provide a reduced-scale, "As-Built", schematic drawing of the irrigation system layout with irrigation zones clearly noted. Laminate the drawing in plastic and mount inside of the controller cabinet door or on/adjacent to the control panel.

1.11 SYSTEM PROTECTION

A. As part of the warranty, the Contractor shall be responsible for winterizing the irrigation system prior to the onset of the freezing season. The Contractor will also be required to reactivate the system in the spring season. Each event must be accomplished within the one (1) year maintenance period. The Contractor will notify the Owner in writing (with at least seventy-two (72) hours notice) when this work will be performed. Winterizing and spring start-up shall be done in the presence of the Owner's maintenance staff. The Contractor will be liable for all damages resulting from failure to comply.

B. When using compressed air to winterize the irrigation system, do so in two (2) short cycles at no more than seventy-five (75) psi pressure. Do not use a compressor with high pressure and low volume or allow the pipe connected to the compressor to get hot to the touch. The Contractor shall winterize the system prior to irrigation system substantial completion approval and acceptance if freezing weather occurs or is forecast. In such an event, the Contractor shall, as directed by the Owner's Representative, reactivate the system for final inspection and acceptance after the winter season. If the irrigation system is reactivated for final inspection prior to Spring, a sufficient period of warm weather that presents or is forecast will be required for reactivation, inspection, and subsequent re-winterization prior to the return of freezing weather.

C. Winterization and reactivation prior to final acceptance will not satisfy the warranty period requirement to deactivate (winterize) and reactivate the irrigation system.

D. Fill and repair depressions and replace construction materials damaged from settlement or repair of irrigation trenches, throughout the warranty period.

E. Adjust sprinkler heads as necessary to maintain overlap coverage designated by the sprinkler spacing on the Contract Drawings and to keep spray off structures, out of roadways, and off pavements as much as possible throughout the warranty period.

F. Replace defective parts throughout the warranty period.

1.12 TRAINING

A. Contractor shall provide on-site, hands-on training for Owner's maintenance staff. Training shall include proper procedures for irrigation system operation, maintenance, and winterizing. Duration and content of training shall be sufficient to ensure adequate understanding of system operation and maintenance to enable the Owner to operate, maintain, and winterize the system after the departure of the Contractor. The Owner's Representative shall be notified of this session at least seventy-two (72) hours in advance. Contractor shall coordinate a mutually agreeable training schedule with the Owner.

1.13 FINAL APPROVAL

A. Final approval will be considered upon satisfactory completion of the following: all performance tests, receipt of acceptable Contractor's "As-Built" documents and extra materials; training session; receipt of signed and approved permits; and substantial completion approval from the Owner's Representative.

PART 2 - PRODUCTS

2.1 PIPE THREAD TAPE / COMPOUND

A. All mainline pressure fittings and pipe threads shall be wrapped at least three (3), but no more than four (4), times with Teflon tape.

2.2 POLYVINYL CHLORIDE (PVD) PIPE, FITTINGS, AND CEMENT

A. Polyvinyl chloride pipe shall be PVC 1120 or 1220.
1. Mainline Pipe up to and including three-inch (3") diameter: Schedule 40 PVC.
2. Lateral Line Pipe up to and including two-inch (2") diameter: Schedule 40 PVC.
3. Sleeves: CL 200 PVC.

B. Risers on swing joints shall be Schedule 80, conforming to ASTM D1784.

C. Solvent weld fittings shall be manufactured by Lasco, Spears, or approved equal and installed as follows:
1. Mainline Fittings: Schedule 40/80.
2. Lateral Line Fittings: Schedule 40.
3. Valve and Quick Coupler Fittings: Schedule 40/80.
4. Swing Joints: Schedule 40/80.

D. Solvent welding compounds shall be IPS "Weld-On" products:
1. Primer: P-70 - purple.
2. Cement: P-711 - gray (heavy bodied).

2.3 PIPE AND WIRE SLEEVES

A. Pipe sleeves shall be twice the size of the insert pipe traveling through it. No more than one pipe shall be installed in each sleeve.

B. Install separate sleeves for control and communication wires (min. 2" diameter).

C. Sleeve under all paved surfaces whether indicated on the plan or not.

D. Where practical, extend all sleeves twelve inches (12") past any pavement edge.

E. Mark sleeve ends with a temporary 2x4 wooden stake driven eighteen inches (18") into grade with twenty-four inches (24") exposed. "IR Sleeve" shall be imprinted in on each stake in black, waterproof ink. The top of each stake shall be painted with fluorescent pink marking paint and shall be further marked with three (3) wraps of fluorescent pink flagging tape. Remove stakes after irrigation lines have been installed.

F. No additional payment shall be made under any circumstances for locating sleeves.

2.4 BACKFLOW PREVENTOR ASSEMBLY

A. Backflow preventor assembly is located within Riser Room 129, see mechanical / plumbing plans for specifics.

2.5 GATE VALVES

A. Gate valves shall be Kennedy KS-FW Valve #8057SS (up to 2½") or #8561ANSS (3" and larger), sized per plan, with a fusion-coated cast-iron body, non-rising stem, and resilient-coated wedge, with a minimum two-hundred (200) psi operating pressure rating. Mainline isolation valves shall be the same size as the mainline.

B. Provide one (1) valve-operating key per Part 1.9 A. above. Keys shall be thirty-six inches (36") long, three-quarters inch (¾") stock with "tee" handle, and painted with rust-resistant paint.

2.6 PRESSURE GAUGES

A. Pressure gauge shall be Ashcroft Duralife Type 1009 or approved equal.

B. Provide one (1) #251009-SW-L04L-100# (100 psi). Gauge shall be liquid filled and rated as shown with gauge cock and shall be provided with appropriate fittings to adapt to a quick coupling valve key.

2.7 MANUAL DRAIN VALVE

A. Manual drain valve shall be Champion #200-1.00" RS one-inch (1") manual brass angle valve with rising swivel – locate at lowest points in the irrigation system mainline and provide a three (3) cu. Ft. gravel sump, surrounded with filter fabric, equal to Mirafi or Amoco.

B. Contact Owner's Representative before installing equipment if low points in system are located within a critical area or within the field of play of the turf lawn area.

C. Record all locations on Contractor's "As-Built" drawings.

2.8 MASTER VALVE

A. Master Valve shall be Superior 3200 2" normally closed, brass, two-inch (2") master valve w/ dirty water protection and no minimum flow feature.

2.9 QUICK COUPLING VALVES

A. Quick coupling valves shall be Rainbird 44-LRC. Valve shall have brass construction, two-piece body design, stainless steel spring, locking thermoplastic cover, and pressure rated to one-hundred twenty-five (125) psi. The valve shall have a manufacturer's limited warranty of not less than five (5) years.

B. Provide two (2) 44K keys and two (2) SH-1 hose swivels per Part 1.9 A. above.

2.10 DRAIN ROCK

A. Drain rock shall be five-eighths inch (5/8") washed pea gravel.

2.11 AUTOMATIC CONTROL VALVES

A. Automatic control valves shall be as follows:
   1. Rain Bird PEB series, glass-filled, nylon construction, normally closed, forward flow design, with flow-control handle, internal bleed, low flow operating capability, globe configuration, and 200 psi rated. Size valves as noted in the Valve Data Table.

B. Install Rain Bird PRS-D dial pressure regulating modules on all valves as indicated in the Valve Data Table on Contract Drawings.

C. Each valve shall be tagged with a Rain Bird VID Series or Christy's ID-STD-Y2 valve i.d. tag (yellow).

2.12 SPRINKLER HEADS (SHRUB SPRAY / TURF ROTOR)

A. As noted on Contract Drawings.

2.13 SPRINKLER AND QUICK COUPLING VALVE SWING JOINTS (RISERS)

A. Swing joints for sprinkler heads shall be described on Contract Drawings.

B. Swing joints for quick coupling valves shall be described on Contract Drawings.

C. Swing joints shall not be installed perpendicular to or parallel with the supply line.

2.14 VALVE BOXES AND VAULTS

A. Valve Boxes shall be a combination of polyolefin and fibrous material. Extensions may be required to bring the valve box to the proper level. Utilize "tee" style covers unless specified otherwise. All unions shall be accessible within the box. Boxes shall be as follows:
1. Automatic Valves: Carson 1324-18 with bolt-down cover or equal. The cover shall be bolted down with stainless steel pentagonal bolts. Box and cover shall be green.
2. Quick Coupling Valves: Carson 910 with 910-4B cover. Box and cover shall be green.
3. Mainline Gate Valves: Six-inch (6") diameter PVC pipe or Ametek or Carson Roadway Extension with a ten-inch (10") valve box on top per detail. Carson 910 with 910-4B cover. Box and cover shall be green.
4. Control wire Splice Box: Carson 1419-12 with bolt-down cover or equal. The cover shall be bolted down with stainless steel pentagonal bolts. Box and cover shall be green.

2.15 IRRIGATION CONTROLLER

A. Irrigation Controller
1. Rain Bird twenty-four (24) station, traditionally wired, pro smart, ESPLXME2P 12-Station w/ (1) ESPLXMSM12 – 12-Station expansion module, indoor/outdoor commercial controller in plastic wall mount enclosure. Mount where shown on Contract Drawings.

2.16 RAIN SENSOR

A. Rain sensor shall be Rain Bird RSD-BEX with metal latching bracket and ext. wire routed in conduit from controller to rain sensor location as noted on Contract Drawings.

2.17 CONTROL WIRES AND PIPE LOCATOR WIRE

A. Control wires between the controller and the master valve and automatic control valves, shall be AWG direct burial, #14 single strand copper wire designed for twenty-four to fifty (24-50) volts and shall be UL approved for UF (underground feeder). UL and UF designations must be clearly marked on the insulation jacket of the wire. Copper conductor must exceed ASTM B3 or B8 specifications. The white colored wire will always be the common wire and the yellow-colored wire will always be the spare leads (auxiliary wires). Hot (signal) leads to each individual valve shall be red. Wire shall be Paige, Service Wire Co. 7079D, or approved equal.

B. Locator wires for below-grade piping shall be #14 bare copper, U.L. approved as UF, ASTM B3 or B8 rated.

C. Control wires between the controller and the flow sensor shall be two (2) AWG direct burial, #14 single strand copper wire designed for twenty-four to fifty (24-50) volts and shall be UL approved for UF (underground feeder). UL and UF designations must be clearly marked on the insulation jacket of the wire. The copper conductor must exceed ASTM B3 or B8 specifications. The color shall be black for the common and orange for the hot (signal) lead. Provide two (2) spare wires colored blue. Wire shall be Paige, Service Wire Co. 7079D, or approved equal.

2.18 DETECTABLE MARKING TAPE

A. Marking tape shall be detectable, three-inch (3”) wide, blue color, reading “Caution Irrigation Water Line Buried Below” and three-inch (3”) wide, yellow color, reading “Caution Irrigation Wire Buried Below”. Manufactured by Christy Enterprises, (800) 258-4583.

B. Place as detailed on Contract Drawings.

2.19 ELECTRICAL TAPE

A. Electrical tape shall be black plastic, three-quarter inch (¾") wide, minimum 0.007-inch thick, and all-weather type.

2.20 ELECTRICAL WIRE SPLICES

A. Automatic control valve wire splices shall be 3M DBY, or DBR, no substitutions. All splices shall be made within a valve box. At each splice, the wire is to be tagged with a non-fading plastic marker with the zone number permanently marked on the tag. An identical tag shall be attached to the zone control valve. Doublers or devices which split or share zones shall not be used.

2.21 ELECTRICAL CONDUIT

A. This specification pertains only to low voltage irrigation system wiring. All one-hundred twenty (120) volt power specifications are referred to in Electrical Specifications Sections.

B. Conduit above finish grade shall be rigid galvanized steel with zinc-protected threads. Fittings shall be of the same material with hot dipped galvanized finish.

C. Conduit within a building shall be EMT where permitted by Code. Fittings shall be suitable for this product.

D. Conduit within the ground shall be gray, Schedule 40 rigid PVC. Fittings shall be suitable for this product.

E. All equipment furnished and installed shall be in accordance with National, State, and County Electrical Codes, established safety codes, and applicable local codes and ordinances.

2.22 CONCRETE THRUST BLOCKING

A. Concrete thrust blocking shall be required on all sections of the mainline piping.

PART 3 - EXECUTION

3.1 EXISTING CONDITIONS

A. Verify that the proper flow and static pressure is available at the irrigation system point of connection prior to beginning any irrigation work.
   1. Flow = 113.4 gallons per minute (gpm).
   2. Static Pressure @ 50 psi.

B. Immediately notify the Owner's Representative in writing if flow and pressure vary from Part 3.1 A. above.

C. Prior to beginning any trenching, verify that the subgrade is at the correct design grade and has been approved by the Owner's Representative.

3.2 PREPARATION

A. Stake the locations of all irrigation components and obtain Owner's Representative's approval before commencing installation. Bring any potential discrepancies to the attention of the Owner's Representative before installation.

B. Locations of irrigation equipment shown on Contract Drawings are approximate. Actual placement may vary as required to achieve the full, overlap coverage required on the plans without spraying onto buildings, sidewalk, fences, adjacent pavements, etc.

C. Make necessary adjustments in layout as required to connect to the point of connection should such equipment not be located as shown, and as may be required to work around new construction, at no increase in contract award.

3.3 GENERAL CONSIDERATIONS

A. Install unions adjacent to valves and to final connections to other components with two and one-half inch (2½") or smaller pipe connections.

B. Install flanges adjacent to valves and to final connections to other components with three-inch (3") or larger pipe connections.

C. Install dielectric fittings to connect piping of dissimilar metals.

D. Transition Fittings: Use transition fittings for plastic-to-metal pipe connections.

E. If reassembly work has to be done after the fittings have been coated, a new coat shall be applied to the disturbed surface.

3.4 PVC PIPE TRENCHING AND BACKFILLING

A. Install PVC piping in dry weather when temperature is above forty (40) degrees Fahrenheit. Allow joints to cure at least twenty-four (24) hours at temperatures above forty (40) degrees Fahrenheit before testing unless otherwise recommended by manufacturer.

B. Mainline pipe shall be installed with a minimum of eighteen inches (18"), and a maximum of twenty-four inches (24"), of cover with blue, detectable marking tape six-inches (6") below finish grade.

C. Lateral line pipe shall be installed with a minimum of twelve inches (12"), and maximum of eighteen inches (18"), of cover.

D. Install pipe with manufacturer's markings facing up (12 o'clock).

E. If the existing soils are determined by the Owner's Representative to be unacceptable for use as backfill material, the pipes shall be sand bedded. Sand shall be placed to a minimum depth of two inches (2") below the pipe and four inches (4") above and alongside the pipe (approx. one (1) CF of sand per LF of trench). The Contractor will be compensated for sand bedding per Section 7.01 of the General Conditions. Do not proceed with any sand bedding prior to inspection / approval by the Owner's Representative

F. Pipe shall be laid on stable soil with trench bottom evenly graded (without humps or depressions). Ledge rock, boulders, and cobbles one inch (1") or larger shall be removed so that there is no contact with any piping. Voids remaining from the removal of large rocks shall be filled and compacted with select material. Install piping free of sags or bends.

G. Where multiple irrigation pipes share a common trench, trench shall be sufficiently wide (or piping shall be arranged) to allow four inches (4") minimum of horizontal separation and six inches (6") minimum of vertical separation between piping, while maintaining specified minimum and maximum cover over piping. Irrigation pipes shall be located in a separate trench from any domestic water piping.

H. Backfill around pipe and fittings shall be free from large rocks and shall be well tamped. Trenches shall be backfilled in compacted, six-inch (6") maximum thickness lifts to a level that is even with subgrade (or surrounding grade). Raise backfill to a slight mound and compact with an approved compactor or vibrator. Compaction by vehicle or equipment wheels is prohibited. All roots, rocks, and surplus excavations shall be removed from the site. Contractor is responsible for correcting all trench settlement during the warranty period of the Contract.

I. The trenches shall be thoroughly compacted to ninety percent (90%) density at optimum moisture content. Submit compaction test results from one (1) location in each lateral trench and three (3) random locations in each mainline. Cost for testing shall be the Contractor's responsibility.

3.5 WELDING OF PLASTIC PIPE AND FITTING

A. All gasketed and solvent weld plastic pipe shall be installed in accordance with manufacturer's installation instructions. Great care shall be taken to ensure that the inside of the pipe is absolutely clean. Pipe ends (not being worked) shall be protected and not left open. Cleaning of cutting burrs is mandatory.

B. For solvent weld pipe, PVC pipe ends shall be cut at a ninety (90) degree angle to the pipe length and shall be cleaned (use approved reaming tool) of all burrs prior to cementing. Pipe ends shall be wiped clean with a rag that has been lightly wetted with PVC thinner. Joints shall be completely free of moisture or condensation.

C. Cement shall be applied with a light coat on the inside of the fitting and a heavier coat on the outside of the pipe (no further back from the end of pipe than the fitting would slip). Application of cement on the interior of the fittings shall be quantified to ensure no cement shall be pushed into the flow stream of the pipe. Pipe shall be inserted into the fitting and given a quarter turn to seat the cement. Excess cement shall be wiped from the outside of the pipe. Cement that becomes unduly thick or heavy shall not be thinned and re-used. CONTRACTOR SHALL DISPOSE OF SAME. Pipe shall be tested as indicated elsewhere in these specifications.

D. Allow fifteen (15) minutes (minimum) set-up time for solvent weld joints before moving or handling. Pipe shall be partially center-loaded to prevent arching or slipping. No water shall be permitted in the pipe for at least ten (10) hours to permit solvent weld set and cure. Backfilling shall be done when the pipe is not in an expanded condition due to heat or pressure. Cooling of the pipe can be accomplished by operating the system for a short period of time before backfilling, or by backfilling in the early part of the morning before the heat of the day. Before pressure testing, allow twenty-four (24) hours cure time for solvent weld joints.

E. Lateral line pipe may be longitudinally bent at a ratio of two-hundred (200) times the outside diameter (o.d.) of the pipe over the length of one (1) full stick of pipe [i.e.: 1½" pipe (1.9" o.d.) can be bent to a minimum radius of 1.9 x 200 or 380 inches (31.7') over 20' length of pipe].

3.6 PIPE AND WIRE SLEEVES

A. Pipe Sleeves: Provide pipe sleeves under paved areas as required whether or not they are shown on the Contract Drawings. Provide multiple parallel pipe sleeves where shown on Contract Drawings or as specified.

B. Wire Sleeves: Install electrical / control wiring in a separate sleeve from irrigation piping. Provide as many conduits as required to accommodate all power and low-voltage control wires to the controller.

3.7 PRESSURE TESTS

A. Before any testing, all piping shall be thoroughly flushed. Center loading of the pipe is permissible prior to testing, but all pipe end joints, fittings, gate valves, and automatic valve stub outs shall be exposed for inspections during the pressure test.

B. Mainlines shall be filled from the point of connection until all air is removed from the mainline. Smaller sections of the mainline can be tested by closing the gate valves that isolate that particular section of piping. All mainline pipe, fittings, gate, and automatic valves shall be subjected to a hydrostatic pressure test of one hundred twenty-five (125) psi for a minimum of four (4) continuous hours, with no allowable pressure loss.

C. Lateral lines shall be tested at seventy-five (75) psi. Test following swing joint or riser installation. All swing joints and fixed risers shall be capped. All pipe end joints, fittings, and swing joints shall be left exposed for inspection. Prior to inspection, lines shall be filled with water and all air shall be purged from the lateral. Inspection of lateral lines will be done visually.

D. Rejected systems or any portions thereof shall be repaired and re-tested as specified.

E. Contractor shall furnish all equipment, materials, and labor for all testing. The Contractor shall notify the Owner's Representative at least seventy-two (72) hours prior to the test so an inspector may witness the test.

3.8 GATE VALVES

A. Gate valves shall be installed per detail at mainline depth. Valves shall be installed in a six-inch (6") PVC pipe collar or plastic roadway valve box (depending upon actual depth), topped with a ten-inch (10") valve box with locking lid.

3.9 PRESSURE GAUGES

A. One (1) pressure gauge shall be provided to Owner with appropriate fitting to adapt onto the quick coupling valve keys.

3.10 MANUAL DRAIN VALVE

A. Install manual drain valve per detail shown on Contract Drawings at low point(s) on mainline only. Record all locations.

3.11 QUICK COUPLING VALVES

A. Owner shall approve all QCV locations prior to construction. Quick coupling valves shall be installed per detail on unibody swing joints.

B. Quick Coupling Valves shall be installed a minimum of twelve inches (12"), and maximum of thirty-six inches (36") from pavement or lawn edge (except at point of connection). The maximum distance from the top of the quick coupler to the top of the valve box shall be three inches (3"). Ensure quick coupler key easily passes the top of the valve box when fully engaged. The valve shall be installed inside a ten-inch (10") round valve box. Care must be taken to prevent excessive water backup within the valve box.

C. A six-inch (6") layer of washed drain rock shall be placed in the bottom of the valve box, encased in a layer of geotextile fabric.

D. Thoroughly flush mainline before installing Quick Coupling Valves.

3.12 MASTER VALVE

A. Install master valve in a rectangular valve box as detailed on Contract Drawings. Wire connections shall be made with proper splices. Care shall be taken to prevent excessive water backup inside the valve box. A six-inch (6”) bed of drain rock shall be placed under the master valve.

3.13 FLOW SENSOR

A. Install flow sensor in a rectangular valve box as detailed on Contract Drawings. Wire connections shall be made with proper splices. Care shall be taken to prevent excessive water backup inside the valve box. A six-inch (6”) bed of drain rock shall be placed under the flow sensor.

B. Provide a minimum length straight pipe section of ten (10) pipe diameters upstream of the flow sensor to any fittings and minimum length straight pipe section of five (5) pipe diameters downstream of the flow sensor to any fittings.

3.14 AUTOMATIC CONTROL VALVES

A. Automatic Control Valves shall be installed per detail in specified valve boxes, one valve per valve box. Provide Schedule 80 PVC Unions, per detail. Flush supply lines before installing automatic control valves. Use valve-box extensions as necessary to extend box completely below bottom of valve.

B. Before installation of automatic control valves, the mainline shall be flushed and pressure tested. Begin installation only after mainline test has been certified by Owner's Representative. Install only one (1) automatic control valve per valve box.

C. Use Schedule 80 TOE nipple and Schedule 80 fittings and pipe from the mainline to the valve. Use valve box extensions to ensure that the valve box extends at least ten inches (10") below the bottom of the valve. The maximum distance from the flow control handle to the top of the

valve box shall be six inches (6"). Care must be taken to prevent excessive water backup within the valve box. A six-inch (6") layer of drain rock shall be placed in the bottom of the valve box. Group valves where practical. Locate valve boxes six inches (6") from and perpendicular or parallel to walk edge, building, and/or walls. Provide twelve inches (12") between boxes where valves are grouped together.

D. For pressure regulating valves (Dial-PRS), set downstream pressure using a pressure gauge assembly to obtain optimum sprinkler performance.

3.15 SPRINKLER HEADS

A. Install pop-up sprinklers as shown on the Contract Drawings (Contractor shall take steps necessary to avoid filling the sprinkler cavity with back-washed sand or soil). Sprinklers in turf areas shall be installed in a manner that permits reel type mowers (reels and rollers) to pass over sprinklers without interference. Install all pop-up sprinkler bodies perpendicular (90 deg. angle) to slope. Adjust radii of sprinklers to obtain optimum overlap coverage required on the Contract Drawings.

B. Backfill around heads shall be approved native or import topsoil, well compacted. Sprinklers shall be installed flush with sidewalks and curbs and exactly two inches (2") from any paved edge. All heads shall be set perpendicular to finish grade unless otherwise specified on the Contract Drawings. Refer to details.

C. Thoroughly flush all lateral lines before installing sprinkler heads.

D. Refer to installation details on Contract Drawings for all sprinkler heads.

3.16 SPRINKLER AND QUICK COUPLING VALVE SWING JOINTS (RISERS)

A. On rotor, spray, and quick coupling valve, use triple swing joints as shown on Contract Drawings. Apply two (2) wraps of Teflon tape around threaded outlet connection (to sprinkler or quick coupling valve). Threaded connections shall be watertight. Do not over tighten.

3.17 VALVE BOXES

A. Install valve boxes plumb and flush with finish grade, so that a reel type mower may pass over without interference. Valves boxes shall be supported on continuous brick foundation per detail. Valve box archway shall not rest on piping - provide a minimum of one-inch (1") clearance around any piping.

B. Provide filter fabric cover over all below grade openings to prevent debris from contaminating the valve box drain rock.

C. If construction debris washes into the automatic valve or quick coupling valve boxes prior to project completion, remove existing drain rock and replace with new drain rock.

3.18 IRRIGATION CONTROLLER

A. The irrigation controller shall be wall mounted in the building Riser Room 129 where directed by Owner. Coordinate with electrical and/or plumbing contractor on controller placement and any connection needed between controller and domestic water booster pump. Include all fittings, conduit, wiring, components, appurtenances, and labor for complete 100% operation of all automatic control valves.

B. Exposed wires shall be strapped or channeled in such a way that they can be easily traced. Enclose exposed control wires inside the building within specified conduit.

C. Coordinate hook up of automatic control valves and sequencing with Owner's Representative to assure irrigation system operates according to the Owner's requirements.

D. Install the rain sensor where indicated on the Contract Drawings and connect to controller.

E. All 120-volt connections within the controller enclosure are subject to local electrical codes and permitting. A licensed electrician shall perform all work with power wiring. Low voltage wiring may be installed and connected by the irrigation contractor.

F. Ground controller per manufacturer's recommendations. Install conduit as required for ground wire. Verify that the controller is grounded.

G. Control wiring shall be installed in a neat and orderly manner and sequenced as per the Owner's Representative's request.

H. Contractor will be responsible for all required permits and permit fees and the installation of any required conduits.

3.19 CONTROL WIRES AND SPLICES

A. Control wires shall be taped together at fifteen foot (15') intervals and shall then placed at the side of the mainline as detailed. Provide thirty-six inch (36") expansion loops at all directional changes. Any control wires not installed along mainline shall be housed inside a three-inch (3") PVC conduit. All ninety (90) degree fittings shall be long radius type only.

B. There shall be a separate "hot" lead for each automatic control valve. A single common wire may be used to reach all valves on an individual controller. Spare wires shall be installed as noted on the Contract Drawings. Install auxiliary wires to pass through each intermediate valve box, providing an eighteen-inch (18") minimum loop within each valve box. Seal ends of spare wires.

C. Minimum size of copper wire for this project is #14 UF. The control wires shall be color coded as follows:
   1. Automatic Control Valve Wire
      a. Neutral Wire (common): WHITE
      b. Signal Wire (control): RED
      c. Auxiliary Wires (spare): YELLOW
   2. Flow Sensor Wire
      a. Neutral Wire (common): BLACK
      b. Signal Wire (control): ORANGE
      c. Auxiliary Wires (spare): BLUE

D. All wire from controller to valves and flow sensor shall be rated Underground Feeder (UF).

E. All splices shall be within a valve box. No splices are permitted between the controller and the valves. At each splice, the wire is to be tagged with a non-fading plastic marker with the zone number permanently marked on the tag. A second, matching tag must also be included at the control valve itself. All splices shall be encapsulated in the device specified in "Electrical Wire Splices", Part 2.20 above and shall be contained in a plastic valve box where a valve is installed.

3.20 TRACER WIRE AND MARKING TAPE

A. Tracer Wire: Install one (1) #14 bare copper locator (trace) wire, taped to top of pipe, along all mainline and lateral piping as detailed on Contract Drawings. Tie all bare coper wire together in cone continuous web. Trace wire shall be visible and accessible in all valve boxes at point of connection, gate valves, quick coupling valves, and automatic control valves.

B. Marking Tape: Install detectable marking tape as detailed on Contract Drawings.

3.21 CONCRETE THRUST BLOCKING

A. The concrete thrust blocking as detailed on the Contract Drawings at every location the mainline changes direction or terminates.

3.22 SYSTEM FLUSHING

A. The entire irrigation system shall be flushed prior to the installation of the sprinkler heads. After capping all risers, Contractor shall remove the cap nearest the automatic valve, flush and recap. Contractor shall then repeat this process by removing the next nearest cap. Repeat this process until the last head on the circuit is flushed.

3.23 PRELIMINARY COVERAGE TEST

A. Prior to any seeding or sodding, the system shall be tested to ensure full coverage of any proposed irrigated areas. The test shall be of sufficient duration so that moisture is visibly apparent on the bare soil or sand areas and that the irrigation system is covering as specified.

3.24 LABELING AND IDENTIFYING

A. Install all valve I.D. tags as specified herein.

B. Provide a reduced and laminated version of the irrigation system layout and mount per the Owner's direction next to the controller panel.

3.25 FINAL REVIEW

A. Prior to request for final review, accomplish the following:
1. Complete the installation.
2. Balance the system by adjusting pressure-regulating devices and flow controls on valves.
3. Confirm proper operation of controller. Perform diagnostic test for communication of the master valve, flow sensor, and rain sensor with controller.
4. Test for proper operation of all equipment.
5. Clean sediment from valve boxes so that drain rock (below valves) and wiring (including auxiliary and trace wire) is clearly visible inside valve box.
6. Submit Operation and Maintenance manuals to the Owner’s Representative for review.
7. Complete Contractor’s "As Built" documents and submit for review by the Owner’s Representative.
8. Submit specified extra materials, miscellaneous keys, spare parts, and required tools and deliver them to the Owner's Representative.

3.26 PERFORMANCE TEST

A. A performance test is part of the final review.

B. Upon completion of the system installation and after the pressure tests have been completed and the system has been adjusted, the Contractor shall operate the system in the presence of the Owner's Representative.

C. Coverage Check: Each automatic control valve shall be operated to determine proper sprinkler coverage. Excessive water on non-landscaped areas will be checked carefully. If applicable, during the coverage check, check operation via the remote control device.

D. Controller shall be tested for manual and automatic operation and for operation of the hand-held remote(s).

E. After the system performance test, the Owner's Representative may request up to five percent (5%) of the total sprinkler nozzles be substituted at no additional cost.

3.27 CLEAN-UP

A. The Contractor is responsible for maintaining a clean and safe working environment throughout the project site. Regular policing of the project site of trash and project debris will be required.

B. Disposal of all trash will be the Contractors' responsibility.

END OF SECTION 32 80 00

32 91 13 – SOIL PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Subgrade Preparation
   2. Topsoil for lawn, meadow, and hydroseed areas

B. Related Requirements:
   1. Section 32 80 00 – Irrigation System
   2. Section 32 92 23 – Hydroseed
   3. Section 32 93 00 – Plants

1.3 REFERENCES

A. ASTM D 1557: Method for Laboratory Compaction Characteristics of Soil using Modified Effort.

1.4 DEFINITIONS

A. Percent Compaction: The required in-place dry density of the material, expressed as a percentage of the maximum dry density of the same material determined by ASTM D1557 test procedure.

B. Soil Subgrade: The soil surface on which compost material is placed.

C. Finished Grades: The final grade elevations indicated on the Grading Drawings.

D. Aesthetic Acceptance of Grades: Acceptance by the Owner's Representative in writing of the Aesthetic Correctness of the contours as observed without a survey instrument. Aesthetic Acceptance does not address whether an area drains properly, whether the areas are at the correct elevation, or whether it has been compacted properly.

E. Acceptance: Wherever the terms "acceptance" or "accepted" are used herein, they mean acceptance of Owner's Representative in writing.

F. Grading Drawings: Contract Drawing plans, sections, and profiles showing finished surface grades.

G. Elements with Fixed Elevations: Paths, paving, concrete pads, headers, footings, foundations, walls, and other structures with fixed-spot elevations.

1.5 SUBMITTALS

A. Submit product data and one-gallon sample of Type I and Type II Topsoil material.

1.6 SITE CONDITIONS

A. Environmental Protection:
1. Soil Moisture Content: Do not work soil when moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil for lawn, meadow, and hydroseed areas shall be a mixture of weed-free compost and Loamy Sand screened through a 3/8" screen unless noted otherwise.
1. Type I Topsoil for Lawn & Meadow (Owner-seeded): 30% compost / 70% Loamy sand.
a. Topsoil for lawn and meadow areas shall be coordinated with the Owner, who will provide and install seed by drill seeding. The Contractor shall be responsible for rough and finish grading, rototilling, and coordination with the Owner to avoid compaction or disturbance of seeded areas.
2. Type I Modified Topsoil for Hydroseed Areas (Contractor-seeded): 20% compost / 80% loamy sand
a. Topsoil in hydroseeded areas shall be lower in organic content to support appropriate native species establishment and minimize weed competition.
b. Native topsoil may be reused in hydroseeded areas with approval by Owner's Representative, provided it meets friability and drainage requirements and includes minor compost incorporation as needed.
c. Native subsoils excavated from depths exceeding three feet (3') shall not be used as surface topsoil in hydroseeded areas unless approved by the Owner's Representative following on-site testing. All planting areas shall receive a minimum of six inches (6") of imported or amended topsoil.
3. Type II Topsoil for Planting: 50% compost, 50% Loamy sand.
4. Topsoil mix for hydroseeded native areas may be reduced in compost content at the discretion of the Owner's Representative to support appropriate native species establishment and minimize weed competition.

B. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and fee of substances toxic to plantings; and as follows:
1. Organic Matter Content: 50% to 60% of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Subgrade:
1. Verification: Verify that the subgrades have been graded to within one tenth of a foot (0.10') of the grades shown on the Grading Drawings.
2. Aesthetic Acceptance: Verify that Owner's Representative has given the subgrade aesthetic acceptance. Do not place compost material or rototill material into subgrade until Owner's Representative has accepted subgrade for aesthetic correctness.

3. Notification of Discrepancies: Notify the Owner's Representative in writing of any discrepancies.

B. Planting:
1. Pre-Planting Inspection: Compost material shall not be installed until a pre-planting inspection has been completed per Section 32 93 00 – Planting.

3.2 SURVEY REQUIREMENTS

A. Lines and Levels: Establish lines and levels, locate and lay out by instrumentation and similar appropriate means for all planting area finish grades.

B. General Staking: Provide a sufficient quantity of grade stakes as required to provide the depths of compost material shown on the drawings.

3.3 PREPARATION

A. Protection of Existing Conditions:
1. General: Use every possible precaution to prevent damage to existing conditions to remain such as structures, utilities, irrigation systems, plant materials and paving on or adjacent to the site of the Work.

B. Surface Preparation:
1. Inspection: Inspect subgrade soil for stones over one inch in diameter, sticks, oils, chemicals, plaster, concrete, and other deleterious materials.
2. Removal: Do all Work when necessary to remove the deleterious materials before and after subgrade preparation.

3.4 PREPARING SUBGRADE

A. Plow with a rototiller or other approved equipment to the depth shown on the drawings. Note: This Work shall occur prior to irrigation Work.

3.5 TOPSOIL PLACEMENT

A. Place Topsoil as detailed on plans.

B. Spillage:
1. Take precautions to prevent spillage when hauling on or adjacent to any public street or highway.
2. In the event that spillage occurs, remove all spillage and sweep, wash, or otherwise clean such streets or highways as required by local City, County, or State authorities.

C. Dust Control: Use water trucks or temporary irrigation and take all precautions needed to prevent a dust nuisance to adjacent public or private properties.

D. Erosion:
1. Correct erosion and siltation damage at no cost to the Owner.

E. Settlement Repair: Correct settlement within the Warranty period at no cost to the Owner.

3.6 FINISH GRADING OPERATIONS

A. General: Grade with uniform slope between points where elevations are given or between such points and existing grades, unless indicated otherwise.

B. Soil Surface Tolerances:
   1. Planting Areas: Bring finished soil surface to within one-tenth of a foot (0.10') of finish grades indicated on Grading Drawings. Grade flatter areas at tighter tolerance if required to provide positive drainage.
   2. Allowances: Make proper allowances for settlement, spoils from plant pits, etc

C. Survey Requirements:
   1. Lines and Levels: Establish lines and levels, locate and lay out by instrumentation and similar appropriate means all planting area finish grades.
   2. Staking: Provide grade stakes and string lines at a maximum twenty-five foot (25') spacing or closer as required to bring the soil surface to the grades shown on the Grading Drawings with a smooth surface and positive surface drainage.

D. Surface Drainage:
   1. Slope finish grades to drain surface water away from buildings, walks, paving, and other structures unless otherwise indicated.
   2. Slope finish grades to drain surface water to catch basins, area drains or trench drains as shown on the Grading Drawings.

E. Rounded Sculptural Landforms: Blade soil surface parallel with contours to achieve smooth, rounded landforms as shown on the Grading Drawings.

F. Depressions and Loose Material: Fill and compact depressions, and remove all loose material to finish surface true to line and grade, presenting a smooth, compacted, and unyielding surface.

G. Excessive Compaction: Rip areas which become compacted more than eighty-five percent (85%) compaction to a twelve-inch (12") depth, rototill and blade smooth, prior to planting. Hydroseed areas in stormwater basins or slopes must remain permeable. Final grading should avoid excessive smoothing / rolling which could reduce permeability.

3.7 PROTECTION

A. Erosion: Correct erosion and siltation damage at no cost to the Owner.

B. Settlement Repair: Correct settlement within the Warranty period at no cost to the Owner.

C. Drainage: Keep surface of compost and topsoil material in such condition that it will drain readily and effectively.

D. Materials, Tools, and Equipment: In handling materials and operating tools and equipment, protect the compost material from damage by laying down planks, plywood, or other accepted protective materials where required.

E. Vehicular Traffic: Do not allow vehicles to travel in a single track. If ruts are formed, blade smooth.

F. Storage of Materials: Do not store or stockpile materials on owner provided compost material. Compost material to be covered with plastic tarpaulins for protection from leaching.

3.8 CLEANUP

A. Daily: Keep all areas of Work clean, neat, and orderly at all times.

B. Final: Clean up and remove all deleterious materials and debris from the entire Work area prior to Final Completion.

END OF SECTION 32 91 13

32 92 23 – LAWN AND HYDROSEED

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Lawn (by owner)
   2. Meadow (by owner)
   3. Hydroseed (by contractor)
   4. Sod at irrigation turf rotors (by contractor)

B. Related Requirements:
   1. Section 32 80 00 – Irrigation System (by contractor)

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface at soil.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulting in successful lawn and hydroseed establishment.
   1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on project site when planting is in progress.

B. Preinstallation Conference: Conduct a conference at project site to comply with requirements in Division 1 Specifications, and to coordinate with Owner. The Owner plans to drill seed for the lawn and meadow areas. Contractor shall coordinate on grading, soil preparation, protection of work, establishment, and fertilizer for these areas to clearly delineate areas of responsibility between the Contractor and the Owner.

1.5 SUBMITTALS

A. Seed Analysis: A complete analysis of the seed shall be submitted by the Contractor prior to planting. The analysis shall include: varieties, percentage of pure seed, germination rate, other crop seed (including inert and weed seed), and the germination test date. All crop seed in excess of one percent (1%) must be itemized.

B. Sod sample and hydroseed analysis.

C. Fertilizer Certification: Submit duplicate copies of all invoices for all fertilizer showing the grade furnished.

D. Maintenance and Establishment Plan: Summarize the installation, fertilization, and establishment process delineating both Contractor and Owner responsibilities.

PART 2 - PRODUCTS

2.1 SEED

A. Turf Grass Seed Mix (By Owner)

B. Meadow Seed Mix (By Owner)

C. Hydroseed Mix:
1. Seed Mix Composition
30% - Tufted Hairgrass, Deschampsia cespitosa
25% - Creeping Red Fescue, Festuca rubra
20% - Blue Wildrye, Elymus glaucus
15% - Idaho Fescue, Festuca idahoensis
10% - California Oatgrass, Danthonia californica
2. Seed must be Pure Live Seed (PLS), and certified noxious weed free.

D. Other Seed Requirements:
1. Seed Law: All seeds shall conform to the requirements of the Washington State Seed Laws, and where applicable, the Federal Seed Act.
2. Noxious Weed Seed: All seed shall be free of seeds of weeds listed as primary noxious by the Washington State Seed Law. Seeds shall not contain seeds of weeds listed as secondary noxious by the Washington State Seed Law, singly or collectively in excess of the labeling tolerance specified by the Washington State Seed Law.
3. Rejection: When seeds furnished under this specification fail to meet the requirements within tolerance, as provided by the Washington State Seed Law, the lot shall be rejected or subjected to fiscal adjustment.
4. Recleaning: Seeds shall be thoroughly recleaned and of uniformly good quality and appearance throughout each lot.
5. Preparation for Delivery: Seeds shall be packed in clean, sound containers of uniform weight. Seed shall be labeled as required by law.
6. Reference Specifications: Chapter 15.49, Washington State Seed Law

2.2 SOD AT IRRIGATION HEADS

A. Provide twelve-inch (12”) diameter of sod at irrigation turf rotor heads. Grass species to match owner installed turf grass seed. Coordinate with owner on installation and protection of irrigation heads during turf and meadow installation and establishment.

2.3 MULCH FOR HYDROSEEDING

A. Bonded Fiber Matrix (BFM) or equivalent erosion control hydro-mulch.
1. Apply 2,000-3,500 lbs per acre

B. Hydroseed mulch shall be one hundred percent (100%) wood fiber mulch manufactured by the defibrating process from fir, hemlock, or alder. The mulch shall have a minimum of sixty percent (60%) of fibers 8.5 mm or longer and seventy-seven percent (77%) of the total fiber exceeding 3.5 mm in length.

C. Wood fiber mulch shall be in uniform weight displayed clearly on each package. Fiber shall be dyed green in color to provide visual metering of application. Tackifier shall be incorporated into the wood fiber in the drying process.

2.4 TACKIFIER

A. Tackifier to be primarily composed of guar gum.

B. Tackifier must be pre-mixed into the mulch.

C. Percentage of tackifier shall not be less than two percent (2%) or greater than ten percent (10%), with the percentage used clearly labeled on the outside of package.

D. Tackifier rates shall be adjusted by adding wood fiber mulch with tackifier and regular wood fiber mulch to provide tackifier rates equivalent to or greater than specified.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive seeding for compliance with requirements and other conditions affecting performance. Verify finish subgrade is correct before beginning work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by seeding operations.
   1. Protect adjacent and adjoining areas from hydroseeding overspray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 INSTALLATION SCHEDULE

A. Seeding is best performed in spring (mid-March to June) or fall (late September to October). If seed is applied in the spring or summer, irrigation must be provided to ensure grass survival. Avoid seeding after October 15 unless approved by Owner's Representative.

3.4 LAWN / MEADOW SEEDING (BY OWNER)

A. Coordinate preparation of lawn and meadow area with Owner.

B. Coordinate protection of irrigation system (by contractor) and all work within lawn and meadow areas during seed installation with Owner.

3.5 HYDROSEEDING

A. Hydroseeding:
   1. Seed, mulch, tackifier, and water shall be thoroughly mixed into a uniform hydroseeding slurry and applied simultaneously in a single operation. The slurry shall be continuously agitated to maintain a homogenous mix until discharge.
   2. Apply slurry using a hydraulic hydroseeder equipped with a continuous mechanical agitator and discharge nozzles capable of delivering a uniform spray pattern. Distribution lines shall be sized to prevent clogging.
   3. Do not begin hydroseeding until final grading is complete and approved. Soil shall be free of loose rocks, debris, and excessive compaction immediately prior to application.
   4. Hydroseed all designated areas uniformly, using light multiple passes if necessary to achieve full, even coverage without bare soil visible. Mulch shall form a continuous protective mat over the seeded surface.

5. Ensure that the hydroseed slurry is applied directly to the soil surface to maximize seed-to-soil contact. Avoid excessive slurry buildup ("pooling") in low areas or thin "stripping" on slopes.
6. On 3:1 slopes or steeper, apply slurry in light, overlapping passes to promote slurry adhesion and minimize runoff or slippage.
7. Do not hydroseed during active rainfall, immediately prior to heavy rainfall, or during periods of high winds.

B. Watering
1. Fall Seeding: No irrigation needed except in prolonged dry spell (greater than two (2) weeks).
2. Spring Seeding: Light watering two to three (2-3) times/week for the first six to eight (6-8) weeks if natural rainfall is insufficient.
3. Water enough to keep soil moist but not saturated.

C. Application Rates:
1. Pure Live Seed (PLS) Seed: 45-50 lbs/acre
2. Bulk rate (carrier + mulch): 90-120 lbs/acre

3.6 SOD IRRIGATION TURF ROTORS (BY CONTRACTOR)

A. Match top of sod with finish grade.

3.7 HYDROSEED MAINTENANCE

A. Establishment Procedures:
1. Provide light irrigation if conditions are dry to encourage germination and deeper root development. Water as needed, avoiding runoff.
2. Monitor seeded areas regularly for weed invasion, with particular attention to noxious weeds.
3. Mow if weeds overtop native seedlings. Mow to eight (8”) to ten inches (10”) high; never mow below six inches (6”) to protect native seedling crowns.
4. Inspect all areas for bare patches, especially on steep slopes and in runoff zones. Spot-reseed any bare areas immediately to prevent erosion. Apply mulch over reseeded areas to stabilize soil.
5. At the end of the first full growing season (12 months post-seeding), seeded areas shall achieve:
   a. A minimum of 60–70% live vegetative cover.
   b. No bare patches larger than fifty (50) square feet.
   c. No active soil erosion or slope failures.
6. If the cover standard is not met, Overseed bare areas and/or complete additional corrective work (e.g., soil amendment, drainage fixes) prior to final acceptance.
7. Upon final acceptance, mowing shall cease to allow native grasses to mature, develop clumps, and self-sow naturally.

B. Herbicide:
1. No broadcast herbicide spraying shall occur.
2. Spot-application of herbicide is allowed only for targeted control of noxious weeds and must be performed with care to avoid impacting native seedlings.

C. Fertilizer:
1. No turf fertilizer applications are permitted unless approved by the Owner’s Representative.
2. If fertilizer is required, use a low or no phosphorus formulation appropriate for native grass establishment.

D. Reseeding Requirements:
   1. Any seeded areas that fail to achieve at least eighty percent (80%) live cover within one (1) month of germination shall be reseeded.
   2. If reseeding fails to achieve establishment, alternate stabilization methods such as erosion control blankets, coir nets, or hydro-mulch applications shall be implemented.
   3. If winter weather prevents adequate grass growth, time limits for reseeding may be adjusted at the discretion of the Owner's Representative.

E. Erosion Repairs:
   1. Any areas that experience erosion shall be immediately repaired by:
      a. Fixing underlying drainage or runoff problems
      b. Regrading if necessary
      c. Reseeding and reapplying mulch over the repaired area.

3.8 LAWN & MEADOW MAINTENANCE

A. Coordinate closely with the Owner regarding lawn and meadow establishment. The Owner will be responsible for seeding the lawn and meadow areas, while the Contractor shall provide overall site preparation, final grading, and irrigation installation. Coordination between the Contractor and Owner is critical to ensure protection of installed work and successful establishment of the lawn and meadow areas.

3.9 INSPECTION AND SUBSTANTIAL COMPLETION

At the time of Substantial Completion, all hydroseeded areas shall exhibit a uniformly applied slurry with no visible bare soil, overspray, or mulch accumulation. The site shall be free of erosion, rills, or sediment movement on hydroseeded slopes. Initial germination of seeded species shall be visible across the full extent of the seeded area. The site must also be free of invasive and noxious weed species. Any areas failing to meet these conditions shall be corrected prior to acceptance of Substantial Completion.

3.10 WARRANTY AND MAINTENANCE PERIOD

A. The Contractor shall provide a one (1) year warranty and maintenance period beginning at the date of Substantial Completion. During this period, the Contractor shall be responsible for ensuring successful establishment of hydroseeded areas, including maintaining erosion-free conditions, achieving required vegetative cover thresholds, and controlling invasive and noxious weeds. The Contractor shall reseed, repair, or otherwise remediate any areas that fail to establish adequately or experience erosion, weed infestation, or die-off during the warranty period. All repairs, reseeding, or corrective measures required during the warranty period shall be performed at no additional cost to the Owner.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove erosion-control measures after establishment period.

END OF SECTION 32 92 23

32 93 00 – PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Installing plant material as shown on the Drawings.
   2. Installing fertilizer, and mulch.

B. Related Requirements:
   1. Section 32 80 00 – Irrigation System
   2. Section 32 91 13 – Soil Preparation

1.3 REFERENCES

A. Refer to the following standards:
   1. WSDA Washington State Department of Agriculture - Rules Relating to Standards for Nursery Stock.
   2. American Standard for Nursery Stock, ANSI Z60.1-1990.
   3. Hortus Third, Cornell University.

1.4 DEFINITIONS

A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than sizes indicated or diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

B. Container Grown Plant: Exterior plants grown and marketed in a container which generally prevents the growth of roots beyond its side walls or bottom, with a fully developed root system which holds the rootball together when the container is removed. Container and plant sizes shall not be less than sizes indicated or diameter and depth recommended by ANSI Z60.1 for type and size of shrub required.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Manufactured Topsoil: See Section 32 91 13 – Soil Preparation.

E. Recycled Topsoil: Screened, on-site soil meeting the requirements of Section 32 91 13 – Soil Preparation.

F. Planting Soil: Topsoil used in tree, shrub and perennial pits shall be a mixture of ten percent (10%) compost by volume and ninety percent (90%) existing, on-site topsoil, screened through a three-eighths inch (3/8”) screen or approved equal.

G. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.5 SYSTEM DESCRIPTION

A. Materials, equipment, and labor for planting; reestablishing finish grading of planting areas following planting; protection and immediate maintenance; guarantee and replacement; and related items necessary to complete the work indicated.

B. Quantities: Determine exact amounts from Contract Drawings.

1.6 SUBMITTALS

A. Submit the following:
   1. Notification: Within thirty (30) days after the award of Contract, submit documentation that plant materials have been ordered, purchase order number, and photographic sample of each plant species.
   2. Product Data:
      a. Mulch
      b. Staking Materials
      c. Root Barrier
      d. Compost

B. Submit Maintenance Data. Include special directions essential for Owner's maintenance program during guarantee/warranty period. Include duplicate copies for landscaping maintenance personnel use during maintenance period.

C. Warrantees:
   1. Plant Material Warranty: Written Warranty on Contractor's letterhead.

D. Samples:
   1. Mulch: One (1) cubic foot.

E. Maintenance Data:
   1. Submit Maintenance Data as specified in Section 01 77 00. Include special directions essential for Owner’s maintenance program during guarantee/warranty period. Include duplicate copies for landscaping maintenance personnel use during maintenance period.

1.7 QUALITY ASSURANCE

A. Supplier, installer qualifications: Contractor to have at least five (5) years’ experience performing comparable work.

B. Pre-Installation Meeting:
   1. All plants shall be reviewed by the Owner’s Representative on site prior to planting.
   2. Stake all tree locations for approval prior to excavating pits.
   3. Plant five (5) shrubs and two (2) trees and stake in the presence of the Owner’s Representative prior to planting all other shrubs and trees.

1.8 DELIVERY, STORAGE, AND HANDLING ON NEW PLANT MATERIAL

A. Products Excluding Plant Materials:
   1. Labeling: Furnish standard products in unopened manufacturer's standard containers bearing original labels showing quantity, analysis and name of manufacturer.
   2. Storage: Store materials and products with protection from weather or other conditions which would damage or impair their effectiveness.

B. Acceptance of Contractor-Procured Plant Materials:
   1. Owner acceptance of Plant Materials at Delivery: Owner's Representative to review plant materials upon delivery to verify that plants are undamaged, healthy and satisfactory for which to provide the Warranty requirements described in these Specifications.
   2. Unsatisfactory Conditions: Contractor to notify Owner's Representative immediately if unsatisfactory conditions are found that will not allow the plants to be warranted as described in these Specifications.
   3. Acceptance of Warranty Responsibility: The Contractor, by accepting delivery of plant material, without providing written notification of unsatisfactory conditions, assumes Warranty responsibilities for the plant material as described in these specifications.
   4. Unloading: The Contractor has responsibility for removing plant material from delivery vehicle.
   5. Protection Prior to Installation: Protect plant materials from sun and drying winds from delivery until planted in final location on site. Heel-in all rootballs if not planted the same day as delivered.
   6. Proper Plant Handling: Handle and protect plants, roots, rootballs, and new buds to prevent plant injuries. Pick up all plants from the rootball or container, not the trunk.
   7. Unsatisfactory Materials: Immediately remove unsatisfactory materials from site.
   8. Verification of Species: All plant material shall be delivered with tags or labels identifying species and variety (as applicable). Incorrect species shall be removed from the site immediately.
   9. Plant Tags: Do not remove yellow, plastic lock-seal tags with serial numbers until end of Warranty period.

1.9 PROJECT SITE CONDITIONS

A. Environmental Requirements: Plant during periods normal for optimum growth, as determined by season, weather conditions, and accepted practice. Contractor may conduct planting operations under unseasonable conditions, without additional compensation, by accepting full responsibility for subsequent resulting losses.

B. Underground Conditions:
   1. Locate utility lines and underground obstructions to avoid damage during excavation.
   2. Contractor shall repair and replace damaged buildings, equipment, underground utilities, irrigation equipment, paving, surfacing, stairs, and other work damaged as a result of Contractor's operations.
   3. Locate and clearly mark irrigation pipe, wire, valves, and other underground equipment.

1.10 SEQUENCING AND SCHEDULING

A. Coordinate ordering of materials with Owner immediately following General Contract award. Ensure that specified sizes and quantities are furnished.

B. Planting Schedule: Contractor is responsible for using good horticultural practices and judgment regarding timing of planting.

1.11 WARRANTY

A. Warranty Period for this work is as stated in General Conditions and begins at Owner acceptance. Warranty period for all plant material shall be one (1) year from date of Owner acceptance.
   1. Guarantee replacement: Acceptance of sample plants does not constitute acceptance of all plants. Final acceptance of plants shall occur at Owner acceptance of the completed project.
      a. Plant materials: Warrant to be healthy and thriving.

b. Remove and replace immediately during the Guarantee Period: Dead, diseased, dying, broken, or missing plant materials (except as noted below). Use specified plant and plant as specified; guarantee until acceptable, active, healthy growth is evident.
c. Contractor's responsibility: During Guarantee Period, you are not held responsible for replacing plants destroyed or damaged by vandalism, accidents caused by vehicle (other than yours), or Acts of God, provided that you have exercised due care to protect the work.
d. When required replacement time falls during non-planting season, you may request Owner's permission to defer planting until proper season. If granted, immediately remove dead plants, including roots, from site.
e. Backfill pits properly with topsoil. Finish grade and leave in acceptable condition until proper planting season occurs. Replace with plants of same kind and size as those originally planted. Plant as originally specified.

1.12 MAINTENANCE

A. The maintenance period shall continue until substantial completion. At a minimum, maintenance shall include: watering, weed and pest control, and temporary barriers as required to insure healthy, thriving plant growth.

PART 2 - PRODUCTS

2.1 MATERIAL – GENERAL

A. Comply with Quality Assurance provisions, references, specifications, and manufacturer's data.

2.2 PLANT MATERIALS

A. Meet or exceed following reference standards for quality, size, and condition:
1. WSDA Rules Related to Standards for Nursery Stock.
2. ANSI Z60.1-2004: Nursery Stock.
3. American Joint Committee of Horticultural Nomenclature: Standardized Plant Names.

B. Plant abbreviations (see Contract Drawings for complete plant list):

B&B	Balled and burlapped	S	Small
BR	Bare root	M	Medium
br	Branches	L	Large
cal	Caliper	EXL	Extra large
cont	Container	NCN	No common name
dia	Diameter	oc	On center
gal	Gallon	tri-spaced	Triangular spaced

2.3 PLANTING SOIL

A. Tree and Shrub Pits: Backfill for tree and shrub pits shall be a mixture of ten percent (10%) compost by volume and ninety percent (90%) existing, on-site topsoil, screened through a three-eighths inch (3/8”) screen or approved equal.

B. Perennial and Groundcover Beds: Perennial and groundccover beds shall be amended with a mixture of ten percent (10%) compost by volume and ninety percent (90%) existing, on-site topsoil, screened through a three-eighths inch (3/8") screen or approved equal.

C. Compost: Shall be made from ground yard waste that has first been screened through a five-eighths inch (5/8") trammel screen. The composting process shall include five (5) three (3) day periods during which the compost temperature is between 131 to 165 degrees Fahrenheit. The total composting time period shall be a minimum of six (6) months. Compost shall be pure compost with no additives and certified organic by the Washington Department of Agriculture with the following minimum nutrient analysis:

Guaranteed Minimum Analysis: Compost	1.10-0.40-1.10%
Total Nitrogen (N)	1.10%
Water Insoluble Organic Nitrogen	1.10%
Available Phosphate (P_2O_5)	0.40%
Soluble Potash (K_20)	1.10%
Calcium (Ca)	0.58%

D. Equal to Cedar Grove Compost, 17825 Cedar Grove Road S.E. Maple Valley, WA 98038, 425-432-2395, 425-432-7043 (fax).

2.4 FERTILIZER

A. Conform to referenced FS O-F-24D, Commercial Fertilizers and WSDA Laws.

B. Fertilizer for All Tree and Shrub Plantings:
1. "Best Paks – 20-10-5 in biodegradable packet available from Simplot Turf and Horticulture, 1-800-992-6066.

2.5 MULCH

A. Reground Fir Mulch

B. Acceptable Products Available From:
1. Whidbey Topsoil (360) 331-7645
2. Or approved equal.

PART 3 - EXECUTION

3.1 PRE-PLANTING INSPECTION

A. General: Verify installation conditions as satisfactory to receive work of this section. Do not install until unsatisfactory conditions are corrected. Beginning work constitutes Contractor's acceptance of conditions as satisfactory.

B. Contaminants:
1. Verify existing soil conditions for contaminants that may have been discarded by other trades, such as thinner or plaster.
2. Report findings in writing immediately to Owner's Representative before placing topsoil.

C. Adverse Drainage Conditions: Notify Owner's Representative in writing of adverse drainage conditions affecting plant growth.

3.2 PREPARATION

A. Field Measurements:
   1. Verify actual plant layout in relation to Contract Drawings: Make adjustments as required by Owner's Representative.
   2. In shrub planting areas, follow specified distances on center rather than estimated number of plants, be it a larger or smaller quantity.

B. Plant Locations:
   1. Stake all tree locations with three-foot (3') wood stakes for acceptance by Owner's Representative.
   2. Make required field adjustments as directed by Owner's Representative.
   3. Shrubs may be staked out by boundary rather than individual plants.
   4. Avoid obstructions such as irrigation equipment.

C. Protect the public, adjacent properties, surfaces, and surrounding areas to prevent harm during Work of this Section.

3.3 INSTALLATION

A. Install the Work in accordance with References and specifications.

3.4 FINISH GRADING

A. Finish subgrade and obtain approval of Owner's Representative before you start planting or place any soil. Finish subgrade shall be smooth and conform to the final finish grade after soil placement. Allow for added soil in individual plantings as specified.

3.5 PLANTING

A. Preparation:
   1. Before planting, soak dry rootballs.
   2. Prune broken roots one-half inch (½") or greater in diameter. Make clean cuts.
   3. Plant when plant materials are available and weather conditions are consistent with good horticultural practice.

B. Plant Pits:
   1. Dig plant pits and plant according to details. Waste excess pit spoils evenly over subgrade.
   2. If you encounter clay soil or unusual conditions likely to be detrimental to new plantings, notify Owner's Representative immediately.
   3. Remove unsuitable material excavated from plant holes and dispose of it legally off project site.
   4. Install plants with POSITIVE drainage away from rootball, unless otherwise noted.

C. Fertilizer – Trees and Shrubs Only:
   1. Prior to completing backfilling of rootball, place Best Paks on sides evenly around rootball, six inches (6") minimum and eight inches (8") maximum below the finish grade and approximately two inches (2") from root tips. Owner's Representative shall be present when Best Paks are installed.
   2. Place quantities by plant size as indicated and in accordance with manufacturer's instructions:
      a. 1 pak - 1 gal.
      b. 3 paks - 5 gal.
      c. 9 paks - 15 gal. (trees)

D. Planting:
   1. Hold plant in center of hole, approximately two inches (2”) above normal growing position and backfill with soil approximately halfway.
   2. Backfill to within five inches (5”) of finish grade; fill hole with water and allow to settle.
   3. Backfill to finish grade with specified planting soil.
   4. Raise plants settling below finish grade to correct elevation.

E. Plant Tags:
   1. Remove and dispose of nursery labels, tags and stakes.
   2. Do not remove yellow, plastic lock-seals with serial numbers until end of Warranty period.

F. Soil:
   1. Place soil to a uniform depth as shown on the Contract Drawings.

3.6 MULCHING

A. Before installing mulch, obtain acceptance of the Owner’s Representative of planting areas, grades, soil depths, and plant locations.

B. Install mulch layer under all trees, shrubs, ferns and groundcover to the limits and depths as shown on the Contract Drawings.

C. Install uniform mulch layer material to the depths shown on the Contract Drawings over cleaned and graded subsurface.

D. At plant trunks and stems, taper mulch back from root ball crown so mulch does not touch bark.

3.7 FINAL INSPECTION

A. Remove defective materials; in their place, install new materials, as specified. Furnish in same variety and current size of existing healthy plant materials, subject to a one (1) year guarantee beginning at the date of new installation. Remove any weeds.

3.8 CLEANING

A. Sweep paving clean. Leave installations properly planted, clean, and orderly; premises free from scatterings and other residue of work. Leave site neat and clean at end of each working day.
   1. Remove and dispose on site such items as excess earth, clippings, trimmings, leaves, litter, and debris.
   2. Rake planting areas to an even, fine grade. Wash hard surfaces clean.
   3. Remove flag labels from plantings.

3.9 PROTECTION OF COMPLETED WORK

A. Install barriers as necessary and required to protect the work during Guarantee Period, or for shorter period as directed.

3.10 PLANT ESTABLISHMENT

A. Contractor to provide water to maintain plants in non-irrigated areas during plant establishment period.

END OF SECTION 32 93 00

SECTION 33 00 00 –PIPE & PIPE FITTINGS: GENERAL STATEMENT (WATER SUPPLY)

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work in this Section includes utility piping systems, plumbing piping systems, pipe pressure testing, and pipe cleaning.

B. This work does not include water main and service work within the Aquatic Center site. Water piping work within the Aquatic Center site shall be in accordance with Section 33 10 00 – Water Service.

1.2 RELATED SECTIONS

A. Water Utility Distribution Piping (Water Supply) - Section 33 11 00
B. Water Utility Distribution Valves (Water Supply)– Section 33 12 16
C. Earthwork – Section 31 00 00

1.3 REFERENCES

A. Washington State Department of Transportation, “Standard Specifications for Road, Bridge, and Municipal Construction”, latest edition. (WSDOT Standard Specifications)

B. American Society for Testing and Materials (ASTM)

1. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
2. A74, Standard Specification for Cast Iron Soil Pipe Fittings
3. A106, Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service
4. A197, Standard Specification for Cupola Malleable Iron
5. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel Alloy Steel for Moderate and Elevated Temperatures
6. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
7. A518, Corrosion – Resistant High – Silicon Iron Castings
8. A774, As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures
9. A778, Welded, Unannealed Austenitic Stainless Steel Tubular Products
10. B86, Standard Specification for Zinc
11. B88, Standard Specification for Seamless Copper Water Tube
12. B306, Copper Drainage Tube CDWV
13. C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
14. C361, Standard Specification for Reinforced Concrete Low Head Pressure Pipe
15. C443, Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
16. C564, Rubber Gaskets for Cast Iron Soil Pipe and Fittings
17. C924, Standard Practice for Testing Concrete Sewer Lines by Low Air Pressure Test Methods
18. C1103, Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
19. D1248, Polyethylene Plastics Molding and Extension Materials
20. D1785, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

21. D2241, Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
22. D2466, Socket Type PVC Plastic Pipe Fittings, Schedule 40
23. D2467, Standard Specification for Socket-Type Poly (Vinyl Chloride)
24. D2997, Standard Specification for Centrifugally Cast Thermosetting Plastic Pipe
25. D3034, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
26. D3350–Continuous Outdoor Use (UV)
27. D4101, Polypropylene Plastic Injection and Extrusion Materials
28. F1417, Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air
29. F438, Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
30. F439, Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 80
31. F441, Standard Specification for Chlorinated Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40 and 80
32. F679, Standard Specifications for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
33. F794, Standard Specification for Poly (Vinyl Chloride) (PVC) Rubber Gravity Sewer Pipe and Fittings based on Controlled Inside Diameter
34. F1417, Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air
35. F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
36. F2206 -- Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene (PE) Plastic Pipe, Fittings, Sheet Stock, Plate Stock, or Block Stock

C. American Water Works Association (AWWA)

1. C104, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. C110, Ductile Iron and Gray Iron Fittings, three (3) inch through forty-eight (48) inch for Water and Other Liquids.
3. C111, Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fitting
4. C115, Flanged Ductile Iron Pipe with Threaded Flanges
5. C151, Ductile Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids
6. C153/A21.53 -- American National Standard for Ductile-Iron Compact Fittings, three (3) inch through twenty-four (24) inch and fifty-four (54) inch through sixty-four (64) inch, for Water Service.
7. C200, Steel Water Pipe 6 inch and Larger
8. C203, Coal Tar Protective Coatings and Linings for Steel Water Lines – Enamel and Tape – Hot Applied
9. C205, Cement Mortar Lining and Coating for Steel Water Pipe four (4) inch and Larger, Shop Applied
10. C207, Steel Pipe Flanges for Waterworks Service – Sizes four (4) inch through one hundred forty-four (144) inch
11. C208, Dimensions for Fabricated Steel Water Pipe Fittings
12. C210, Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
13. C214, Tape Coating Systems for the Exterior of Steel Water Pipelines
14. C600-99, Installation of Ductile-Iron Water Mains and Their Appurtenances
15. C605-94, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
16. C606, Grooved and Shouldered Joints
17. C651, Disinfection of Water Mains

18. C900, Polyvinyl Chloride (PVC) Pressure Pipe four (4) inch through twelve (12) inch for Water
19. C905, Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters fourteen (14) inch through thirty-six (36) inch
20. C906 – Polyethelene (PE) Pressure Pipes and Fitting (Revised to Incorporate PE4710)
21. C909, Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe four (4) inch through twenty four (24) inch for Water
22. M11, Steel Pipe – A Guide for Design and Installation
23. Cast Iron Soil Pipe Institute (CISPI)
24. CISPI301, Hubless Cast Iron Sanitary System with No Hub Pipe and Fittings
25. CISPI310, Coupling for Use in Connection with Hubless Cast Iron and Fittings for Sanitary and Stormdrain, Waste, and Vent Piping Applications

D. Plastic Pipe Institute – Handbook of PE Pipe, Current Edition.

1. To include Technical Reports and Technical Notes
   a. Technical Note #46, “Guidance for Field Hydrostatic Testing of High Density Polyethylene Pressure Pipelines: Owner’s Considerations, Planning, Procedures, and Checklists TN-46/2013”.

E. National Electric Manufacturer’s Association (NEMA)

1. ICS6, Enclosures for Industrial Controls and Systems

F. National Fire Protection Association (NFPA)

1. 54, National Fuel Gas Code

1.4 SUBMITTALS

A. Catalog data consistent with Section 01 33 00 – Submittal Procedure – Shop Drawings, Product Data, and Samples including:

1. Schedule showing pipe type, size, schedule of pipe, appurtenances, type of linings and coatings, cathodic protection.
2. Copies of any manufacturer’s written directions regarding material handling, delivery, storage and installation.
3. Technical product data on piping appurtenances.

B. Certifications and Testing consistent with Section 01 45 00 – Quality Control including:

1. Certification that products used meet standards referenced.
2. Notification of time and date of piping pressure tests.
3. Copies of pressure test results on all piping systems.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe coating during handling using methods recommended by manufacturer. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnish piping, fittings and appurtenances in accordance with the Contract Documents.

B. Pipe sizes indicated are nominal inside diameter, except for HDPE pipe which is based on iron pipe sizing.

C. Use straight, round pipe.

D. For temporary piping not specifically addressed in Piping Schedule, utilize materials, joints and fittings equal to those specified for similar applications of permanent construction.

2.2 COMPONENTS AND ACCESSORIES

A. Couplings Restraint

1. Provide mechanical restraint for all couplings.
2. Assure couplings and restraint match test pressure rating of piping system.

2.3 MECHANICALLY RESTRAINED JOINTS

A. The restraining of water pipes, fittings, and valves shall be accomplished by the use of either a bolted or boltless system. Any device utilizing round point set screws shall not be permitted.

B. All couplings installed underground to connect to ductile iron or PVC pipe shall be manufactured of ductile iron.

C. All mechanical restraints shall conform to the State of Washington Department of Transportation, “Standard Specifications for Road, Bridge, and Municipal Construction”, latest edition. (WSDOT Standard Specifications).

2.4 BRONZE NIPPLES, COUPLERS, AND FITTINGS

A. Bronze threaded nipples, couplers, and fittings shall meet the requirements of ANSI B-16.15, ASA 125-pound class.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation, inspect and verify condition of piping and appurtenances. Installation constitutes installer’s acceptance of product condition for satisfactory installation.

3.2 PREPARATION

A. Correct defects or conditions which may interfere with or prevent a satisfactory installation.

3.3 EXTERIOR PIPING ERECTION/INSTALLATION/APPLICATION

A. Unless otherwise shown on the Drawings, provide a minimum of thirty (30) inches earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing.

B. Laying Pipe in Trench

1. Excavate and backfill trench in accordance with Section 31 00 00 – Earthwork.
2. Clean each pipe length thoroughly and inspect for compliance to Specifications.
3. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom or bedding material.
4. Provide gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
5. Except for first two (2) joints, before making final connections of joints, two (2) full sections of pipe shall have been previously installed with earth tamped alongside of pipe of final bedding material placed.
6. Lay pipe in only suitable weather with good trench conditions. Never lay pipe in water except where approved by the Engineer.

C. Lining-up Push-on Joint Piping

1. Lay piping on route lines shown on Drawings.
2. Deflect from straight alignments or grades by vertical or horizontal curves.
3. Maximum offset between extended centerlines of any two (2) adjacent pipe lengths is in strict accordance with the pipe manufacturers published literature on deflections and offsets.
4. Provide special bends when specified or where required alignment exceeds allowable deflections stipulated.
5. Provide shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded.

D. Anchorage and Blocking

1. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by forces at buried or exposed piping tees, wye branches, plugs, or bends.
2. Size thrust block as detailed on the Drawings.
3. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall. Concrete blocks shall not cover pipe joints.
4. Provide bearing area of concrete in accordance with details on Drawings.
5. Provide insulating components where dissimilar metals are joined together.

3.4 CONNECTIONS WITH EXISTING PIPING

A. Where connection between new work and existing work is made, use suitable and proper fittings to suit conditions encountered.

B. Perform connections with existing piping at time and under conditions which will least interfere with service to those affected by such operation.

C. Undertake connections in fashion which will disturb existing system as little as possible.

D. Utilize suitable equipment and facilities to dewater, drain, and dispose of liquid removed without damage to adjacent property.

E. Where connections to existing systems necessitate employment of past installation methods not currently part of trade practice, utilize necessary special piping components.

3.5 FIELD QUALITY CONTROL

A. General

1. Utilize pressures, media, and pressure test durations as specified on Piping Schedules and provided under project specifications for applicable pipe material.
2. Isolate equipment which may be damaged by the specified pressure test conditions.
3. Perform pressure test using calibrated pressure gauges and calibrated volumetric measuring equipment to determine leakage rates. Select each gauge so that the specified test pressure falls within the upper half of the gauge's range. Notify Engineer twenty-four (24) hours prior to each test.
4. Completely assemble and test new piping systems prior to connection to existing pipe systems.
5. Acknowledge satisfactory performance of test and inspections in writing to Engineer prior to final acceptance.
6. Provide all necessary equipment and perform all work required in connection with the test and inspections.
7. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and reexamination.

3.6 CLEANING AND DISINFECTION

A. Cleaning

1. Clean interior of piping systems thoroughly before installing.
2. Maintain pipe in clean condition during installation.
3. Before joining piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
4. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.
5. At completion of work and prior to final acceptance, thoroughly clean work installed under these specifications. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes. Repair any stoppage of discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to the Owner.

END OF SECTION

SECTION 33 05 26 – UTILITY LINE IDENTIFICATION MARKING (WATER SUPPLY)

PART 1 – GENERAL

1.1 DESCRIPTION

A. The work of this Section includes furnishing and installing utility line marking tape and tracer wire in the water utility trench.

B. This work does not include water main and service work within the Aquatic Center site. Water piping work within the Aquatic Center site shall be in accordance with Section 33 10 00 – Water Service.

1.2 SUBMITTALS

A. As specified in Section 01 33 00 – Submittal Procedure – Shop Drawings, Product Data, and Samples.

B. Certification that the materials used in the tape fabrication meet the requirements of this Section.

PART 2 - PRODUCTS

2.1 MARKING TAPE

A. Capable of being inductively detected electronically.

B. Construction: Two (2) layers of impervious plastic film not less than four inches (4”) wide. Total thickness of tape shall not be less than 0.005 inch (five (5) millimeters) plus or minus ten percent (10%) manufacturing tolerances.

1. Film: Inert plastic. Each film layer shall be not less than 0.0005 inch thick (one half (0.5) millimeters).
2. Adhesive: Compatible with foil and film.

C. Imprint: One inch (1”) or larger bold black letters.

D. Legend: Identify buried utility line tape with imprint such as “CAUTION: WATER LINE BELOW.” Repeat identification at approximately twenty-four inch (24”) intervals.

E. Background Color: APWA color code and as specified below:

Color	Utility
Safety Red	Electric
High Visibility Safety Yellow	Gas, Oil, Steam, Dangerous Materials
Safety Alert Orange	Telephone, Communications, Cable Television
Safety Precaution Blue	Water System, Irrigation
Safety Green	Sanitary Sewer, Storm Sewer
Safety Brown	Force Mains, Reclaimed Water, and Effluent Lines

F. Manufacturer: Lineguard, Inc., Wheaton, Illinois; Reef Industries, Inc., Houston, Texas; Thor Enterprises, Inc., Sun Prairie, Wisconsin; or approved equal.

2.2 TRACER WIRE

A. Tracer wire shall be blue coated No. 12 AWG, continuous to above ground access points (meters and valves). Splices in wire, if needed, shall be made with waterproof splice kits.

PART 3- EXECUTION

3.1 MARKING TAPE

A. Install tape in backfill directly over each buried utility line as shown. Place tape during final backfilling. Bury tape approximately twelve (12) inches above the crown of the pipe.

3.2 TRACER WIRE

A. Install tracer wire in backfill over each buried utility line as shown in the construction plans.

B. A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes after meeting final elevation.

C. Trace wire must be properly grounded at all dead ends/stubs.

D. Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.

END OF SECTION

33 09 10 – INSTRUMENTATION AND CONTROL FOR WATER UTILITIES (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Design of the instrumentation and control system and associated electrical components shall be the responsibility of the Contractor. The design shall meet the requirements of the Specifications and Plans. The contractor shall provide a complete and functional system that meets the intent of the Specifications and Plans.

B. Section includes performance requirements for water system controls including the following:

1. Potable Reservoir Controls
2. Irrigation Reservoir Controls
3. Well pump variable frequency drive (VFD) controls
4. Chemical metering pump controls
5. ATEC filtration system controls

C. Section also includes product specifications for the following:

1. Submersible level transmitter
2. Pressure transmitter
3. Well pump VFD
4. Source meter

D. Related Requirements:

1. Section 22 05 23.2 “General Duty Valves for Plumbing Piping (Water Supply)” for flow control solenoid valve.
2. Division 26 "Electrical."
3. Section 33 11 13 “Potable Water Supply Wells.”
4. Section 33 12 16 "Water Utility Distribution Valves (Water Supply)" for pressure sustaining solenoid valve.
5. Section 33 16 13 “Above Ground Concrete Water Reservoir (Water Supply).”
6. Section 46 30 00 “Water and Wastewater Chemical Feed Equipment (Water Supply)” for chemical metering pumps and flow switches.
7. Section 46 61 00 “Filtration Equipment (Water Supply)” for ATEC filtration system.

1.2 REFERENCES

A. National Electrical Manufacturers Association (NEMA):

1. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)

B. Underwriters' Laboratories:

1. UL 508 – Industrial Control Equipment

C. National Sanitation Foundation (NSF International):

1. NSF 61 – Drinking Water System Components – Health Effects
2. NSF 372 – Technical Requirements

1.3 SUBMITTALS

A. See Section 01 33 00 “Submittal Procedures” for submittal requirements.

B. Section 01 77 00 “Closeout Procedures.”

C. Submit shop drawings and one line diagrams for the control system.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years of experience.

B. Installer: Company specializing in performing work of this section with minimum three years of experience.

1.5 PERFORMANCE REQUIREMENTS

A. Potable Reservoir Controls

1. A submersible level transmitter will be installed in the potable reservoir and shall perform the following functions:
   a. Open flow control solenoid valve: the submersible level transmitter sends a signal to the flow control solenoid valve in the treatment building to open, which will start potable reservoir filling. Opening the valve will cause pressure to drop in the raw water line from the well as measured by the pressure transmitter in the pressure sustaining solenoid valve vault. When the pressure drops below the well pump VFD pressure setpoint, the VFD will turn the well pump on.
   b. Close flow control solenoid valve: the submersible level transmitter sends a signal to the flow control solenoid valve in the treatment building to close, which will stop potable reservoir filling. Closing the valve will cause pressure to increase in the raw water line from the well as measured by the pressure transmitter in the pressure sustaining solenoid valve vault. When the pressure reaches the well pump VFD pressure setpoint, the VFD will turn the well pump off.
   c. Potable reservoir high water level alarm: the submersible level transmitter sends a signal to the well pump control panel to activate the potable reservoir high-level alarm.
   d. Potable reservoir low water level alarm: the submersible level transmitter sends a signal to the well pump control panel to activate the potable reservoir low-level alarm.

B. Irrigation Reservoir Controls

1. A submersible level transmitter will be installed in the irrigation reservoir and shall perform the following functions:
   a. Open pressure sustaining solenoid valve: the submersible level transmitter sends a signal to the pressure sustaining solenoid valve on the irrigation reservoir fill line to open, which will start irrigation reservoir filling. Opening the valve will cause pressure

to drop in the raw water line from the well as measured by the pressure transmitter in the pressure sustaining solenoid valve vault. When the pressure drops below the well pump VFD pressure setpoint, the VFD will turn the well pump on.

b. Close pressure sustaining solenoid valve: the submersible level transmitter sends a signal to the pressure sustaining solenoid valve on the irrigation reservoir fill line to close, which will stop irrigation reservoir filling. Closing the valve will cause pressure to increase in the raw water line from the well as measured by the pressure transmitter in the pressure sustaining solenoid valve vault. When the pressure reaches the well pump VFD pressure setpoint, the VFD will turn the well pump off.
c. Irrigation reservoir high water level alarm: the submersible level transmitter sends a signal to the well pump control panel to activate the irrigation reservoir high-level alarm.
d. Irrigation reservoir low water level alarm: the submersible level transmitter sends a signal to the well pump control panel to activate the irrigation reservoir low-level alarm.
e. Re-establish any irrigation pump shut-offs, if present, to de-energize irrigation pumps due to an extreme irritation reservoir low water level.

2. Pressure Sustaining Solenoid Valve
   a. Valve shall be normally closed. When the irrigation reservoir calls for water, the valve shall open in pressure sustaining mode.
   b. When the valve is open in pressure sustaining mode, the valve shall maintain a minimum pressure on the upstream side of the valve to ensure that potable reservoir filling is prioritized above irrigation reservoir filling.
   c. Pressure sustaining solenoid valve pressure setting is indicated in the Plans.
   d. When both reservoirs are calling for water, the pressure sustaining solenoid valve will modulate (close) to limit flow to the fire reservoir.

3. Flow Control Solenoid Valve
   a. Valve shall be normally closed. When the potable reservoir calls for water, the valve shall open in flow control mode.
   b. When the valve is open in flow control mode, the valve shall limit the flow rate of water through the valve to a maximum rate.
   c. Flow control solenoid valve flow rate setting is indicated in the Plans.

C. Reservoir Set Point Control Panel

1. Install panel in reservoir site pumphouse as indicated in the Plans.
2. Signal from the reservoir level transmitters shall pass through the reservoir set point control panel before going to the flow control and pressure sustaining solenoid valves.
3. The water level that triggers the following control functions for both the potable and irrigation reservoirs shall be adjustable with this panel.
   a. Potable reservoir:
      1) Open flow control solenoid valve
      2) Close flow control solenoid valve
      3) High water-level alarm
      4) Low water-level alarm

   b. Irrigation reservoir
      1) Open pressure sustaining solenoid valve
      2) Close pressure sustaining solenoid valve
      3) High water-level alarm
      4) Low water-level alarm

D. Well Pump VFD Controls

1. VFD control panel shall be capable of controlling the well pump in the following scenario:
   a. Control well pump on/off based on pressure in treatment building as measured by treatment building pressure transmitter. Flowrate to match treatment system capacity of 35 gpm.
   b. VFD shall adjust well pump motor speed to maintain a constant pressure in treatment building as measured by treatment building pressure transmitter. VFD pressure setting is indicated in the Plans.
   c. VFD shall utilize flow rate limiting to limit well pumping rate to a maximum of 120 gpm as measured by the source meter.

E. Chemical Metering Pump Controls

1. Dedicated switched receptacles:
   a. Provide dedicated 120V receptacles for chemical metering pumps as indicated on the Plans.
   b. Receptacles shall be switched, meaning they are wired such that they are energized only when the flow control solenoid valve in the treatment building is open (potable water reservoir filling) and de-energized when the valve is closed.

2. Flow Switch:
   a. Flow switch shall monitor if no-flow conditions or flow conditions exist in the pipe on which it is installed.
   b. Provide wiring such that when no-flow conditions exist, power to dedicated receptacles for chemical metering pumps is interrupted.

F. ATEC Filtration System

1. Filter system control panel shall be energized only when the flow control solenoid valve in the treatment building is open. Panel includes a timer to monitor filter run-time for system backwashing.
2. Filter solenoid backwash valves shall be hydraulically actuated with pressure from the filter inlet piping.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE LEVEL TRANSMITTER

A. Meet the following requirements

1. NSF 61 and/or 372 certified.
2. UL-listed.
3. Output signal: 4-20mA analog.
4. Measuring range: 0 to 60 feet of water min.
5. Material: standard 316L stainless steel

B. Manufacturers and Products

1. Keller Levelgage
2. Endress & Hauser Waterpilot FMX11
3. Engineer approved equal

2.2 PRESSURE TRANSMITTER

A. Meet the following requirements

1. NSF 61 and/or 372 certified
2. Piezoresistive sensing element
3. ¼" NPT connection
4. Wetted materials: 316 stainless steel
5. Pressure range: 0 to 100 psi (min.)
6. Output signal: 4-20 mA
7. ±0.5% accuracy

B. Manufacturers

1. Keller Valueline
2. USA Bluebook
3. Engineer approved equal

2.3 WELL PUMP VFD

A. Well pump motor shall be controlled by a variable frequency drive (VFD) control panel with the following integrated features/capabilities:

1. HAND/OFF/AUTO modes for well pump control.
2. Compatible with site power
3. Accepts pulse and 4-20mA analog signal input from source meter and pressure transmitter.
4. Flow Rate Limiter: VFD limits well pump flow rate to a maximum user input flow rate value.

B. Manufacturer and Products:

1. Yaskawa iQpump 1000
2. Engineer approved equal

2.4 SOURCE METER

A. Source meter shall be a magnetic flow meter with the following features:

1. 4-20mA analog signal output.
2. NSF 61 and/or 372 certified
3. Remote digital display with flow rate and total volume display

B. Manufacturer and Products:

1. Seametrics iMAG 4700r (2-inch)
2. Engineer approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Requirements: Verification of existing conditions before starting work.

B. Verify correct power supply is available.

3.2 INSTALLATION

A. Install control systems at locations indicated on Drawings.

B. Install control system components in accordance with manufacturer's instructions.

C. Install control wire in conduit from reservoir level transmitters to reservoir set point control panel in pumphouse at reservoir site and pressure sustaining solenoid valve and flow control solenoid valve. Signal path for 4-20mA analog signal from level transmitters to solenoid valves shall be as follows: level transmitters > reservoir set point control panel > pressure sustaining and flow control solenoid valves.

D. Install control wire in conduit from source meter to remote digital display and well pump VFD control panel. Signal path for 4-20mA analog signal from source meter to well pump VFD control panel shall be as follows: source meter > remote digital display > VFD control panel. Install source meter remote display and VFD control panel in pumphouse near well site per plans.

3.3 FIELD QUALITY CONTROL

A. Start-up control systems by energizing system equipment and testing operation of hardware in presence of Engineer. Verify operation in conformance with the Plans and these Specifications.

B. Equipment Acceptance:

1. Adjust, repair, modify or replace system components that fail to perform as specified and rerun tests. Make final adjustments to equipment per manufacturer's requirements.
2. Document adjustments, repairs and replacements in manufacturer's field services certification.

3.4 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, system operation, routine maintenance, alarm condition responses, and emergency repair procedures to Owner personnel.

END OF SECTION 33 09 10

SECTION 33 10 00 - WATER SERVICE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not limited to the following:

1. Water main within Building project area, water services, fire hydrants and fire department connections.
2. Coordination and installation with Fire Protection Designer and Fire Marshal.
3. Coordination of building plumbing connection point.
4. Coordination of water main connection point.
5. Construction records.

1.2 REFERENCES

A. Reference the following standards:

AHJ	Public Authority Having Jurisdiction AHJ is an abbreviation for public Authorities Having Jurisdiction. For this project the AHJ denotes Island County.
UPC	The Uniform Plumbing Code
AWWA	American Water Works Association Standards
ASTM	American Society for Testing and Materials
WSDOT	Washington Department of Transportation 2025 Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction

1.3 SUBMITTALS

A. Submit the following information in conformance with submittal procedures noted in Division 01.

1. Product data sheets or shop drawings for all materials listed in Part 2 Products and/or noted on Plans.
2. Record drawings.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Pipe four inches in diameter and larger shall be ductile iron pipe Class 52 per WSDOT Section 9-30.1(1).

B. Fittings shall be per applicable portions of WSDOT Section 9-30.2.

C. Pipe shall be marked with the National Sanitation Foundation (NSF) seal and in accordance with ASTM and AWWA marking requirements, which include, but are not limited to, the manufacturer's name and class of pipe. Pipe shall bear no evidence of interior or exterior extrusion marks. Pipe walls shall be uniform, smooth, and glossy.

D. Conductive warning tape shall be as defined per Section 31 00 00 - Earthwork.

2.2 VALVES

A. Gate valves (3 to 16 inches) shall conform to WSDOT Section 9-30.3.

B. Valve boxes for buried valves shall be in accordance with WSDOT Section 9-30.3(4).

2.3 FIRE DEPARTMENT CONNECTION (FDC)

A. FDC shall be approved by the Fire Marshall and shall conform to AHJ requirements.

2.4 HYDRANTS

A. Hydrants shall conform to AHJ requirements per WSDOT 9-30.5 and AHJ requirements.

2.5 CONCRETE THRUST BLOCKING

A. Concrete thrust blocking shall conform to WSDOT Section 7-09.3 and AHJ requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify trenches are ready to receive work, and are excavated to the dimensions and elevations indicated on the Contract Documents.

3.2 INSTALLATION

A. Conform trench excavation, bedding, and backfill for water mains to requirements of Section 31 00 00 - Earthwork, unless otherwise specified.

1. Provide a minimum of 30-inches of cover for all water and fire service lines in accordance with AHJ Standards.

B. Install water main pipe, fittings and appurtenances in accordance with WSDOT Section 7-09, and in accordance with manufacturer's instructions.

1. Pipe deflection at joints shall be no more than one half the manufacturer's allowable amount.

C. Install valves for water mains in accordance with WSDOT Section 7-12.

D. Install conductive warning tape in accordance with Section 31 00 00 - Earthwork.

E. Connect to building water system.

F. Install fire hydrants in accordance with AHJ requirements.

G. Install concrete thrust blocking in accordance with WSDOT 7-09.3.

3.3 TESTING AND DISINFECTION

A. Coordinate testing with AHJ requirements.

B. Pressure test water main pipe in accordance with WSDOT Section 7-09.3, AWWA C600 and AHJ requirements.

C. Flush and disinfect water services (greater than 2-inch) in accordance with WSDOT Section 7-09.3 and AHJ requirements. Provide and pay costs for disinfection, sampling, and testing for water service.

1. Prevent flooding and downstream property damage when flushing water lines.

D. Flush and disinfect water service connections (2 inch and smaller) in accordance with WSDOT Section 7-15.3 and AHJ's requirements. Provide and pay costs for disinfection, sampling, and testing for water service.

1. Prevent flooding and downstream property damage when flushing water lines.

3.4 CLEANING

A. Leave premises clean and free of residue of work of this Section in accordance with the requirements of Division 01 of this Project Manual.

END OF SECTION 33 10 00

SECTION 33 11 00 - WATER UTILITY DISTRIBUTION PIPING (WATER SUPPLY)

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work covered in this Section includes furnishing, installing, and cleaning piping systems and fittings for project water lines, to include water service lines, valves, miscellaneous products, accessories, and appurtenant items.

B. This work does not include water main and service work within the Aquatic Center site. Water piping work within the Aquatic Center site shall be in accordance with Section 33 10 00 – Water Service.

1.2 RELATED SECTIONS

A. Section 33 05 26 – Utility Line Identification Marking

1.3 REFERENCES

A. See “Pipe & Pipe Fittings: General Statement” – Section 33 00 00.

B. State of Washington Department of Transportation, “Standard Specifications for Road, Bridge, and Municipal Construction”, latest edition. (WSDOT Standard Specifications).

C. NSF 61 – Drinking Water System Components – Health Effects

1.4 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedure – Shop Drawings, Product Data, and Samples.

B. Product Data: Provide data on pipe materials, pipe fittings, expansion joint fittings, flex fittings, valves, accessories, and miscellaneous products. Provide manufacturer’s catalog information and manufacturer’s certification. Indicate valve and data ratings.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Contractor Qualifications: A minimum of five project references, including current contact name, address, and telephone number where the Contractor or their subcontractor has successfully performed similar work within the past five years. Material References: A minimum of five project references, including current contact name, address, and telephone number where the submitted materials have been successfully applied, in similar exposures, within the past five years.

E. Pressure test results on all piping systems, include the following information:
   i. Time and date of piping pressure tests
   ii. Pressure test witnesses
   iii. Pressures recorded during test, including expansion phase and test phase pressures
   iv. Duration of expansion phase and test phase

F. Project Record Documents: Record actual locations of pipelines, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities. Contractor records and drawings shall be

submitted with as-built submittals. Contractor to maintain as-builts throughout the project duration during construction on-site.

G. Operation and Maintenance Manuals consistent with Section 01 78 50 – Operation and Maintenance Data.

1.5 DELIVERY, STORAGE, PROTECTION AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Deliver and store fire hydrants in shipping containers with labeling in place.

E. Deliver and store piping covered to protect piping from ultraviolet UV exposure.

F. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of the completed system.

PART 2 - PRODUCTS

2.1 WATER PIPE

A. Polyethylene (PE) Pressure Pipe (4 inches and over): PE pressure pipe shall meet the requirements of ANSI/AWWA C906. Pipe materials shall be high-density polyethylene PE 4710 conforming to the requirements of ASTM D3350 cell classification of PE445574C/E, type II, grade PE47. Pipe diameter shall be iron pipe size per Table 3 of ANSI/AWWA C906. Pipe pressure class shall be as listed in Table 5 of ANSI/AWWA C906 for DR 11 PE4710 material.

B. Polyethylene Tubing: Polyethylene tubing shall meet the requirements of AWWA C901. Tubing shall be high molecular mass with a 300 psi rating. Tubing used for ¾ and 1 inch shall be SDR 7 (copper pipe size). Tubing used for 1-1/2 and 2 inches shall be SDR 7 (copper tube size).

C. Ductile Iron Pipe: Class 52 meeting the requirements of AWWA C151. Ductile iron pipe shall have a cement mortar lining and a 1-mil thick seal coat meeting the requirements of AWWA C104.

D. PVC Pipe (Under 4-inches): ASTM D 1785 Schedule 80.

E. Galvanized Steel pipes under 4-inches: Steel pipe less than 4 inches in diameter must conform to ASTM A 53, schedule 40 and must be hot dip galvanized inside and out, including the couplings. The pipe sections must be coupled by malleable iron screw coupling per ANSI Specification B16.3.

2.2 FITTINGS

A. General: Bolts, nuts and washers used for securing fittings shall be of similar materials. Steel bolts shall meet the requirements of ASTM A 307 or ASTM 568 for carbon steel or ASTM F 593 or ASTM F 738 for stainless steel. Nuts shall meet the requirements of ASTM A 563 for

carbon steel or ASTM F 594 or ASTM F 836 for stainless steel. Iron bolts and nuts shall meet the requirements of ASTM A 536, grade 65-45-12.

B. Polyethylene (PE) Pipe (4 inches and Over): Fittings for PE pipe shall meet the requirements of ANSI/AWWA C906.

C. Ductile Iron Pipe: Fittings for ductile iron pipe shall meet the requirements of AWWA C110 or AWWA C153. Joints shall meet the requirements of AWWA C111. Fittings shall be cement mortar lined, meeting the requirements of AWWA C104. Gaskets for flat faced or raised faced flanges shall be 1/8 inch thick neoprene having a durometer of 60 plus or minus 5 of 1/16-cloth inserted. The type, material, and identification mark for bolts and nuts shall be provided.

D. Polyvinyl Chloride (PVC) Pipe (Under 4-inches): Fittings for PVC pipe under 4 inches shall meet the requirements of ASTM D2466.

2.4 BEDDING AND COVER MATERIALS

A. Bedding and Backfill: As specified in Section 31 00 00 - Earthwork.

2.5 ACCESSORIES

A. Concrete for Thrust Restraints:

1. When specified, concrete thrust blocks and anchors shall be installed as shown on the Drawings.
2. The thrust block cavity shall be hand dug into undisturbed soil or previously placed compacted backfill. The cavity shall be formed with soil or wood to hold the freshly placed concrete without displacement until an initial set has occurred.
3. Concrete thrust blocking, as detailed on the Plans, shall be placed at bends, tees, dead ends, and crosses. Blocking shall be commercial concrete meeting the requirement of WSDOT Standard Specifications Section 6-02.3(2)B poured in place. Concrete blocking shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as not to obstruct access to the joints of the pipe or fittings.

B. Joint Restraint

1. Restraint Devices for PVC Pipe shall incorporate a series of serrations on the inside diameter to provide positive restraint, exact fit, 360-degree contact and support of the pipe wall.
2. Restraint Devices shall be manufactured of high strength ductile iron, ASTM A536, Grade 65-45-12 or ASTM A36 structural steel.
3. Bolts and connecting hardware shall be of high strength low alloy material in accordance with ANSI/AWWA C111/A21.11
4. Restraint Devices for PVC Pipe shall have a water working pressure rating equivalent to the full rated pressure of the PVC Pipe on which they are installed, with a minimum two to one (2:1) safety factor in any nominal pipe size.
5. Notarized certification from the manufacturer of the restraint device shall be provided with submittals.
6. Restraint Devices for mechanical Joint or Push-On fittings shall be Uni-Flange 1300 (series) or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that water main and main line tee size, location, and invert are as indicated.

B. The Contractor shall inspect each pipe and fitting prior to installation to ensure that there are no damaged portions of the pipe. Pipe damage prior to completion of the project shall be repaired or replaced by the Contractor.

C. Handling: Pipe, fittings and accessories shall be carefully inspected before and after installation and those found defective shall be rejected. Pipe and fittings shall be free from fins and burrs. Before being placed in position, pipe, fittings, and accessories shall be cleaned, and shall be maintained in a clean condition. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe, fittings or any other material be dropped or dumped into trenches.

D. Storage: Pipe should be stored, if possible, at the job site in unit packages provided by the manufacturer. Caution should be exercised to avoid compression damage or deformation to bell ends of the pipe. Pipe should be stored in such a way as to prevent sagging or bending and protected from exposure to direct sunlight by covering with an opaque material while permitting adequate air circulation above and around the pipe. Gaskets should be stored in a cool, dark place out of the direct rays of the sun, preferably in original cartons.

E. Assure exposed piping is sufficiently supported to bear weight of valve when it is installed.

3.2 PREPARATION

A. Cut pipe ends square, ream pipe ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or mechanical joints.

3.3 TRENCHING

A. See Section 31 00 00 – Earthwork for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide required square foot of thrust restraint bearing on subsoil as indicated on the drawings.

D. Backfill around sides and to top of pipe with backfill material, tamp in place and compact, then complete backfilling.

3.4 INSTALLATION – GENERAL PIPE

A. Maintain separation of non-potable water main from potable water sources in accordance with State code.

B. Establish elevations of buried piping to ensure not less than three (3) feet of cover over pipe; or as indicated on the drawings and as directed by the engineer.

C. Install pipe to indicated elevation to within tolerance of one (1) inch.

D. Install HDPE pipe and fittings in accordance with manufacturer's recommendations and to AWWA C906, ASTM F2206 and PPI Handbook of PE Pipe 2nd edition, including Technical Reports and Notes, standards.

E. Install ductile iron piping and fittings to AWWA C600.

F. Install PVC pressure piping and fittings to ASTM D2774.

G. Install pipelines to line and grade indicated.

H. Install pipe to allow for expansion and contraction without stressing pipe or joints.

I. Install locator tape 12 inches above installed pipe.

J. Install trace wire as indicated in project Drawings.

K. All ductile iron sleeves, fittings, and valves with mechanical joints shall be restrained with an approved Restraining Device (Joint Restraint).

L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00 – Paints & Coatings.

M. Install bell and spigot pipe with bell end upstream.

N. Install valves with stems upright or horizontal, not inverted.

O. Install above ground water piping to the most current version of ASME B31.9, ASME B31.3, and ASME 31.4.

P. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers or supporting posts from reinforced concrete slabs and sides of reinforced concrete structures.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over four (4) inches.

Q. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.996.
2. Support horizontal piping as scheduled.
3. Wall and Footing Support for Pipe Sizes four (4) inches and over: Welded steel bracket and wrought steel clamp and/or sleeve.

3.5 INSTALLATION - VALVES

A. Set valves on concrete block or other acceptable solid bearing.

B. Center and plumb valve box over valve operating nut. Set box cover flush with finished grade.

3.6 CONNECTIONS TO EXISTING WATER LINES

A. Connection to existing water lines shall be made where and as indicated on the drawings and as directed by the Engineer. The sizes of pipe, fittings, valves and appurtenant items required to make connection shall correspond to the sizes of existing pipe and of project pipe. Connections shall be done in accordance with WSDOT Standard Specification 7-09.3(19).

3.7 APPLICATION

A. Install gate valves for shut-off and to isolate tanks, or parts of system.

3.8 HYDROSTATIC PRESSURE TESTING

A. Pressure test shall be witnessed by Engineer. Notify Engineer at least 48 hours prior to conducting pressure test.

B. Hydrostatic Tests:

1. Water main appurtenances and service connections to the meter setter shall be tested in sections of convenient length under a hydrostatic pressure equal to the pressure specified for the expansion phase and test phase. Pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose and piping, and measuring equipment necessary for performing the test shall be furnished and operated by the Contractor.

2. Sections to be tested shall normally be limited to 1,500 feet. The pipeline shall be backfilled sufficiently to prevent movement of the pipe under pressure.

3. Expansion Phase: During the expansion phase, the test section is pressurized 10 psi above the test pressure (235 psi) and make-up water is added, as required, to maintain the required expansion phase pressure for four (4) hours. Upon completion of the expansion phase the pressure is reduced by 10 psi to the test pressure (225 psi).

4. Test Phase: During the test phase, the test section of pipe is brought to the test pressure and is monitored for at least 15 minutes, provided no leakage is detected (i.e., no loss of pressure). Should leakage occur, the test duration shall be 2-hours. If the 2-hour duration is necessary, the hydrostatic pressure shall not vary by more than 5 psi.

   a. Under no circumstances shall the total time under both phases exceed eight (8) hours. If the test is not completed due to leakage, equipment failure or any other reason, depressurize the test section, and permit the system to "relax" for eight (8) hours prior to the next testing sequence.

   b. Each valve, along the test section, shall be tested by closing each in turn and relieving the pressure beyond. This test of the valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked. The Contractor shall verify that the pressure differential across the valve does not exceed the rated working pressure of the valve.

   c. Prior to calling out the Engineer to witness the pressure test, the Contractor shall have all equipment set up completely ready for operation and shall have successfully performed the test to ensure that the pipe is in satisfactory condition.

5. Any visible leakage detected shall be corrected by the Contractor regardless of the allowable pressure change specified above. Should the tested section fail to meet the

pressure test successfully as specified, the Contractor shall, at no additional expense to the Parks, locate and repair the defects and then retest the pipeline.

6. Test shall be made with the hydrant auxiliary gate valves open and pressure against the hydrant valve. Each valve shall be tested by closing each in turn and relieving the pressure beyond. This test of the valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked. The Contractor shall verify the pressure differential across the valve does not exceed the rated working pressure of the valve.

7. Defective materials or workmanship, discovered as a result of hydrostatic field test, shall be replaced by the Contractor at no additional expense to the Parks. Whenever it is necessary to replace defective material or correct the workmanship, the hydrostatic test shall be re-run at the Contractor's expense until a satisfactory test is obtained.

3.9 CLEANING

A. Clean interior of piping systems thoroughly before installing.

B. Maintain pipe in clean condition during installation.

C. Before joining piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.

D. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.

E. At completion of work and prior to final acceptance, thoroughly clean work installed under these specifications. Clean fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes.

3.10 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with this Section.

B. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest at no cost to the Owner.

3.11 DISINFECTION OF WATER PIPING SYSTEM

A. Refer to Section 33 13 00.

END OF SECTION

SECTION 33 11 13 – POTABLE WATER SUPPLY WELLS (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes work for rehabilitation of the well and for replacing the well pump and appurtenances, including:

1. Well pump
2. Well pump motor
3. Riser pipe
4. Check valves
5. Torque arrestors
6. Sounding tubes

B. Related Requirements:

1. Section 33 00 00 "Pipe & Pipe Fittings: General Statement (Water Supply)."

1.2 REFERENCES

A. American Water Works Association (AWWA):

1. AWWA A100 – Water Wells
2. AWWA C654 – Disinfection of Wells

B. National Sanitation Foundation (NSF International):

1. NSF 61 - Drinking Water System Components – Health Effects

C. Water System Design Manual, Washington State Department of Health, Current Edition.

1.3 QUALIFICATIONS

A. The work of this section shall be performed by a licensed well driller in the state of Washington.

1.4 SUBMITTALS

A. Section 01 33 00 “Submittal Procedures” Shop Drawings, Product Data, and Samples.

B. Product Data: Submit pump curve defining full range of pump performance, efficiency, and horsepower.

C. Manufacturer’s Installation Instructions: Submit installation instructions for pumps and accessories.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 33 00 “Submittal Procedures” Shop Drawings, Product Data, and Samples.

B. Section 01 78 23 “Operation and Maintenance Data.”

C. Section 01 78 39 “Project Record Documents.”

D. Operation and Maintenance Data: Submit spare parts list, exploded assembly views, and recommended maintenance intervals.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA A100.

B. Perform Work in accordance with Drawings, Washington State Department of Ecology, Washington State Department of Health, State, and County standards.

C. All components that come in contact with potable water must be approved for use with potable water by the National Sanitation Foundation (NSF), now called NSF International.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept equipment on site in shipping containers with labeling in place. Inspect for damage.

B. Protect equipment from entry of foreign materials and other damage by temporary covers.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials coming into contact with potable water shall be NSF 61 certified.

2.2 WELL PUMP

A. Well pump shall meet the following requirements:

1. Submersible style pump
2. 375 ft of head at 120 gpm
3. 4-inch motor or 6-inch motor that fits in existing well casing

B. Manufacturer:

1. Grundfos SP160S150-9
2. Engineer approved equal

2.3 WELL PUMP MOTOR

A. Motor shall be compatible with well pump
B. 3-phase power and voltage compatible with site power and VFD Controller

2.4 RISER PIPE

A. Riser Pipe: Riser pipe shall be 3” galvanized steel.

2.5 CHECK VALVES

A. Material: stainless steel
Diameter: Match riser pipe

B. Manufacturer:

1. Flowmatic 80SS
2. Engineer approved equal

2.6 TORQUE ARRESTORS

A. Material: Styrene-butadiene rubber (SBR)
Diameter: Match riser pipe

B. Manufacturer:

1. Boshart Industries spyder type torque arrestor.
2. Engineer approved equal

2.7 SOUNDING TUBE

A. Shall be constructed of 1” inner diameter (ID) polyethylene (PE) for well depth probe. Tube shall extend from top of pump to top of casing. Provide a second sounding tube if space is available in the casing.

PART 3 - EXECUTION

3.1 GENERAL

A. Install new well pump and appurtenances after performing well rehabilitation.

3.2 INSTALLATION

A. Pump/Motor

1. Install pump and motor in accordance with the manufacturer’s recommendations. Pump depth should match current installation depth, with pump intake no lower than the top of the screen.

3.3 CLEANING

A. The Contractor shall leave all affected areas in existing or better conditions.

B. The Contractor shall remove all remnants of construction following well pump replacement.

3.4 WELL REHABILITATION

A. Well rehabilitation work shall include the following:

1. Pre-rehabilitation pump test

a. Measure and record static water level in well before conducting pump test.

b. Conduct 30-minute constant rate pump test (with existing well pump). Measure and record drawdown, pumping water level, and well production rate at the following intervals. Drawdown and pumping water level measurements shall be made to the nearest 0.01 feet.

1) 0 to 10 minutes from start of pumping: every 30 seconds
2) 10 to 15 minutes from start of pumping: every 1 minute
3) 15 to 30 minutes from start of pumping: every 2 minutes

c. Measure and record water level recovery in well. Record water level in well to the nearest 0.01 foot at the following intervals:

1) 0 to 10 minutes from start of pumping: every 30 seconds
2) 10 to 15 minutes from start of pumping: every 1 minute
3) 15 minutes from start of pumping to recovery within 95% of static water level: every 2 minutes

2. Document make, model, and horsepower of existing submersible well pump when removed. Document riser pipe length and diameter. Provide information to Owner and Engineer.

3. Well inspection and well rehabilitation plan

a. Inspect well to identify potential factors that may be impacting well performance.

b. Develop plan for well rehabilitation to address factors identified during inspections. Possible rehabilitation approaches include brushing of casing interior and well screen, acid cleaning, jetting/surging for well redevelopment, and chlorine disinfection.

c. Discuss plan with Owner and Engineer to confirm scope of well rehabilitation.

4. Perform well rehabilitation

a. Perform the scope of work confirmed with Owner and Engineer.

5. Post-rehabilitation pump test

a. Follow same procedure as pre-rehabilitation pump test, except that test will be performed with new well pump. Submit pump test information to Engineer to confirm capacity of well.

3.5 DISINFECTION OF WELL

A. Well shall be disinfected according to the requirements of AWWA C654 – Disinfection of Wells.

3.6 FIELD QUALITY CONTROL

A. Operation Test

1. Verify pump operation after installation by operating pump in presence of engineer. Check pump’s maximum rate of flow, shut off pressure, and vibration.

B. All materials used in the well shall be new and free of defects.

END OF SECTION 33 11 13

SECTION 33 12 16 – WATER UTILITY DISTRIBUTION VALVES (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Valves
2. Valve Boxes
3. Pressure Sustaining Solenoid Valve
4. Fire Hydrants
5. Meters and Accessories

B. Related Sections:

1. Section 31 00 00 – Earthwork
2. Section 33 11 00 – Water Utility Distribution Piping (Water Supply)
3. Section 33 13 00 – Disinfecting Water Utility Distribution (Water Supply)

C. This work does not include water main and service work within the Aquatic Center site. Water piping work within the Aquatic Center site shall be in accordance with Section 33 10 00 – Water Service.

1.2 REFERENCES

A. American Water Works Association:

1. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
2. AWWA C509 - Resilient-Seated Gate Valves for Water-Supply Service.
3. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.

B. National Sanitation Foundation (NSF International):

1. NSF 61 - Drinking Water System Components - Health Effects

C. Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications), latest edition.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedure – Shop Drawings, Product Data, and Samples.

B. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 33 00 - Submittal Procedures – Shop Drawings, Product Data, and Sample.

B. Section 01 78 50 – Operation and Maintenance Data.

C. Section 01 78 90 – Project Record Documents.

D. Project Record Documents: Record actual locations of valves.

E. Provide Operation and Maintenance Data for valves; include illustrations, installation instructions, maintenance instructions and parts lists.

F. Manufacturer's Certificates: Submit Statement of Compliance, supporting data, from material suppliers attesting that valves and accessories provided meet or exceed AWWA Standards and specification requirements.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with the project plans, AWWA, State, and County standards.

1.6 QUALIFICATIONS

A. Manufacturer: company specializing in manufacturing Products specified in this section with minimum three years of experience.

B. Installer: Company specializing in performing work of this section with minimum three years of experience.

1.7 DELIVERY, STORAGE AND HANDLING

A. Prepare valves and accessories for shipment according to AWWA Standards and seal valve and ends to prevent entry of foreign matter into product body.

B. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in adjacent areas.

1.9 MAINTENANCE MATERIALS

A. Section 01 78 50 – Operation and Maintenance Data.

B. Furnish two (2) tee wrenches (valve keys) to Owner; required length.

PART 2 - PRODUCTS

2.1 RESILIENT WEDGE GATE VALVES

A. Manufacturers:

1. Mueller Company
2. Kennedy Valve Co.
3. M&H Valve Co.
4. Clow Eddy - Iowa
5. American Flow Control
6. Substitutions: Section 016700 – Product Requirements.

B. Furnish materials.

C. Resilient Wedge Gate Valves: AWWA C509; iron body, bronze or ductile iron.

1. Resilient seats.
2. Stem: Non-rising bronze stem.
3. Operating Nut: Square; open counterclockwise unless otherwise indicated.
4. Ends: Flanged, mechanical joint or bell end connections.
5. Coating: AWWA C550; interior/exterior.
6. Sizes 12-inch diameter and smaller: 200 psig.

2.2 VALVE BOXES

A. 12-inch diameter valves and smaller: Domestic cast iron, two-piece, screw type, as manufactured by Tyler Union or approved equivalent.

B. Cast iron lid, marked "Water".

C. Valve boxes and lids shall be traffic (H-20) rated.

2.3 VALVE ACCESSORIES

A. Concrete for Thrust Restraints/Thrust Blocks: Concrete type specified on project plans.

B. Concrete for grouting of vault lids: Concrete be in conformance with WSDOT Specification Section 6-02.

2.4 PRESSURE SUSTAINING SOLENOID VALVE

A. See Section 33 09 10 Instrumentation and Control for Water Utilities (Water Supply)" for description of pressure sustaining solenoid valve operation.

B. Operation: valve shall go into pressure sustaining mode when solenoid is energized. While in pressure sustaining mode, valve shall modulate open/close to maintain a pre-set pressure on the upstream side of the valve. See plans for pressure setting. Valve shall be closed when solenoid is not energized.

C. Valve requirements:

1. Valve body material: Epoxy coated ductile iron
2. Normally closed solenoid (when solenoid is not energized)
3. Opening and closing speed control
4. Integral pressure gauge on upstream side of valve.
5. Size: 3-inch
6. Maximum headloss through valve: 4 psi at 120 gpm

D. Manufacturers:

1. Bermad 730-55 EN Series
2. Engineer approved equal

2.5 FIRE HYDRANTS

A. Fire hydrants shall be a Clow Model Medallion with 5.25 in. hydrant valve, a 4.5 in. NST port with 5 in Storz adapter, and (2) 2.5 in. NST ports. Installed as specified in the Drawings.

2.6 AIR RELEASE VALVES

A. Valves must comply with ANSI/AWWA C512.

B. Valves shall be cast iron or ductile iron and have a 1-inch NPT inlet.

2.7 BLOW OFF ASSEMBLIES

A. Blowoff assemblies shall be constructed at the locations shown on the Drawings and in accordance with the pertinent detailing included in the Drawings.

2.8 POLYETHYLENE TUBING

A. Fittings used for service connections shall be made of bronze or brass alloy.

B. Fittings used for polyethylene tubing shall be either compression or stab type. Stab type fittings shall utilize an internal grip ring and O ring seal. Stainless steel liners shall be used when utilizing compression fittings on polyethylene tubing.

2.9 SERVICE FITTINGS

C. Polyethylene tubing shall meet the requirements of AWWA C901. Tubing shall be high molecular mass with a 300 psi rating. Tubing shall be SDR 7 (copper pipe size).

2.10 BRONZE NIPPLES AND FITTINGS

A. Bronze threaded nipples and fittings shall meet the requirements of ANSI B16.15, ASA 125 pound class.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

B. Determine exact location and size of valves from Drawings; obtain clarification and directions from Engineer prior to execution of work.

C. Verify invert elevations of existing work prior to excavation and installation of valves.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify, and protect utilities to remain from damage.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

1. Notify Owner not less than 3 days in advance of proposed utility interruption.
2. Do not proceed without written permission from the Owner.

D. Perform trench excavation, backfilling and compaction in accordance with Section 31 00 00 – Earthwork.

3.3 INSTALLATION

A. Install valves in conjunction with pipe laying; set valves plumb.

B. Provide buried valves with valve boxes installed flush with finished grade.

C. Install insulation to outside of valve boxes.

D. Install Work in accordance with the project plans, AWWA, State, and County standards.

3.4 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.5 FIELD QUALITY CONTROL

A. Section 01 45 00 - Quality Control and Section 01 82 00 – Demonstration and Testing.

B. Perform pressure test on site water distribution system in accordance with Section 33 11 00, Site Water Utility Distribution Piping.

END OF SECTION

SECTION 33 13 00 – DISINFECTING WATER UTILITY DISTRIBUTION (WATER SUPPLY)

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes disinfection of potable water distribution and transmission system; and testing and reporting results.

B. Related Sections:
   1. Section 33 11 00 – Water Utility Distribution Piping (Water Supply)

1.2 REFERENCES

A. Washington State Department of Health.

B. American Water Works Association:
   1. AWWA B300 - Hypochlorites
   2. AWWA B301 - Liquid Chlorine
   3. AWWA B302 - Ammonium Sulfate
   4. AWWA B303 - Sodium Chlorite
   5. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances
   6. AWWA C651 - Disinfecting Water Mains

1.3 CLOSEOUT SUBMITTALS

A. Section 01 33 00 – Submittal Procedure – Shop Drawings, Product Data, and Samples.

B. Disinfection Report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Name of person collecting samples.
   5. Initial and 24-hour disinfectant residuals in treated water in parts per million for each outlet tested.
   6. Date and time of flushing start and completion.
   7. Disinfectant residual after flushing in parts per million for each outlet tested.

C. Bacteriological Report:
   1. Date issued, project name, and testing laboratory name, address, and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
   5. Coliform bacteria test results for each outlet tested.
   6. Certify water conforms, or fails to conform, to bacterial standards of the Washington State Department of Health.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651.

B. Perform Work in accordance with the Drawings, State, and County standards.

1.5 QUALIFICATIONS

A. Water Treatment: Company must have documented experience in disinfecting potable water systems specified in this section with minimum three years of experience.

B. Testing Laboratory: Company specializing in testing potable water systems, specifically bacteriological testing, certified by the State of Washington.

PART 2 – PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, or AWWA B303, Sodium Chlorite.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

B. Verify piping system has been cleaned, inspected, and pressure tested.

C. Perform scheduling and disinfecting activity with start-up, water pressure testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.2 INSTALLATION

A. Provide and attach required equipment to perform the Work of this section.

B. Perform disinfection of water distribution system and installation of system and pressure testing. Refer to Section 33 11 00.

C. Introduce treatment into piping system.

D. Maintain disinfectant in system for 24 hours.

E. Flush, circulate, and clean until required cleanliness is achieved.

F. Replace permanent system devices removed for disinfection.

3.3 FIELD QUALITY CONTROL

A. Section 01 45 00 - Quality Control and Section 01 82 00 – Demonstration and Training.

B. Disinfection, Flushing, and Sampling:

1. Disinfect pipeline installation in accordance with AWWA C651.
2. Upon completion of retention period required for disinfection, flush pipeline until chlorine concentration in water leaving pipeline is no higher than that generally acceptable for domestic use.
3. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to chlorinated water to neutralize chlorine residual remaining in water.

C. After final flushing and before pipeline is connected to existing system, or placed in service, employ an approved independent testing laboratory to sample, test and certify water quality suitable for human consumption.

END OF SECTION

33 13 13 – WATER RESERVOIR DISINFECTION (WATER SUPPLY)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes:

1. Water tank disinfection.
2. Bacteriological testing.

1.2 REFERENCES

A. American Water Works Association:

1. AWWA C652 - Disinfection of Water Storage Facilities.

1.3 SUBMITTALS

A. Section 01 33 00 – Submittal Procedure – Shop Drawings, Product Data, and Samples.

B. Disinfection Procedure: Submit procedure description including type of disinfectant to be used and calculations indicating quantities of disinfectants required to produce specified chlorine concentration in accordance with Section 3 and 4 of AWWA C652.

C. Test Reports: Indicate results of bacteriological and residual chlorine laboratory test reports.

D. Manufacturer’s Certificate:

1. Certify disinfectants meet or exceed AWWA Standards requirements.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 33 00 - Submittal Procedures – Shop Drawings, Product Data, and Sample.

B. Section 01 78 50 – Operation and Maintenance Data.

C. Section 01 78 90 – Project Record Documents

D. Project Record Documents: Record actual location.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with the Drawings, State, and County standards.

B. Perform Work in accordance with AWWA C652.

1.6 DELIVERY, STORAGE, AND HANDLING

B. Store disinfectants in cool, dry place away from combustibles such as wood, rags, oils and grease.

C. Handle disinfectants with caution; protect skin and eyes from contact; avoid breathing vapors; wear gloves, aprons, goggles, and vapor masks.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Furnish personnel working inside tank during disinfection with equipment to comply with Federal and State regulations for work conducted in hazardous atmosphere.

B. Neutralize disinfectant solution before disposal.

C. Legally dispose of disinfection solution.

D. Repair damage caused by disinfectant solution and disinfection procedures.

PART 2 - PRODUCTS

2.1 DISINFECTANTS

A. Chlorine Forms: In accordance with AWWA C652, Section 3.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

B. Conduct inspection of tank interior before beginning disinfection.

1. Verify tank is clean and free of polluting materials.
2. Verify tank pipe and vent connections are properly made and clear of obstructions.
3. Verify paint is thoroughly cured in accordance with paint manufacturer's instructions.

3.2 PREPARATION

A. Protect aquatic life and vegetation from damage from disinfectant solution purged from tank.

3.3 APPLICATION

A. Use any one or a combination of the three methods for disinfecting tank specified in Section 4 of AWWA C652:

1. Chlorination Method 1.
2. Chlorination Method 2.
3. Chlorination Method 3.

3.4 FIELD QUALITY CONTROL

A. Section 01 45 00 - Quality Control, 01 82 00 – Demonstration and Training.

B. Collect samples of water from filled tank for bacteriological analysis in accordance with Section 4.4 of AWWA C652; take inlet and outlet water samples.

C. Test water samples per State of Washington Department of Health including but not limited to bacterial contamination and residual chlorine.

D. When water samples fail to meet State of Washington Department of Health standards for potable water perform the following corrective measures until water quality conforms to State Health Standards:

1. Inlet and Outlet Water Sample Failure: Eliminate source of contamination in water supply, repeat disinfection, and retest water quality.
2. Outlet Water Sample Failure: Repeat disinfection, and retest water quality.

END OF SECTION

SECTION 33 14 17 - WATER UTILITY SERVICE LATERALS (WATER SUPPLY)

PART 1 – GENERAL

1.1 DESCRIPTION

A. The work of this Section includes installing 2-inch and smaller service connections from the main to maintenance facilities, including associated meter setter, meter, meter box, and fittings.

B. This work does not include water main and service work within the Aquatic Center site. Water piping work within the Aquatic Center site shall be in accordance with Section 33 10 00 – Water Service.

1.2 SUBMITTALS

A. As specified Section 01 33 00 “Submittal Procedures.”

B. Product Data: Submit data on service connection accessories including piping, fittings, meter setters, meters, meter boxes and associated appurtenances. Include relevant illustrations, installation instructions, maintenance instructions, and parts lists.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

PART 2 – PRODUCTS

2.1 SADDLES

A. Saddles shall be ductile iron, bronze, brass, or stainless steel.

B. Saddles used for ¾- and 1-inch services shall be single strap and may be either AWWA tapered thread or female iron pipe thread outlet. Saddles used for 1½- and 2-inch services shall be double strap and shall be female iron pipe thread outlet. Saddles used on PVC pipe shall be formed for PVC pipe and have flat, stainless steel straps.

C. Saddles shall be designed for use with the pipe material being used (i.e., PVC, HDPE, Ductile Iron, etc.).

2.2 CORPORATION STOPS

A. Corporation stops shall be made of bronze or brass alloy. Corporation stops shall have either AWWA tapered thread or male iron pipe thread inlets and outlet connections compatible with either copper or polyethylene tubing. Thread patterns for the saddle outlet and corporation stop inlet shall be the same.

2.3 POLYETHYLENE TUBING

A. Polyethylene tubing shall meet the requirements of AWWA C901. Tubing shall be high molecular mass with a 200 psi rating. Tubing shall be SDR 7 (copper pipe size).

2.4 SERVICE FITTINGS

A. Fittings used for service connections shall be made of bronze or brass alloy.

B. Fittings used for polyethylene tubing shall be either compression or stab type. Stab type fittings shall utilize an internal grip ring and O ring seal. Stainless steel liners shall be used when utilizing compression fittings on polyethylene tubing.

2.5 METER SETTERS

A. Meter setters shall be manufactured and tested in accordance with all applicable parts of AWWA C800.

B. Meter setters shall have an inlet angle ball valve, outlet angle dual check valve, measure 12 inches in height, and shall have inlet and outlet threads compatible with fittings connecting to service pipes.

C. Meter setters shall have meter saddle nuts for installation and removal of the meter.

2.6 BRONZE NIPPLES AND FITTINGS

A. Bronze threaded nipples and fittings shall meet the requirements of ANSI B16.15, ASA 125-pound class.

2.7 METER BOXES

A. Meter boxes and covers located in the non-traffic areas shall be constructed of either reinforced concrete or high-density polyethylene. High-density polyethylene meter boxes and covers shall have a tensile strength conforming to ASTM D638. Meter box covers shall include a reading lid.

B. Meter boxes located in traffic areas shall be constructed of reinforced concrete, cast iron, or ductile iron. Traffic covers shall be constructed of aluminum, steel, cast iron, or ductile iron. Meter boxes and covers shall be designed for H-20 loading.

2.8 METERS

A. Meters shall be new and complete, front proof units conforming in all details to AWWA C700 for cold water displacement type meters or AWWA C708 for cold water multi-jet type meters.

B. Meters shall be guaranteed to operate normally and accurately, without leakage or damage to any part at a constant working pressure of 150 psi.

C. Meters shall not be digital display type.

D. Meter model shall be submitted to and approved by the Engineer.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

B. Determine exact location and size of service laterals from Drawings; obtain clarification and directions from Project Representative prior to execution of work.

C. Verify invert elevations of existing work prior to excavation and installation of new work.

3.2 PREPARATION

A. Locate, identify, and protect utilities to remain from damage.

B. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

1. Notify the Owner not less than 3 days in advance of proposed utility interruption.
2. Do not proceed without written permission from the COR.

C. Perform trench excavation, backfilling, and compaction in accordance with Section 31 00 00 - Earthwork.

3.3 INSTALLATION

A. Install service laterals in conjunction with laying new pipe as necessary.

B. Install Work in accordance with the project plans, AWWA, State, and County standards.

3.4 DISINFECTION OF WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00 “Disinfecting Water Utility Distribution Piping.”

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements” and Section 01 77 00 “Closeout Procedures.”

B. Perform pressure test on site water distribution system in accordance with Section 33 11 00 “Water Utility Distribution Piping.”

END OF SECTION 33 14 17

33 16 13 – ABOVE GROUND CONCRETE WATER RESERVOIR (WATER SUPPLY)

PART 1 - GENERAL

1.1 DESCRIPTION

A. Section includes:

1. Contractor designed, reinforced concrete, cast-in-place water storage tank
2. Tank appurtenances
3. Piping connections

B. Contractor shall furnish all labor, materials, equipment, and incidentals required to design, fabricate, deliver, erect, and test each tank. Each tank structure shall include a foundation and other accessory components as shown on the Contract Drawings and described herein.

1.2 REFERENCES

A. Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications), latest edition.

B. American Concrete Institute

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
3. ACI 305R - Hot Weather Concreting.
4. ACI 306R - Standard Specification for Cold Weather Concreting.
5. ACI 309R - Standard Guide for Consolidation of Concrete.
6. ACI 318 - Building Code Requirements for Structural Concrete.
7. ACI 347 - Guide to Formwork for Concrete.
8. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures
9. ACI 350.3 - Seismic Design of Liquid-Containing Concrete Structures

C. American Society for Civil Engineers:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

D. ASTM International:

1. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
2. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
3. ASTM A821/A821M - Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Tanks.
4. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
5. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
6. ASTM C33 - Standard Specification for Concrete Aggregates.
7. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
8. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

9. ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
10. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
11. ASTM C143/A143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
12. ASTM C150 - Standard Specification for Portland Cement.
13. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
14. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
15. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
16. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
17. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
18. ASTM C535 - Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
19. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
20. ASTM D1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
21. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications.
22. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

E. American Water Works Association:

1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C115 - Standard for Flanged Ductile-Iron Pipe with Threaded Flanges.
4. AWWA C150 - Standard for Thickness Design of Ductile-Iron Pipe.
5. AWWA D110 - Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks
6. AWWA D115 - Circular Prestressed Concrete Water Tanks With Circumferential Tendons

F. American Welding Society:

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

G. Concrete Reinforcing Steel Institute:

1. CRSI - Manual of Standard Practice.

H. Corps of Engineers:

1. CRD C572 - Corps of Engineers Specification for Waterstops and Other Preformed Joint Materials for Civil Works Structures.

I. Federal Specifications (FS):

1. TT-S-00227E - Sealing Compound: Synthetic Rubber Base, Single Component, Chemically Curing (for Calking, Sealing, and Glazing in Building Construction).

J. Society for Protective Coatings:

1. SSPC SP 10 - Near-White Blast Cleaning.

K. National Sanitation Foundation:

1. NSF 61 - Drinking Water System Components - Health Effects

L. “Recommended Standards for Water Works”, latest edition, by Great Lakes Upper Mississippi Board of State Public Health and Environmental Managers.

M. International Building Code (IBC).

1.3 DESIGN REQUIREMENTS

A. The reservoir contractor shall be responsible for the reservoir design and the design shall meet all State, Federal, and local requirements for domestic water storage. The reservoir contractor shall be responsible for obtaining the required building permit from the Island County Building Department.

B. Design Criteria:

1. Soil Bearing: Refer to the Geotechnical Investigation Report. This information should be made available to the engineer performing the site/soils analysis for his use in making a determination regarding site suitability and reservoir design.
2. Engineer: The reservoir design shall be fully developed and provided by the contractor and all drawings and design data shall be stamped and certified by a registered engineer currently licensed in the State of Washington.
3. Structural Design: The design of the reservoir shall be in accordance with the most current edition of the following codes: IBC-2015, ASCE 7, ACI 318, ACI 350, ACI 350.3, AWWA D-110 and AWWA D-115.
4. Design Loads:

    a. Seismic – The reservoir, including the foundation slab, shall be designed to resist seismic forces per IBC & ASCE 7, with seismic criteria per Zip Code, I=1.5, and W=weight of concrete plus full contents. The reservoir base shall be sized to not exceed the soil bearing capacities determined for the site.
    b. Wind – The reservoir shall be designed for a basic wind speed of 115 mph (exposure D) per IBC & ASCE 7 current edition. Empty, the reservoir shall have a minimum factor of safety of 4 against overturning and 3 against sliding (coefficient of friction assumed at 0.35 or as provided by the soil analysis).
    c. Snow Load – The roof shall be designed for a minimum snow load of 45 psf, or per IBC, or local code; whichever is higher.
    d. Hydraulic Load – Hoop steel stresses shall not exceed an average of 12,000 psi at full volume, and all bars shall be at the smallest practical diameter in order to maintain maximum bonding areas.
    e. Soil Bearing Pressure – Reservoir static loading shall be uniformly distributed by the base. Seismic soil loading may be distributed as a triangular wedge under a circular base or an octagonal base of equal section modules.

5. Hand Railings: Withstand 200 pounds applied in any direction on top rail with no permanent set, cracking or failure of welds.

1.4 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedure – Shop Drawings, Product Data, and Samples.

B. Shop Drawings and Product Data: Signed and sealed by professional engineer.

1. Include details of all tank components (see Product Data).
2. Include details of reinforcing steel, joint design, concrete mix design.
3. Include details of all penetrations and waterstop measures of the penetrations.

C. Product Data: Submit manufacturer's product literature including catalog information, dimensions, materials, instructions for installation and use, and application rates for:

1. Waterstops.
2. Joint Filler.
3. Bond Breaker.
4. Curing Compound.
5. Vibration Equipment.
6. Bearing Pads.
7. Joint Sealant.
8. Roof Hatch.
9. Roof Ventilator.
10. Ladders and Railings.
11. Piping.
12. Couplings.
13. Inlets, outlets, drains, and overflows.

D. Design Data: Submit structural calculations for tank and tank foundation, signed and sealed by professional engineer.

E. Building Permit: Submit a copy of the approved Building Permit obtained from Island County.

F. Test Reports:

1. Submit reports of slump tests, air content tests, strength tests and any special inspections as required by structural engineer or Island County.

G. Manufacturer’s Certificate: Certify products meet or exceed State, Federal, and local requirements for the following:

1. Non-prestressed reinforcing steel.
2. Non-prestressed welded steel wire fabric.
3. Concrete mix design.
4. Concrete mix ingredients, including admixtures.
5. Concrete batch tickets in accordance with ASTM C94/C94M with the following additional information:

a. Type, name, and quantity of admixtures.
b. Type, brand, and quantity of cement.
c. Total water content by producer.
d. Maximum size of aggregate.
e. Weights of fine and coarse aggregate.
f. Indicate ingredients are as previously certified.

6. Pipe, pipe fittings, joints, joint gaskets, lubricants, and coatings.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 78 50 – Operation and Maintenance Data.

B. Section 01 78 90 – Project Record Documents.

C. Building Permit Final Inspection/Approval: Provide approved final inspection report for the reservoir installation.

D. Project Record Documents: Record actual location layout and final configuration of water storage tank.

1.6 QUALITY ASSURANCE

A. Design and construct concrete tank in accordance with AWWA D110 and AWWA D115.

B. Perform Work in accordance with the Island County Building Department, International Building Code, Washington State Department of Health, Island County Public Health Department, structural engineer, and Owner standards.

1.7 QUALIFICATIONS

A. Manufacturer/Installer: Company specializing in performing work of this section shall be required to prove experience in having installed a minimum of ten similar water reservoirs within the previous five years.

B. Design concrete water storage tank under direct supervision of Professional Engineer experienced in design of this work and licensed in State of Washington.

C. Installation shall be executed by a qualified and experienced erection crew, trained and certified by the tank manufacturer.

1.8 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Reinforcing Steel:
   1. For reinforcing steel fabricated on-site, ship from mill in bundles, limited to one size and length, tagged with waterproof tag showing name of mill, heat number, grade and size of bars, and identifying number.
   2. For reinforcing steel fabricated off-site, deliver in bundles identified as to structure and shop drawing number; identify each individual bar with waterproof tag showing grade, size and bar mark from shop drawings.
   3. Protect reinforcing steel and wire fabric from damage and from dirt, oil, grease, other foreign matter, and rust-causing conditions.
   4. Do not store reinforcement in direct contact with ground.

B. Concrete Ingredients:

   1. Handle, control and store concrete materials in accordance with ACI 304.

1.10 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.11 COORDINATION

A. Coordinate work, including piping for water system, with Project Representative.

1.12 MAINTENANCE MATERIALS

A. Section 01 78 50 – Operation and Maintenance Data.

PART 2 – PRODUCTS

2.1 GENERAL

A. All materials inside the tank that can come in contact with potable water shall be NSF-61 certified.

B. All required tank materials and principal appurtenances shall be supplied by the tank manufacturer.

2.2 CONCRETE WATER STORAGE TANK

A. Manufacturers:
1. Baker Silo, LLC. or approved equivalent.

2.3 CONCRETE

A. Materials:

1. Portland Cement: Cement used shall be standard Portland Cement, Type 1. It shall contain a minimum of 6 sacks cement per cubic yard and shall have a 28-day minimum compressive strength of 4,500 psi.
2. Aggregate:

a. Maximum aggregate size shall be 1 ½” for the base unless otherwise noted.
b. Maximum aggregate size on all formed surfaces 6” or less in thickness shall be ¾”. In the event that ¾” rock is not available, the closest available size approximating ¾” shall be used.

3. Slump: Maximum slump shall generally be 6 to 6 ½”. If additives, such as air entrainment, water reducing agents, or super plasticizers are used, the allowable slump may be correspondingly higher. Not to exceed 9”.
4. Air Entrainment: 4 ½ - 7 ½ %
5. Water: Potable.
6. Admixtures:

a. Air entraining Admixture: ASTM C260
b. Other Admixtures: ASTM C94/C94M
c. Admixtures containing calcium chloride or soluble chlorides are not permitted.
d. Maximum Free Chloride Ions: 0.06 percent of weight of cement in concrete mix.

7. Curing: After placement, the concrete shall be sprayed with an approved curing compound.

8. Testing: A minimum of 6 test cylinders shall be cast for each pour. The cylinders shall be tested by a certified testing lab and each set of cylinders shall be tested per the following:

   a. One Cylinder at 7 days.
   b. Three Cylinders at 28 days.
   c. Two Cylinders on hold if needed.

2.4 REINFORCEMENT

A. General:

1. All reinforcing steel shall conform with ASTM specification A615, Grade 60, having a minimum yield stress of 60,000 psi.
2. Bars shall be free from loose scale, dirt, grease, or any other substance which will impair the bond between the concrete and reinforcing bars.
3. Tie Wire – Tie wire shall be steel, black annealed, 16 gauge minimum.

2.5 WATER STOP

A. General:

1. Waterstop shall be installed in all construction joints below water level.
2. Waterstop shall be spliced per manufacturer's recommendations or lapped a minimum of 12".
3. Waterstop shall be 3/16" x 4" for reservoirs under 30' in height and shall be 3/16" x 6" for reservoirs 30' and over in height.
4. Waterstop shall be "Greenstreak" #703, or approved equal, for base to wall connection.
5. Waterstop RX 101 (Bentonite Swellstop) shall be used in wall cold joints.

2.6 ACCESSORIES

A. All accessories shall comply with "Recommended Standards for Water Works," latest edition, by Great Lakes Upper Mississippi Board of State Public Health and Environmental Managers.

B. Access Hatch: All hatches shall be installed in the roof, shall be constructed from a minimum of 14-gauge, galvanized metal, shall include provisions for a padlock and shall have weather stripping where the hatch cover meets the hatch. Roof hatch size shall be 2'-6" x 3'.

C. Air Vent: All vents shall be a minimum of 8", screened with non-corrosive screen (24 mesh) and installed in the center of the roof. The vent shall be designed to prevent the entrance of surface and rainwater, birds, animals, insects and dust as much as is feasible and still vent properly.

D. Overflow: All overflows shall be 4" unless otherwise noted, screened with non-corrodible screen and installed in the sidewall immediately under the roof. Overflows shall be provided with a pipe thread at the exterior wall surface and piped to ground level with PVC pipe and fittings. An air gap shall be provided on the overflow to prevent back siphoning into the reservoir. The end of the pipe at the air gap shall be covered with 24 mesh screen to prevent the entrance of birds, animals, and insects as much as feasible. Galvanized steel brackets fabricated from ¼" x 1 1/2" flat bar mounted to the reservoir wall with 3/8" x 3 ¾" anchor bolts shall be provided at such intervals as will adequately stabilize the overflow pipe, approximately every 7'.

E. Ladders: The ladders shall be hot dip galvanized after fabrication. A minor amount of welding may be necessary after galvanizing. Welds shall then be painted with a cold galvanizing compound. Interior ladders shall extend the full height of the reservoir. Any ladder over 20' in length shall be equipped with a "Lad-Saf" Flexible Cable Safety System (Galvanized) or equal per State of Washington General and Health Standards, WAC 296-24-81009, Special Requirements. (5).

F. Handrail on Roof: Aluminum or galvanized three feet high or as indicated on Drawings; conform to OSHA Standards.

G. Water Level Indicator: Half travel indicators shall consist of a nominal 1" x 6" white PVC indicator board with black numerals and gradation markings, stainless steel float, weatherproof pulleys and 1/16" stainless steel cable.

H. Control Wire Blockouts: Unless otherwise shown on the plans, (2) 2" galvanized pipes shall be cast into the roof adjacent to the access hatch for mounting the water system controls onto the reservoir.

2.7 CURE SPRAY, FORM RELEASE AGENTS, AND COATINGS

A. General:

1. All cure sprays, form release agents and coatings used on surfaces that will come into contact with the water to be stored in the reservoir must have NSF approval for use with potable water.

2.8 FLEXIBLE PIPE COUPLINGS

A. Factory pre-assembled couplings for plain-end pipe; double-ring, wedge-gasketed, flared-sleeve type mechanical joint, AWWA C111.

2.9 SOURCE QUALITY CONTROL

A. Section 01 45 00 – Quality Control.

B. Concrete Testing:

1. Perform compressive strength, slump, and air content tests for each day of pouring concrete; cast 6 cylindrical strength test specimens for each test set.
2. Test one cylinder at 7 days; test three cylinders at 28 days; hold remaining cylinders for testing when other cylinders are damaged prior to testing.
3. Determine concrete strength from standard test specimens made and cured according to ASTM C31/C31M and ASTM C172, and tested in accordance with ASTM C39/C39M.
4. Determine air content in accordance with ASTM C231 or C173/C173M, as applicable.
5. Determine slump in accordance with ASTM C143/C143M.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of existing conditions before starting work.

B. Verify elevations and grading for water storage tank and location of water storage tank.

C. Verify compacted subgrade is dry and is ready to support imposed loads.

D. Verify drainage structure frames, manhole frames, and any other utility access frame/lids are installed in correct position and elevation.

3.2 PIPING

A. General:

1. All pipes extending into the reservoir shall be installed prior to the start of reservoir construction and shall be stubbed up out of the ground so that the reservoir base slab can be poured around the pipes. Pipes 4” and larger shall be ductile iron pipe with mechanical joint fittings. Pipes smaller than 4” shall be galvanized with threaded fittings. Retainer glands, such as “Megalugs” shall be used for joint restraints in lieu of thrust blocks wherever applicable. Pipes must pass pressure test requirements prior to reservoir installation.

3.3 CONCRETE

A. Unless otherwise specified, conform to ACI 304, ACI 305, and ACI 306R for concrete installation requirements such as preparation, mixing, conveying, depositing, curing, and cold and hot weather requirements.

B. Concrete shall generally be placed within 90 minutes of batching. However, in extreme cases where this is not physically possible because of the distance between the job site and the ready mix plant, an approved retarding agent may be used.

C. Unless otherwise shown on the Drawings, the base shall slope to a specific drain pipe at a minimum of ¼” per foot of radius, assuming the drain pipe is near the center of the tank. Otherwise, the base should be flat. The roof shall slope form the center to the outside edge at a minimum of ¼” per foot of radius.

3.4 REINFORCEMENT

A. Non-Prestressed:

1. Cleaning and Bending: Clean metal reinforcement free of loose rust, mill scale, or other coatings capable of reducing bond.
2. Cutting and Bending:

   a. Perform cutting and bending in the shop.
   b. Bend and cut steel cold; do not bend or straighten bars in manner capable of injuring material.

3. Placement:

   a. Arrange and place reinforcement in accordance with shop drawings.
   b. Secure in position with chairs, spacers, and ties. Concrete brick may be used to support reinforcement for slabs on grade when approved by Engineer.
   c. Bending and placing shall be in accordance with “Specifications for Structural Concrete for Buildings” (ACI 318-latest edition). Laps and splices shall be staggered, and all reinforcing steel shall be accurately placed as shown on the plans. All reinforcing steel shall be firmly secured to prevent movement during the

placing of the concrete. The only exception to this shall be where dowel bars are used at the connection of the base and wall. These dowels may be installed after the concrete is placed ("wet set") as long as the depth of embedment and the location are accurately controlled, and installation is done prior to the initial setting of the concrete.

4. Splicing:

   a. Furnish reinforcing bars in full lengths as indicated on Drawings and shop drawings.
   b. Do not splice bars unless indicated on Drawings.
   c. Make splices in accordance with ACI 318; perform welding in accordance with AWS D1.4.
   d. Lap mesh reinforcement a minimum of one mesh space plus 3", and tie.

5. Concrete Cover:
   a. Provide clearance and spacing indicated on Drawings.
   b. Where no clearances are indicated, provide minimum concrete cover over reinforcement as required by IBC.

3.5 FORMWORK

A. Responsibility: Design and construction of formwork is sole responsibility of Contractor.

B. Design Criteria:

1. Design formwork system with adequate bracing, strength, and stability to ensure finished concrete within tolerances specified in ACI 347.
2. Provide formwork sufficiently tight to prevent leakage of mortar.
3. Chamfer external corners ¾".

C. Coating Forms:

1. Coat forms with bond breaker before placing reinforcing steel.
2. Do not allow excess form coating material to stand in puddles in forms or to come in contact with concrete against which fresh concrete is to be placed.
3. Clean reinforcing steel contaminated with bond breaker before placing concrete.

D. Embedded Items:

1. Clean items to be embedded in concrete free from oil or foreign matter capable of reducing bond of concrete to these items.
2. Install inserts, anchors, sleeves, and other items specified under other sections of these specifications.
3. Close ends of conduits, piping, and sleeves embedded in concrete with caps or plugs.

E. Waterstops:

1. Install waterstops in accordance with manufacturer's instructions.
2. Support and protect portion of waterstop extending beyond bulkhead during placing of concrete and subsequent removal of forms.
3. Make watertight field splices by heat-sealing. Maintain continuity of ribs and bulbs. Allow splice to cool before stressing reinforcement.
4. Repair damaged waterstops before placing concrete.

3.6 MIXING

A. Mix and deliver ready-mixed concrete in accordance with ASTM C94/C94M.

B. Do not over-mix or use concrete which is retained in mixers so long as to require additional water in excess of design mix water to permit satisfactory placing.

C. Use preparation methods capable of producing concrete with temperature not more than 90 degrees F, and not less than 50 degrees F, when placed.

D. Do not heat concrete ingredients to temperature higher than necessary to keep temperature of mixed concrete, as placed, within specified temperatures.

E. Do not heat water in excess of 90 degrees F.

3.7 CONVEYING

A. Convey concrete from mixer to final deposit by methods preventing segregation or loss of materials.

3.8 CONCRETE PLACEMENT

A. Before each wall pour, the existing concrete shall be thoroughly cleaned by pressurized water or whatever means may be necessary to remove all loose scale, oil and any foreign material that may prevent a good bond with the existing concrete.

B. In the pouring process, concrete shall not be allowed to free-fall more than 5 feet. The concrete shall be deposited in horizontal layers not to exceed 18” in depth and shall be placed as closely as possible to its final position to avoid segregation.

C. Deposit concrete as nearly as practical in its final position to avoid segregation due to rehandling or flowing; do not use vibrators to move concrete horizontally with forms.

D. Do not use retempered concrete or concrete contaminated by foreign material.

E. Plan and conduct concrete placement to ensure concrete is kept plastic and free of cold joints.

F. When continuous installation is delayed more than 45 minutes between adjacent concrete placements, install bulkhead construction joint, complete with waterstops where required.

G. Remove temporary spreaders in forms when concrete has reached elevation making spreaders unnecessary.

H. Do not commence placing when sun, heat, wind, or limitations of facilities provided prevent proper finishing or curing.

I. Discontinue concreting when descending ambient air temperature falls lower than 50 degrees F unless preparations are made and in place to heat or insulate concrete in accordance with cold weather concreting requirements.

3.9 CONSOLIDATION

A. Consolidate concrete thoroughly as concrete is placed to secure dense mass; work concrete well around reinforcement and embedded items and into corners of forms.

B. Use internal vibrators inserted vertically over entire area.

C. Vibrate all concrete with high frequency internal vibrators as it is placed. Penetrate the concrete with a sufficient number of vibrations to thoroughly work the concrete around reinforcement and embedded fixtures without separation of aggregate.

D. Vibrate until voids are eliminated, coarse aggregate is suspended in mortar, and entrapped air bubbles begin to rise to surface; concrete should move back into space vacated by vibrator.

E. Space vibrator insertions so area visibly affected by vibrator overlaps adjacent just-vibrated area by several inches.

F. Penetrate at least 6 inches into previously placed layers to bond between layers and avoid cold joints.

G. Do not use form vibrators.

H. Take care not to over-vibrate air entrained concrete; place vibrator to eliminate honeycombing but avoid excess vibrating that bleeds entrapped air from mix.

I. Do not use vibrators to transport concrete.

3.10 CONCRETE FINISHES

A. Base and Roof:

1. All slab finishes shall be a “wood float” finish only, to prevent slippery surfaces. The concrete shall be worked no more than is necessary to produce a “wood float” finish that is uniform in texture and relatively free from screed/float marks. The underside of the roof shall be a rough form finish as results for the use plywood forms.

B. Walls:

1. Steel forms shall be used on all wall pours. Forms may be built with a minimum of refinement but as a minimum must not leak excessive amounts of mortar or yield beyond specific tolerances when the concrete is vibrated. Rock pockets, honeycombed areas, form tie holes and any holes over ½” deep will be repaired. However, no grinding/repairing will be done on “fins”, projections and minor form misalignments (especially at construction joints) as long as they do not exceed the specified tolerances. No sacking or hand-rubbing will be performed on any concrete finishes.

3.11 CONCRETE PROTECTION

A. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperature and mechanical injury.

B. Maintain concrete with minimum moisture loss and relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. After concrete has hardened, loosen forms as soon as possible without damage to concrete, and run curing water continuously down inside form.

3.12 REMOVAL OF FORMS

A. Do not remove forms until members have acquired sufficient strength to support their own weight and imposed loads safely.

B. Normal elapsed time on wall form removal shall be approximately 16 hours unless low temperatures or poor weather conditions dictate otherwise. The normal elapsed time for roof form removal shall be 7 to 10 days.

C. Notify Engineer before forms are removed so examination of newly stripped surfaces may be made prior to patching.

3.13 REPAIR OF TIE HOLES AND MINOR DEFECTS

A. Allowable tolerances for concrete surfaces shall be classified as “abrupt” and “gradual”. Offsets caused by displaced or misplaced forms and form alignment shall be considered as abrupt irregularities. All other are classed as gradual irregularities. Allowable tolerances are the same for both slabs and walls and are as follows:

1. Abrupt – ½”
2. Gradual – 1”

B. Repair concrete immediately after form removal.

C. Honeycombs and small defective areas:

1. Remove to sound concrete.
2. Wet affected area.
3. Brush on bonding grout consisting of 1 part cement, 1 part fine sand and water to produce consistency of thick cream.
4. Apply patching mortar consisting of 1 part cement, 2-1/2 parts sand and enough water to produce stiff consistency.
5. Consolidate patching mortar and strike off to leave patch slightly higher than surrounding surface.
6. Finish repaired area flush with surrounding area after mortar has been in place for 1 hour.

D. Tie Holes:

1. Thoroughly clean and dampen.
2. Fill solid with patching mortar.

E. Perform patching before curing compound is applied.

F. Cure patched areas the same as adjacent concrete.

G. Make repairs uniform in color and finish with surrounding concrete.

3.14 CURING

A. Keep concrete moist for at least 7 curing days after placement.

B. Water curing is preferred method of protection.

1. Cover exposed surfaces with saturated burlap or cotton mats and keep wet continuously with soil soaker hose for 7 days.
2. Leave covering in place, without wetting, for additional 3 days.

C. Use of curing compound is permissible provided it meets NSF approval.

1. Do not use curing compounds on surfaces to which mortar, concrete or paint is applied.
2. Keep surfaces moist after forms are removed, and form tie holes repaired.
3. After surfaces are finished, apply curing compound according to manufacturer's instructions.

D. Slabs: Immediately following slab finishing, apply liquid membrane forming curing compound or begin water curing before surface becomes dry.

3.15 FLOOR AND WALL FOOTINGS

A. Construct floor and wall footings to dimensions indicated on Drawings.

B. Place vapor retarder over subbase; overlap joints minimum of 12 inches or the minimum specified in the IBC; whichever is larger.

C. Install inlet, outlet, drain and overflow pipes, and other penetrations through floor and encased in concrete.

D. Install and support vertical waterstop so bottom of center bulb is at elevation of top of footing.

1. Support waterstop without puncturing water stop.
2. Splice waterstop using thermostatically controlled sealing iron.
3. Spark test each splice before encasement in concrete.

E. Install floor and wall footings monolithically. Construction joints in floor or between floor and footings are not permitted.

F. Cure floor by flooding with water and maintaining saturated for 7 days.

G. Finish floor slab with mechanical steel float.

3.16 HOT WEATHER REQUIREMENTS

A. Conform to ACI 305 when concreting during hot weather.

3.17 COLD WEATHER REQUIREMENTS

A. Conform to ACI 306.1 when concreting during cold weather.

3.18 TANK ACCESSORIES

A. Coordinate placement of tank accessories. Set items level, plumb, and in alignment with adjoining work.

B. Provide anchors and inserts in sufficient number for proper fastening of items. Embed anchors in concrete to accurately align metal work at proper level.

C. Drill holes as required for bolts and screws in supports and in metal work. Conceal fasteners where possible.

D. Provide join sealant as required to set, seal, and secure metal items.

3.19 MANUFACTURER'S FIELD SERVICES

A. Section 01 45 00 – Quality Control.

B. Furnish field representative experienced in installation of tank to supervise installation.

1. Furnish Installation Certificate attesting foundation and tank are properly installed.

3.20 CLEANING, DISINFECTION, AND TESTING

A. Cleaning: Tank installer shall clean and pressure wash the interior of the reservoir after it is constructed.

B. Leak Testing:

1. Testing of the reservoir consists of filling the reservoir to check for water tightness no sooner than 28 days after all concrete pouring is completed and no later than 60 days after completed. The testing of the water can be done from this initial filling and if there are no obvious problems with the reservoir, it can be put on line without emptying and refilling.
2. To test the reservoir, fill to full, close all valves and let set for 24 hours. Note the height of the water. Check the water height after three consecutive 24 hour periods. Allowing for evaporation, the water level shouldn't drop more than 1 tenth of one percent in any 24-hour period.

C. Disinfecting: Disinfect tank in accordance with Section 33 13 13 Water Reservoir Disinfection.

D. Purities Testing: This testing typically consists of taking samples of the water to a certified lab for bacteria testing prior to placing the reservoir in service. Special attention must be given to ensure that the water source has been tested and is clear of bacteria and contaminants that could affect the samples taken from the reservoir.

END OF SECTION

33 31 13 – SANITARY SEWER PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

A. The WORK under this Section includes providing all labor, materials, tools and equipment necessary for furnishing and installing PVC sanitary sewer pipe, in accordance with these Specifications and in reasonably close conformity with the lines and grades shown on the Drawings or established by the ENGINEER.

B. This WORK includes furnishings and installing connecting bands, branch connections, elbows or other fittings, and all appurtenances required to complete the sanitary sewer installation.

1.2 SUBMITTALS

A. Sanitary Sewer Pipe: Material certifications stating conformance with the requirements of this Section.

B. Project Record Documents: Accurately record actual locations and inverts of buried pipe.

PART 2 - PRODUCTS

2.1 PVC PRESSURE PIPE (FORCE MAIN)

A. Polyvinyl chloride (PVC) under 4 inches shall meet the requirements of ASTM D2241. Pipe material shall be PVC 1120, PVC 1220, or PVC 2120, and shall have minimum wall thickness equal or greater than a standard dimension ratio (SDR) of 21. Pipe shall bear the National Sanitation Foundation Seal for use to transport potable water. Pipe shall be considered flexible conduit. Joints shall meet the requirements of ASTM D3139 using a restrained rubber gasket meeting the requirements of ASTM F477.

2.2 PVC GRAVITY PIPE AND FITTINGS

A. Solid wall PVC sanitary sewer pipe and fittings shall be solid wall construction and shall conform to the following requirements: For pipe sizes up to 15 inches: ASTM D3034 SDR 35. Joints for solid wall PVC pipe shall conform to ASTM D3212 using elastomeric gaskets conforming to ASTM F477. Fittings for solid wall PVC pipe shall be injection molded, factory welded, or factory solvent cemented.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Bedding and backfill shall conform to the requirements of Utility Trenching and Backfill.

B. Sheeting and bracing required for trenches shall meet OSHA requirements.

C. Before lowering into the trench; the pipe shall be inspected for defects. All cracked, chipped, or broken pipe shall be discarded. The ends and interior of the pipe shall be clean. Belled ends shall be laid upgrade. Handling of the pipe shall be accomplished in a manner that will not damage the pipe. The joint shall be made in the manner recommended by the manufacturer. Care shall be taken not to buckle or disturb previously laid pipe.

D. Pipe shall be laid accurately to the line and grade.

E. Pipe shall be cleaned of all foreign matter, and water shall be kept out of trenches until joints have been completed. When WORK is not in progress, open ends of pipe and fittings shall be securely closed to keep foreign matter and animals from entering.

F. Each joint shall be inspected to ensure that it is properly made before backfilling is done. Care shall be taken to prevent any dirt or foreign matter from entering the open end of the pipe. Where it is necessary to cut pipe, such cuts shall be neatly made in an approved manner. The laid pipe shall be true to line and grade and, when completed, the sewer shall have a smooth and uniform invert. No section of gravity sewer, including service connections shall have an adverse grade which would pond water in the invert of the sewer.

G. Pressure test gravity pipe using a low-pressure air test in accordance with ASTM F1417.

H. Pressure test pressure rated pipe to 200 psi. Repair leaks and re-test

1. Coordinate all pipe installation and testing with ODEQ to ensure all inspection and testing requirements are met.
2. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct hydrostatic pressure and leakage test in accordance with AWWA C600.
3. Provide equipment required to perform leakage and hydrostatic pressure tests.
4. No pipeline will be approved when pressure test varies by more than 5 psi at completion of hydrostatic pressure test.
5. Before applying test pressure, completely expel air from section of piping under test. Provide corporation cocks so air can be expelled as pipeline is filled with water. After air has been expelled, close corporation cocks and apply test pressure. At conclusion of tests, remove corporation cocks and plug resulting piping openings.
6. No pipeline installation will be approved when leakage is greater than that determined by the following formula:

$L = (SD\sqrt{P})/133{,}200$ where:
L = Allowable leakage in gallons per hour
S = Length of pipe tested in inches
D = Nominal diameter of pipe in inches
P = Average test pressure in pounds per square inch (gauge)

I. Connections to existing sewer mains shall be made so that no projections or rough surfaces occur within the pipe.

J. All sewer mains shall be installed to the criteria for the separation of water mains and sanitary sewers set forth in WAC 246-272B. Any deviations from such requirements must be approved by the Owner.

END OF SECTION 33 31 13

33 34 00 – ONSITE WASTEWATER DISPOSAL

PART 1 - GENERAL

1.1 DESCRIPTION

A. The WORK under this Section includes providing all labor, materials, tools and equipment necessary for furnishing and installing the proposed wastewater drainfield systems in accordance with the plans. This includes all associated system components, wastewater treatment systems, interconnecting piping and valving, and the complete pressurized distribution drainfield system in accordance with these Specifications and in reasonably close conformity with the lines and grades shown on the Drawings or established by the ENGINEER.

1.2 SUBMITTALS

A. Product Data: Submit data on wastewater treatment system, piping and valving, drainfield components including piping and alternative media (gravelless chambers).

B. Project Record Documents: Accurately record actual locations and inverts of buried pipe.

1.3 REFERENCES

A. Washington State Department of Health Large On-site Sewage System Regulations (Chapter 246-272B WAC)

B. ASTM D 1784: Rigid Vinyl Compounds

C. ASTM D 2564: Solvent Cement for PVC Pipe and Fittings

D. ASTM F 1668: Procedures for Buried Plastic Pipe

1.4 SUBMITTALS

A. Product Data: Submit data on wastewater treatment system, piping and valving, pumps and controls and drainfield components including piping and alternative media (gravelless chambers).

B. Manufacturer’s Installation Instructions: Submit special procedures for alternative media (gravelless chamber) and wastewater treatment system installation.

C. Project Record Documents: Accurately record actual locations and inverts of all installed infrastructure including buried pipe and drainfield components.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect treatement equipment, interconnecting piping and valves and drainfield components during handling using methods recommended by manufacturer.

B. Prevent damage to pipe, treatment equipment and gravelless chambers during transit. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

A. Pipe and fittings shall meet the requirement of 33 31 13 Sanitary Sewer Pipe.

2.2 ALTERNATE MEDIA – GRAVELLESS DRAINFIELD CHAMBERS

A. Gravelless drainfield chamber units shall be Quick4 Plus Standard Low Profile chambers as manufactured by Infiltrator Water Technologies or approved equivalent.

2.3 WASTEWATER TREATMENT SYSTEM

A. BioMicrobics, Inc. MicroFAST 3.0.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Bedding and backfill shall conform to the requirements of Utility Trenching and Backfill.

B. Sheeting and bracing required for trenches shall meet OSHA requirements.

C. Before lowering into the trench; the pipe shall be inspected for defects. All cracked, chipped, or broken pipe shall be discarded. The ends and interior of the pipe shall be clean. Belled ends shall be laid upgrade. Handling of the pipe shall be accomplished in a manner that will not damage the pipe. The joint shall be made in the manner recommended by the manufacturer. Care shall be taken not to buckle or disturb previously laid pipe.

D. Pipe shall be laid accurately to the line and grade.

E. Pipe shall be cleaned of all foreign matter, and water shall be kept out of trenches until joints have been completed. When WORK is not in progress, open ends of pipe and fittings shall be securely closed to keep foreign matter and animals from entering.

F. Each joint shall be inspected to ensure that it is properly made before backfilling is done. Care shall be taken to prevent any dirt or foreign matter from entering the open end of the pipe. Where it is necessary to cut pipe, such cuts shall be neatly made in an approved manner. The laid pipe shall be true to line and grade and, when completed, the sewer shall have a smooth and uniform invert. No section of gravity sewer, including service connections shall have an adverse grade which would pond water in the invert of the sewer.

G. Gravelless Drainfield Chambers

1. Stake out location of drainfield trenches. Set the elevation of the trench bottoms.
2. Install sedimentation and erosion control measures as necessary.
3. Excavate and level the designated area.
4. Remove any debris from the bed walls. Rake the bottom and sides if smearing has occurred while excavating. Verify the bottom of the trenches are level using a transit, laser or level.
5. Install and backfill the chambers and lateral piping in accordance with the manufacturer's recommendations.
6. Perform "squirt" testing as required for Department of Health acceptance.

END OF SECTION 33 34 00

33 34 13 – SEPTIC TANKS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The WORK under this Section includes providing all labor, materials, tools and equipment necessary for furnishing and installing the proposed septic tank, pump tanks and treatment tank systems as depicted in the project plans and in reasonably close conformity with the lines and grades shown or established by the ENGINEER.

B. The CONTRACTOR shall provide fiberglass reinforced plastic (FRP) and concrete wastewater storage tanks as shown on the drawings. The onsite wastewater tanks shall be manufactured according to applicable American National Standards Institute (ANSI) and American Water Works Association (AWWA) standards. The tank sizes, fittings and accessories shall be as shown on the drawings.

C. The FRP and concrete tanks shall be designed for underground installation and shall be constructed in compliance with WAC 246-272B-06450.

1.2 REFERENCES

A. Washington State Department of Health Large On-site Sewage System Regulations (Chapter 246-272B WAC)

B. ANSI/AWWA D120-09; Thermosetting fiberglass-reinforced plastic tanks.

1.3 SUBMITTALS

A. Product Data: Submit data on tank(s), including scaled drawings, piping, effluent filter and tank accessories.

B. Manufacturer’s Installation Instructions: Submit special procedures for septic tank installation.

C. Project Record Documents: Accurately record actual locations and inverts of all tanks and associated components.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prevent damage to septic tanks during transit to the site. Handle and store the tanks in accordance with manufacturers recommendations. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 SINGLE-WALL AND DOUBLE-WALL FIBERGLASS REINFORCED PLASTIC (FRP) UNDERGROUND ONSITE WASTEWATER TANKS

A. Loading Condition: Tank(s) shall meet the following design criteria:

1. Internal Load – Tank(s) shall be designed to withstand a 5-PSIG air-pressure test with a 5:1 safety factor.
2. Surface Loads – Tank shall be designed to withstand surface H-20 and HS-20 axle loads when properly installed according to manufacturer's current installation manual and operation guidelines.
3. External Hydrostatic Pressure For Underground Tanks – Tank shall be designed for 7 feet of overburden over the top of the tank, the hole fully flooded, and a safety factor of 5:1 against general buckling.

B. Materials:

1. Tank(s) shall be manufactured with a laminate consisting of resin and glass fiber reinforcement. No sand/silica fillers or resin extenders shall be used.
2. All internal mounting hardware shall be manufactured of rustproof materials.

C. Design:

1. The tank(s) shall be designed as a single-wall or double-wall vessel as specified and shown in the drawings.
2. Tank(s) shall be manufactured with structural ribs which are fabricated as an integral part of the tank wall.
3. Capacity and Dimensions:
   a. Tank shall have a nominal capacity of 22,000 gallons.
   b. Tanks shall have a nominal outside diameter of 10 feet.

2.2 PRECAST CONCRETE SEPTIC TANKS

A. Tanks shall be as specified on the plans or approved alternates from the Washington State Department of Health's Qualified Products list.

2.3 ACCESSORIES

A. Access Openings:

1. All access openings shall have a diameter of 24 inches or 30 inches, as specified on the plans, complete with riser, lid and necessary hardware.
2. Size and location(s) as shown on tank drawings.

B. Pipe and Fittings:

1. Tank(s) shall be equipped with factory-installed threaded fittings, or pipe stubs.
2. PVC pipe shall at a minimum meet the requirements of ANSI Schedule 40.
3. All flanged nozzles shall be flanged and flat-faced, and conform to Class 150 bolting patterns as specified in ANSI/ASME/B16.5-2009.

4. Steel NPT fittings shall withstand a minimum of 150 foot-pounds of torque and 1,000 foot-pounds of bending, both with a 2:1 safety factor.
5. Location of fittings and piping shall be as shown on tank drawings.

C. Attached Access Risers:

1. Attached access risers shall be PVC or FRP as supplied by tank manufacturer.
2. Attached access risers shall be 30 inch diameter.
3. Access risers shall be attached to access openings during installation utilizing adhesive or FRP bonding kits supplied by the tank manufacturer.

D. Anchoring:

1. Anchor straps shall be FRP anchor straps supplied by tank manufacturer.
2. Number and location of straps shall be as shown on drawings or as recommended by manufacturer.
3. Prefabricated concrete deadmen, which are designed to ACI standard 318-11, shall be supplied by tank manufacturer.

2.4 BEDDING AND BACKFILL MATERIAL

A. Aggregate Bedding and backfill Material shall be as specifically recommended by the tank manufacturer.

B. Geotextile Fabric: The geotextile fabric specified for backfill separation shall be Mirafi 180N Filter Fabric or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 01 00 – General Requirements: Verification of existing conditions before starting work.

B. Verify upstream and downstream sanitary sewer connections, size, location and depth.

3.2 PREPARATION

A. Ream pipe ends and remove burrs.

B. Remove scale and dirt from components before assembly.

C. Establish invert elevations for each component in the system.

D. Hand trim excavation to suit septic tank and pipe connections.

3.3 TANK AND TANK BEDDING

A. Excavate in accordance with plans and actual field conditions.

B. Place bedding material level in on continuous layer not exceeding 6 inches compacted depth. Compact to 95%.

C. Install septic tank and backfill in accordance with manufacturer's recommendations.

D. Test tank in accordance with manufacturer's recommendations and in accordance with WAC 246-272b-06450 to verify water tightness. Coordinate all testing/inspection activity with ENGINEER prior to commencement.

END OF SECTION 33 34 13

33 36 16 – UTILITY SEPTIC TANK EFFLUENT PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The WORK under this Section includes providing all labor, materials, tools and equipment necessary for furnishing and installing complete submersible effluent pump systems, including all accessories and control units, in accordance with the drawings or as established in the field by the OWNER or their representative.

1.2 REFERENCES

A. Washington State Department of Health Large On-site Sewage System Regulations (Chapter 246-272B WAC)

1.3 SUBMITTALS

A. Shop Drawings: The Contractor shall furnish shop drawings and technical data sheets for the pumping systems. Show size, materials, and components of system. The submittals shall clearly specify the materials of construction, equipment compatibility, along with drawings for each unique system and related equipment being supplied.

B. Product Data: Submit for each type of pumping system required. Include data for all pump system appurtenances including, but not limited to, slide rail assembly, discharge piping, valves, junction boxes, level controls and control panels. Include pump catalog data and performance curves, as well as, control data and panel wiring schematic

C. Manufacturer’s Certificate: Certify products meet or exceed specified requirements.

D. Manufacturer’s Installation Instructions: Submit special procedures for system installation.

E. Project Record Documents: Accurately record actual locations and inverts of all system components.

1.4 OR-EQUAL EVALUATION

A. The term “approved equal” shall mean equal in the judgment of the ENGINEER. Should the Contractor seek approval of a product other than the brand or brands named in the specifications, it shall furnish written evidence that such product conforms in all respects to the specified requirements, and that it has been used successfully elsewhere under similar conditions. It will not be the responsibility of the manufacturer specified within these specifications to provide research, documentation, or data supporting the difference between the “or equal” and the specified product. This will be the sole responsibility of the Contractor seeking the approval.

B. Where the specified requirements involve conformance to recognized codes or standards, the Contractor shall furnish evidence of such conformance in the form of test or inspection reports, prepared by a recognized agency, and bearing an authorized signature. Manufacturer’s standard data and catalog cut sheets will not be considered sufficient in themselves, and the ENGINEER will not be responsible for seeking further data from the manufacturer, or for otherwise

researching the product. Failure to provide complete data will be cause for rejection of the product.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing wastewater effluent pumping systems with a minimum of three years documented experience.

B. Installer: Company specializing in performing work of this section with a minimum of three years documented experience.

1.6 WARRANTY

A. The effluent pump manufacturer shall provide a five (5) year warranty for the effluent pump system. Warranty term shall ensue after acceptance and system startup procedures are complete. The manufacturer shall submit detailed exclusions from the warranty or additional cost items required to maintain the equipment in warrantable condition. The warranty shall be documented in product literature.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protect all components from entry of foreign materials and water during delivery and storage.

B. Accept system components on site in manufacturer’s original containers or configuration. Inspect for damage.

C. Store sensitive materials for field assembly in dry area in original shipping containers.

D. Repair any damage according to manufacturer’s instructions.

PART 2 - PRODUCTS

2.1 PUMPS

A. Pumps must be approved for the use described in these specifications. Pump shall be 0.33 to 3.0 hp, 60 Hz, two-wire motor, with 30 foot long extra heavy duty (SOOW) electrical cord with ground. The pumps must be submersible High-Head Effluent pumps. Pumps shall be UL and CSA listed for use with effluent in Class I Division 1 locations. The pumps must have a minimum 24-hour run dry capability without water lubrication. The pumps shall have a 1/8-inch bypass orifice to ensure flow circulation for motor cooling and to prevent air bind. The pump shall have a floating impeller design to protect against up thrust and increase pump life. The pumps liquid ends must be repairable (by replacing impellers and/or diffusers) for better long-term cost of ownership. The motor must be rated for continuous use and frequent cycling, at least 100 cycles per day. The motor cable must be suitable for Class 1, Division 1 and 2 applications. The pumps shall be lightweight for easy removal and maintenance. The pump intake screen must be 1/8-inch mesh polypropylene. The pump shall have internal thermal overload protection and internal lightning protection. All pumps shall undergo 3-point (Dead head, Design Flow, and Design Flow + 30%) wet testing at the factory to confirm performance.

2.2 SPLICE BOX CONDUIT SEALS AND SEALANTS

A. The use of a UL-approved conduit seal kit accessible above ground shall be required to prevent the passage of gases, vapors, or flames through the conduit to the control panel. An additional UL classified sealant shall be added to the splice box coupling to prevent condensation accumulation in the splice box. The following UL approved sealants shall be used:

1. UL classified moisture-cure polyurethane quick drying foam or approved equal with an R-5 rating for each inch of foam.
2. UL classified silicone sealant or approved equal consisting of a neutral cure silicone, non-acetic, non-corrosive silicone able to withstand temperatures to 450° F.

2.3 CONTROLS

A. Controls and alarms shall be listed per UL 508. Panels shall be repairable in the field without the use of soldering irons or substantial disassembly.

B. Panels shall be Orenco Systems®, Inc. or approved equal. Control Panels shall be configured as recommended by manufacturer for the pumping system being operated.

2.4 INSTALLATION

A. All pumping system, and electrical components shall be installed in accordance with the Manufacturer's recommendations, the project plans, and all state and local regulations.

2.1 LOCATION

A. The location of the pump control panel shall be as indicated on the drawings. Consult with the ENGINEER for any variations to the locations shown. The panel, when possible, should be mounted in the shade and protected from the weather. The panel should be located at a convenient height (usually about five feet above the ground) and where it will be accessible for maintenance.

PART 3 - EXECUTION

3.1 PRECONSTRUCTION CONFERENCE

A. Before any work at the site is started, a conference attended by the Owners Representatives, Contractor, and others as appropriate will be held to establish a working understanding among the parties as to the work involved for installing each component of the effluent pump systems.

3.2 PUMP INSTALLATION

A. Install pump including fittings, brackets, discharge piping, valves, rail and lifting system, float systems and wire pump to junction box.

3.3 CONTROL PANEL INSTALLATION

A. Mount and wire control panel for pumping station operation.

B. Wire control panel in accordance with electrical drawings, National Electrical Code and manufacturer's recommendations.

3.4 STARTUP, INITIAL TESTING AND OPERATION

A. Notify Owner's Respresentative three days prior to effluent pump system testing.

B. Provide startup and initial testing of system. Hydraulically test pump system to performance requirements by receiving, pumping and discharging water.

C. Correct failures during test by repairing or replacing malfunctioning parts or equipment or faulty workmanship, regardless of cause, within 48 hours after discovery.

D. After correcting failures caused by defective equipment, material, or faulty workmanship, retest until failures are eliminated.

E. Confirm general sequencing of pump and float operation and control panel are in accordance with performance requirements.

F. Document and certify startup results in startup report.

END OF SECTION 33 36 16

SECTION 33 40 00 - STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes, but is not limited to:

1. Catch basins, culverts, area drains, cleanouts, storm drain pipes, fittings, and other appurtenances as shown on the Plans.
2. Stormwater facility including but not limited to pre-settling cell, sand filter and infiltration pond.
3. Coordination of building plumbing connection points.
4. Construction records.

1.2 REFERENCES

A. Reference the following standards:

AHJ	Public Authority Having Jurisdiction. For this project the AHJ denotes Island County.
WSDOT	Washington Department of Transportation 2025 Standard Specifications and Standard Plans for Road, Bridge, and Municipal Construction
Ecology	State of Washington Department of Ecology Stormwater Management Manual for Western Washington, 2019. (www.ecy.wa.gov/programs/wq/stormwater/manual.html)
ASTM	American Society for Testing and Materials

1.3 SUBMITTALS

A. Submit the following in accordance with submittal procedures noted in Division 01.

1. Product data sheets and shop drawings for materials listed in Part 2 Products and/or noted on Plans.

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) DRAIN PIPE

A. Polyvinyl Chloride (PVC) Drain Pipe: conform to WSDOT Section 9-05.12(1) with rubber gasket joints.

1. Fittings shall be same material as pipe.
2. Provide connections to catch basins and inlets with AC or GPK manhole adapter or an approved equivalent product. Portland cement joints on pipe are prohibited.

2.2 DUCTILE IRON PIPE (DI)

A. Ductile Iron Pipe shall be Class per Plan and shall conform to WSDOT 9-05.13.

B. Fittings for ductile iron pipe shall be in accordance with WSDOT Section 9-05.13. Saddles fastened to pipe with external bands shall not be acceptable on any new ductile iron pipe.

C. Culvert pipe's inlet and outlet ends shall be beveled per Plans.

2.3 FITTINGS, COUPLINGS AND JOINTS

A. Fittings shall be the same material as the pipe.

B. Connections to maintenance holes shall be connected by core drilling and flexible connections.

C. Jointing of dissimilar pipe shall be in accordance with WSDOT Section 7-08.3(2)G.

2.4 CONDUCTIVE WARNING TAPE

A. Conductive warning tape shall conform to Section 31 00 00 - Earthwork.

2.5 BEDDING AND BACKFILL MATERIAL

A. Bedding and backfill material shall be in accordance with Section 31 00 00 - Earthwork and as noted on the Plans.

2.6 CATCH BASINS

A. WSDOT Type 1 and Type 2 catch basins shall be per WSDOT Standard Plans B-5.20-03 and B-10.20-02 respectively unless otherwise specified.

1. Grates within parcel area shall be Herringbone metal frame and grate conforming to WSDOT Standard Plans B-30.10-03 and B-30.50-03.
2. Accessible grates for rectangular frames in pedestrian areas shall meet Accessible requirements and shall conform to WSDOT Standard Plan B-30.15-00.
3. Where solid cover is noted on plans, Rectangular Solid Metal Cover shall conform WSDOT Standard Plan B-30.2-04.

2.7 AREA DRAIN

A. Area Drain shall be per plans.

1. Rim to invert distance shall be 18 inches minimum.
2. Area drain to include minimum 18 inch depth sump.

2.8 SAND FILTER

A. Sand Medium shall be per plan.

2.9 GRAVEL BACKFILL FOR DRAINS

A. Gravel Backfill for Drains shall conform to wsdot section 9-33.2(1) Table 3 and per Plans.

2.10 COBBLES:

A. Cobbles per Section 31 00 00 – Earthwork.

2.11 GEOTEXTILES

A. Geotextiles per Section 31 00 00 – Earthwork.

PART 3 - EXECUTION

3.1 EXAMINATION AND COORDINATION WITH OTHER WORK

A. Verify trenches are ready to receive work, and are excavated to the dimensions and elevations indicated on the Contract Documents.

3.2 TRENCHING AND PIPE INSTALLATION

A. Excavate trench and install pipe to alignments, elevations, grades and slopes indicated on the drawings.

B. Excavate and prepare trench in accordance with Section 31 00 00 - Earthwork.

C. Place bedding and backfill in conformance with Section 31 00 00 - Earthwork.

D. Install service drain pipe in conformance with WSDOT Section 7-18.

E. Install conductive warning tape in accordance with Section 31 00 00 - Earthwork.

3.3 CATCH BASIN INSTALLATION

A. Install catch basins and storm drain structures in accordance with WSDOT Section 7-05 and the Plans.

3.4 AREA DRAIN INSTALLATION

A. Install area drains in accordance with the manufacturer’s installation requirements, WSDOT Section 7-05 and the Plans.

3.5 STORMWATER FACILITY INSTALLATION

A. Excavate and form stormwater facility cell and pond in accordance with Section 31 00 00 – Earthwork, the Plans, and Owner's Geotechnical Engineer's requirements on site.

3.6 CLEANING AND TESTING

A. Clean and test pipe in conformance with WSDOT Section 7-04.3

1. Replace sections that do not pass testing as directed by Owner's Representative or AHJ at no additional cost to Owner.

B. Leave premises clean and free of residue of work of this Section in accordance with the requirements of this Project Manual.

END OF SECTION 33 40 00

40 75 21 – CHLORINE ANALYZERS (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following items inside the treatment building:

1. Free and monochloramine analyzer sensor
2. Free and monochloramine analyzer display panel

B. Related Requirements:

1. Division 26 "Electrical."
2. Section 46 30 00 “Water and Wastewater Chemical Feed Equipment (Water Supply).”
3. Section 46 61 00 “Filtration Equipment (Water Supply).”

1.2 REFERENCES

A. National Electrical Manufacturers Association (NEMA):

1. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum)

B. National Sanitation Foundation (NSF International):

1. NSF 61 – Drinking Water System Components – Health Effects

1.3 SUBMITTALS

A. See Section 01 33 00 “Submittal Procedures” for submittal requirements.

B. Section 01 77 00 “Closeout Procedures.”

1.4 CLOSEOUT SUBMITTALS

A. Section 01 33 00 “Submittal Procedures” Shop Drawings, Product Data, and Samples.

B. Section 01 78 23 “Operation and Maintenance Data.”

C. Section 01 78 39 “Project Record Documents.”

D. Operation and Maintenance Data: Submit spare parts list, exploded assembly views, and recommended maintenance intervals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept equipment on site in shipping containers with labeling in place. Inspect for damage.

B. Protect equipment from entry of foreign materials and other damage by temporary covers.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials coming into contact with potable water shall be NSF 61 certified.

2.2 FREE AND MONOCHLORAMINE ANALYZER SENSOR

A. Sensor shall be an amperometric chlorine analyzer sensor that meets the following requirements

1. Measured parameters:
   a. Free chlorine
   b. Monochloramine
   c. pH
   d. Conductivity
   e. Temperature
2. Free chlorine measurement shall be without monochloramine interference (i.e., free chlorine value shall be the true value, including in the presence of monochloramine)
3. Measurements not be dependent on flow rate of water
4. Self-cleaning sensor
5. No reagents or waste stream
6. NSF 61 certified.

B. Manufacturers and Products

1. Halogen Systems MP-Mono Monochloramine & Free Chlorine Sensor
2. Engineer approved equal

2.3 FREE AND MONOCHLORAMINE ANALYZER DISPLAY PANEL

A. Display panel shall be by the same manufacturer as the sensor and shall meet the following requirements

1. Display all parameters measured by sensor on one screen
2. Data log capacity: 1 million lines of logged data on included SD card
3. Communication board with cellular/ethernet connection and Bluetooth® mobile app, allowing for real-time remote access to sensor data and alarms
4. (4) 4-20 mA analog outputs
5. (1) alarm-dry contact
6. NEMA 250 type 4X enclosure
7. UL certified

B. Manufacturers

1. Halogen Systems D20 Display/Controller
2. Engineer approved equal

PART 3 - EXECUTION

3.1 EXAMINATION

A. Requirements: Verification of existing conditions before starting work.

B. Verify correct power supply is available.

3.2 INSTALLATION

A. Install control systems at locations indicated on Drawings.

B. Install control system components in accordance with manufacturer's instructions.

C. Install necessary equipment (i.e., cellular antenna, wiring, etc.) for display panel communications module. Provide a complete and functional system that provides water system operator with real-time remote access to sensor data and alarms.

D. Mount display panel on treatment building wall at location shown in Plans.

3.3 FREE CHLORINE RESIDUAL LOW-LEVEL ALARM

A. Set display panel to trigger alarm via communications module to notify water system operator if free chlorine residual drops below 0.5 mg/L.

3.4 SUBSCRIPTIONS

A. Provide Owner with one-year subscription to remote access communications module subscription.

3.5 FIELD QUALITY CONTROL

A. Follow manufacturer instructions for sensor and display panel start-up, commissioning, and calibration procedures.

B. Equipment Acceptance:

1. Adjust, repair, modify or replace system components that fail to perform as specified and rerun tests. Make final adjustments to equipment per manufacturer's requirements.
2. Document adjustments, repairs and replacements in manufacturer's field services certification.

3.6 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, system operation, routine maintenance, alarm condition responses, and emergency repair procedures to Owner personnel.

END OF SECTION 40 75 21

46 30 00 – WATER AND WASTEWATER CHEMICAL FEED EQUIPMENT (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes the sodium hypochlorite chemical metering system in the treatment building, including:

1. Chemical metering pump
2. Chemical storage tanks
3. Chemical injection points
4. Chemical injection tubing
5. Static mixers
6. Flow switches
7. Treatment chemicals

1.2 REFERENCES

A. National Sanitation Foundation (NSF International):

1. NSF 60 - Drinking Water Treatment Chemicals – Health Effects
2. NSF 61 - Drinking Water System Components – Health Effects

1.3 SUBMITTALS

A. As specified in Section 01 33 00 “Submittal Procedures.”

B. Product Data:

1. Submit manufacturer product information concerning materials of construction and fabrication.
2. Chemical metering pump: Submit pump information showing performance characteristics with pump and system operating point indicated. Include electrical characteristics and connection requirements. Submit manufacturer model number, dimensions, service sizes, and finishes.

C. Manufacturer's Installation Instructions:

1. Submit detailed instructions on installation requirements including storage and handling procedures, anchoring, and layout.
2. Submit application, selection, and hookup configuration with pipe and accessory elevations. Submit hanging and support requirements and recommendations.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Manufacturer's Field Reports: Submit certification after installation certifying equipment has been installed in accordance with manufacturer’s instructions.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the project plans, State, and County standards.

B. Ensure materials of construction on pump liquid end, tubing, and fittings are compatible with chemicals listed in Part 2 of this Section.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspect for damage.

B. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

1.7 CLOSEOUT SUBMITTALS

A. See Section 01 77 00 “Closeout Procedures” and Section 01 33 00 “Submittals Procedures” for closeout submittal requirements.

B. Project Record Documents: Record actual locations and final orientation of equipment and accessories. Provide solution dilution ratio and final equipment settings that were used to obtain the required chlorine residual.

C. Operation and Maintenance Data: Submit maintenance instructions for equipment and accessories consistent with Section 01 78 23 “Operation and Maintenance Data.”

1.8 SCHEDULING

A. See Section 01 32 16 “Construction Progress Documentation.”

B. Schedule work after piping changes/installation.

1.9 COORDINATION

A. Coordinate installation and start-up with Engineer.

1.10 WARRANTY

A. See Section 01 77 00 “Closeout Procedures” for warranty requirements.

B. Furnish manufacturer’s warranty for products in this section.

1.11 EXTRA MATERIALS

A. See Section 01 77 00 “Closeout Procedures” for requirements for spare parts and maintenance products.

B. Furnish one complete set of manufacturer's recommended spare parts for each type of metering pump, including but not limited to:

1. One complete rebuild kit for each type of chemical metering pump provided, to include replacement diaphragm, ball check valves, O-rings, and gaskets.

C. Furnish special tools required for equipment maintenance. Furnish list of equipment and tools needed to maintain and calibrate equipment.

PART 2 - PRODUCTS

2.1 GENERAL

A. All treatment chemicals shall be NSF 60 certified.

B. All materials coming into contact with potable water shall be NSF 61 certified, unless otherwise allowed by engineer.

2.2 CHEMICAL METERING PUMPS

A. Metering pump shall meet the following requirements:

1. Diaphragm type pump with auto prime valve.
2. Materials of Construction: Acrylic head, PVC fittings, ceramic balls, PTFE/Polyprel® seat/O-rings.
3. Output Capacity (with auto prime valve): 1.75 gallon per hour minimum.
4. Rated Pressure at Rated Output Capacity: 50 psi minimum.
5. Manual speed control.

B. Manufacturers

1. LMI PD061-A40HI
2. Engineer approved equal.

C. Metering pump accessories

1. Provide one repair and maintenance (RPM) kit: LMI RMP-A40A.

2.3 CHEMICAL STORAGE TANKS

A. 50-gallon polyethylene tank and cover.

B. Tank shall be suitable for the intended use. Metering pump shall be mounted on the tank cover.

2.4 CHEMICAL INJECTION POINTS

A. PVC construction.

B. Ball valve, check valve, and injection quill.

C. Manufacturers

1. LMI
2. Griffco
3. Engineer approved equal

2.5 CHEMICAL INJECTION TUBING

A. Clear tubing for chemical injection supplied by metering pump manufacturer, to ensure capability with chemicals used. Tubing material and size shall be per the manufacturer's recommendation.

B. Mounting brackets, miscellaneous fittings, and connections.

2.6 STATIC MIXERS

A. Static mixer shall meet the following requirements:

1. Blade style mixer
2. Schedule 80 PVC
3. 6 mixing elements
4. Male NPT pipe threads, same size as connecting pipe

B. Manufacturers

1. Koflo 2-80-4-6-2
2. Engineer approved equal

2.7 FLOW SWITCHES

A. Flow switch shall meet the following requirements:

1. Paddle type flow switch with 316 stainless steel paddle.
2. NPT connection.
3. On switch point of 16 gallons per minute (gpm) and off switch point of 11 gpm when installed in 2-inch pipe.
4. 200 psi working pressure.

B. Manufacturers:

1. Harwil Q-10N/6/NO
2. Engineer approved equal

2.8 TREATMENT CHEMICALS

A. Sodium hypochlorite:

1. 12.5% strength
2. NSF 60 certified

B. Contractor is responsible for providing sufficient quantities of chemical solution to conduct all testing requirements of this section. In addition to the quantities required for testing, contractor shall provide (1) 15-gallon container of each chemical listed in this section.

2.9 PRODUCT LIST

A. A summary of the required products is provided in the following table.

Quantity	Description	Manufacturer	Model/Capacity	Options/Accessories
1	Chemical metering pump	LMI	PD061-A40HI (1.75 gph, or approved equal)	RPM-832 spare parts kit
1	Chemical storage tank	Submit for approval	50-gallon, or approved equal	
1	Chemical injection points	Submit for approval	Submit for approval	
As needed	Chemical injection tubing	Submit for approval		Mounting brackets, miscellaneous fittings, connections
1	Static mixer	Submit for approval	Submit for approval	
1	Flow Switch	Submit for approval	Submit for approval	
As needed	Sodium hypochlorite	Submit for approval	12.5%	

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify layout and orientation of pumps, accessories, and piping connections.

3.2 INSTALLATION

A. Mount pump to chemical storage tank

B. Install piping accessories in pump suction and discharge.

C. Connect piping to pump suction and discharge.

D. Flush piping with clean water.

E. Install flow switch per manufacturer recommendations, including with recommended upstream and downstream unobstructed straight pipe requirements. Perform testing to confirm that flow switch interrupts power to chemical metering pump when now flow conditions exist. Report results of testing to Engineer per Section 01 77 00 “Closeout Procedures.”

F. Install Work in accordance manufacturer's recommendations and State of Washington requirements.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 “Quality Requirements” and Section 01 77 00 “Closeout Procedures”: Field inspecting, testing, adjusting, and balancing.

B. Pre-operational Check: Before operating system or components, make the following checks:

1. Vent air from system to assure water in pump.

C. Start-up and Performance Testing:

1. Conduct pump calibration upon startup. Follow manufacturer's instructions. Equipment used for calibration (including calibration column) is to become property of the Owner.
2. Operate chemical metering system on clear water for continuous period of four hours, under supervision of manufacturer's representative.
3. Hydrostatically test system piping for leaks at 150 psig.

D. Equipment Acceptance:

1. Adjust, repair, modify and replace components of system failing to perform and repeat tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

3.4 MANUFACTURER’S FIELD SERVICES

A. Section 01 40 00 “Quality Requirements”: Requirements for manufacturer’s field services.

B. Furnish services of manufacturer's representative experienced in installation of products supplied under this specification for not less than one man-day on-site for installation inspection and field testing and instructing Owner's personnel in maintenance of equipment.

C. Furnish installation certificate from equipment manufacturer's representative attesting equipment has been properly installed and is ready for start-up and testing.

END OF SECTION 46 30 00

46 61 00 – FILTRATION EQUIPMENT (WATER SUPPLY)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Iron and manganese filtration system in the treatment building, including the required appurtenances to create a functional treatment system that meets project objectives.

B. Related Requirements:

1. Section 46 30 00 “Water and Wastewater Chemical Feed Equipment (Water Supply).”

1.2 REFERENCES

A. National Sanitation Foundation (NSF International):

1. NSF 61 - Drinking Water System Components – Health Effects

B. American Water Works Association (AWWA):

1. AWWA C653 “Disinfection of Water Treatment Plants.”

1.3 SUBMITTALS

A. As specified in Section 01 33 00 “Submittal Procedures.”

B. Submit installation and arrangement drawings showing the design of the fabricated skid, including dimensions and locations of equipment. Show locations of tanks, piping, electrical equipment, pipe and valve supports, and skid anchor hold-downs.

C. Submit operations and maintenance manuals.

D. Submit shop drawings and product data for the individual pieces of equipment, components, and accessories per those equipment specifications.

E. Submit data as a single complete package for tanks, piping, structural skid or base design, valves and actuators, control panels, instrument components, power and instrumentation conduits and wiring, and other items.

F. Submit structural and or seismic anchorage drawings showing the design of the fabricated skid.

G. Certification from manufacturer(s) that products used meet standards referenced.

1.4 DELIVERY, STORAGE. AND HANDLING

A. Protect filtration equipment during handling using methods recommended by manufacturer.

B. Prevent damage to equipment during transit. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

1.5 GUARANTEES

A. The manufacturer shall guarantee all equipment, coatings, valves, and controls for three (3) years against defects in workmanship or materials. Any part proving defective shall be replaced or repaired as per the manufacturer's recommendation within this period in accordance with this guarantee.

B. The manufacturer shall guarantee that, under actual operating conditions: (1) the media shall not be washed out of the system during the service run or backwashing period, and (2) the underdrain system, gravel and media shall not become fouled, either with turbidity or by other particles, while operating as specified by the manufacturer.

1.6 CLOSEOUT SUBMITTALS

A. As specified in Section 01 33 00 "Submittal Procedures" and Section 01 77 00 "Closeout Procedures.

B. Provide the following closeout submittals:

1. Satisfactory bacteriological test results from a certified laboratory.
2. Satisfactory full-scale pilot test results: Completed copy of the Full-Scale Pilot Test Worksheet provided at the end of this section. Including water quality test results from a certified laboratory.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. ATEC Water Systems, or engineer approved equal.

2.2 FABRICATED SYSTEM COMPONENTS

A. Filter vessels

1. The vessels shall be of electric welded pressure vessel quality carbon steel construction rated for 150 psig working pressure and hydrostatically tested at 225 psig. Heads shall be built of Grade SA-455 steel. Sidewalls shall be built of Grade SA-572 steel and tank heads and handholds shall comply with ASME Code requirements. Sidewalls and heads shall each have a thickness of at least 1/4-inch.
2. Vessels shall have stainless steel grooved coupling connections on the service inlet and outlet. Manifolds shall have a flanged connection on the system inlet and outlet.
3. Access opening for tanks shall include one 11" x 15" manhole in the top head and one 8" circular access port in lower sidewall of tank adjacent to lower head to allow for underdrain servicing and/or media removal. Support for tanks shall be structural steel angle iron legs welded to lower section of the sidewall.
4. The vessels shall be mounted to a common 4 inch by 6 inch by ¼ inch tubular steel frame (skid) with forklift brackets and four crane lifting hooks. The vessels shall be mounted so

that they can be removed individually with the use of standard hand tools and a forklift or similar lifting device.

5. Hold-down tabs with oversized ¾ " bolt holes shall be positioned at key places on the length of the skids to allow the system's attachment to the floor by anchor bolts which shall be provided by the Contractor.

B. Coatings

1. Both immersed and non-immersed steel surfaces on tanks of all diameters shall be sand blasted to a near white metal surface finish per SSPC-SP-10 finish.
2. All filter vessel and manifold immersion service surfaces shall be coated with 3M Company ScotchKote 134, an epoxy fusion coating which conforms to the requirements of NSF Standard 61 for contact with potable water. The coating shall be applied in accordance with the manufacturer's recommendations to a minimum coating thickness of 10 mils DFT (dry film thickness).
3. The exterior finish shall be applied in at least two coats and may be achieved in more than two coats. Exterior surfaces will be coated by a primer coat and application by applying a 2-3 mil DFT coat of a rust resistant primer and 1.5-2.5 mils DFT of Cardinal 6400 Series Polyurethane.
4. Touch-up paint shall be supplied for all coating systems and colors used. Paint shall be in sealed containers from the manufacturer labelled with color as well as system location applicability.

C. Internal Distribution

1. The filter system shall be a "down-flow" type with raw water entering the top of the filter, flowing through the filter tank, and coming out the bottom of the tank.
2. The upper distribution system shall be of the baffle type to evenly distribute the water over the entire tank area.
3. The lower distribution system shall be of a proven design to provide a uniform backwash flow across all the filter media. The underdrain will be constructed with the appropriate number of individual stainless steel wedge wire radial outlets with openings of not more than 0.010 inches to optimize distribution functionality. The radial arms are secured to a stainless-steel hub-base by nipples threaded into stainless steel pipe couplings welded to the hub. Each radial arm shall have adequate outlet orifices for the stated flow located beneath the wedge wire. The underdrain shall be designed to handle two times the design backwash flow rate with less than two (2) psi of head loss. The distribution system shall be embedded in a single layer sub-fill of ½" washed gravel to support the filter bed.

D. Main Operating Valve

1. The main operating valve on each tank shall be an industrial automatic multi-port diaphragm type, slow opening and closing, free of water hammer. The diaphragm assembly shall be fully guided on its perimeter when pressure activated from one position to another to assure a smooth reliable shut-off without sticking. There shall be no contact of dissimilar metals within the valve and no special tools shall be required to service the valve. The valve shall be hydraulically actuated. Valve shall be certified to ANSI/NSF 61 standard.
2. Main operating valve shall be Bermad IR-350-P or engineer approved equal.

E. Pipe and Fittings

1. Raw and treated water manifold and piping shall be Schedule 40 steel with a nominal wall thickness of 0.25" or greater. Backwash piping shall be Schedule 40 steel. Immersed

portions of manifolds shall be coated with a fusion epoxy coating, certified to NSF/ANSI Standard 61 in the same manner specified for filter vessels in Section 2.A.

2. A 2" threaded connection shall be provided on the inlet manifold near the inlet connection point.

F. Controls

1. A factory-mounted and wired cycle controller shall incorporate multi-ported pilot control valves to govern all steps of automatic backwash. Provision for manually initiated backwash shall be included as will provisions to accommodate remote initiation of backwash. The controller shall be an Alex-Tronix controller requiring a 120 or 220 VAC connection to power the local panel which controls and monitors backwash status.
2. The pilot control valves shall be pre-connected to automatically pressure activate the operating control valve through the steps of backwash and return to service. In case of power failure, a complete backwash cycle shall be started through manual operation of the pilot control valve. The control panel shall always indicate the cycle of operation.
3. The system shall be equipped with electrical lockouts to prevent more than one unit from backwashing at the same time, except when the system is manually overridden.

G. Filter Media

1. The filter media shall be NSF/ANSI Standard 61 listed manganese dioxide coated media meeting the following requirements:
   a. Mesh size: 45 to 16 U.S. Mesh (0.36 mm to 1.9 mm)
   b. Media substrate: silica sand
   c. Coating: manganese dioxide
   d. 12.5% manganese dioxide content
   e. Recommended service flow rate: 2 – 10 gpm/ft^2
   f. Recommended backwash rate: 12 – 18 gpm/ft^2
   g. Manufacturer: Vibrantz Technologies Pyrolox Advantage
2. The media shall not require regeneration to operate if sodium hypochlorite is used as the oxidant and a free chlorine residual of at least 0.5 mg/L is maintained in the filter effluent.
3. Media shall be provided by filter manufacturer.

H. Oxidation System

1. Chlorine, in the form of sodium hypochlorite solution injected in the raw water, shall be the oxidant used in this system and a free chlorine residual equal to or greater than 0.5 gm/L shall be maintained in the product water leaving the treatment system.
2. See Section 46 30 00 “Water and Wastewater Chemical Feed Equipment (Water Supply)” for additional requirements.

I. Backwash Assembly

1. A backwash assembly shall be provided by the filter manufacturer consisting of the following components:
   a. Backwash throttling gate valve
   b. Site glass
   c. Flow meter with display panel. Flow meter shall measure totalizing and instantaneous flow of water through the backwash assembly.
2. Pipe material shall be as described in Part 2 Section 1.2.E “Pipe and Fittings.”

J. Accessories

1. Liquid filled pressure gauges of ½% full scale accuracy in corrosion resistant frames shall be provided (0-160 psig) for inlet and outlet manifold of the system. Gauges shall be 4½" in diameter with surge suppression snubbers and will be mounted above the control panel.
2. Sampling ports shall be supplied for treated product water from each filter vessel as well as composite sampling ports for raw and finished water and for backwash effluent.
3. Two ¾" threaded half couplings shall be provided, one on the inlet and one on the outlet manifold for such use as the customer may consider appropriate. These shall be plugged at time of delivery.

PART 3 - PRODUCTS

3.1 EXAMINATION

A. Prior to installation, inspect and verify condition of vessels, internal distribution manifolds, valves, assemblies, piping and appurtenances. Installation constitutes installer's acceptance of product condition for satisfactory installation.

3.2 PREPARATION

A. Correct defects or conditions which may interfere with or prevent a satisfactory installation.

3.3 INSTALLATION

A. Install filtration equipment in accordance with the manufacturer's instructions.

B. Ensure filter skid is level and true to floor and existing utilities.

C. Complete pipe, electrical and pneumatic/pressurized water connections.

D. Place gravel and media in accordance with the manufacturer's instructions.

E. Properly disinfect gravel and pre-treat media in accordance with the manufacturer's instructions.

F. Install control panel and necessary electrical wiring for operation of the system.

G. Route treated water and backwash water to waste during system startup. Engineer must provide approval before treated water is routed to the potable reservoir.

H. Ensure system setup is in accordance with the manufacturer's instructions.

I. Provide assistance, including manpower to system operator and Engineer during treatment startup and full-scale pilot test.

3.4 FIELD SERVICE

A. The Contractor, water system operator, Engineer, and a factor authorized service representative shall be present for treatment system startup.

B. The services of a factory authorized service representative shall be made available to supervise, inspect and supply operator training and initial start-up as needed for initial system operation. The manufacturer's representative (factory trained) for the filter system specified herein shall be present at the jobsite for one (1) eight-hour day, travel time excluded.

C. The Contractor will verify that the system is ready for startup per manufacturer's start up requirements and provide notification at least two weeks in advance of the manufacturer's representative's scheduled visits on site.

3.5 CLEANING AND DISINFECTION

A. Cleaning

1. Clean treatment facility in accordance with AWWA C653 "Disinfection of Water Treatment Plants" before disinfecting, conducting bacteriological sampling, and treatment system startup.
2. Maintain equipment in clean condition during installation.
3. Before joining piping or other connections, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
4. Prior to equipment testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.
5. At completion of work and prior to final acceptance, thoroughly clean work installed under these specifications. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes. Repair any damage to equipment, piping, or parts of building, its finish, or furnishings, due to failure to properly clean, without cost to the Owner.

B. Disinfection

1. Disinfect treatment facility in accordance with AWWA C653 "Disinfection of Water Treatment Plants" before conducting bacteriological sampling and treatment system startup.
2. Disinfect all piping in the treatment building.
3. Dechlorinate chlorinated discharge water in accordance with AWWA C653 "Disinfection of Water Treatment Plants" and state, county, and other applicable requirements.

C. Bacteriological Sampling

1. Contractor shall conduct bacteriological sampling in accordance with AWWA C653 "Disinfection of Water Treatment Plants" until satisfactory results have been obtained.
2. Bacteriological testing shall be performed by a certified lab at the expense of the Contractor.
3. Provide lab test results to Engineer.
4. Satisfactory bacteriological test results must be provided to the Engineer and the Engineer must give approval before treatment system startup.

3.6 FULL-SCALE PILOT TESTING

A. Full-scale pilot testing shall be conducted after satisfactory bacteriological test results are provided to the Engineer and the Engineer gives approval to commence full-scale pilot testing.

B. The Contractor, water system operator, and Engineer shall meet on site to review full-scale pilot test requirements, and for the start of pilot testing. Water system operator shall conduct the

remainder of the pilot test under the direction of the Engineer. The Contractor shall provide manpower and equipment as necessary to correct treatment system installation deficiencies (if any) identified during full-scale pilot testing.

C. Water system operator shall complete the Full-Scale Pilot Test Worksheet provided at the end of this section, including water quality test results from a certified laboratory.

D. Engineer will full-scale pilot test results. If test results are adequate as determined by Engineer, Engineer will coordinate with Contractor and water system operator to implement final treatment system settings. If test results are inadequate as determined by Engineer, Contractor shall coordinate with water system operator and Engineer to repeat Validation Testing until adequate results are obtained.

E. Contractor shall bear the cost of all testing and inspecting (including water quality lab testing), locating and remedying of leaks, and any necessary retesting and reexamination.

END OF SECTION 46 61 00

Geotechnical Report

South Whidbey Aquatic and Recreation Center

PGC Project No.: 23014-01

January 9, 2024

Prepared for:

ARC Architects

Prepared by:

PALMER Geotechnical Consultants, Inc.

PO Box 1064, Coupeville, WA 98239
www.palmergeo.com
360-929-5676

January 9, 2024

South Whidbey Parks and Recreation District
Jennifer Cox
5475 Maxwelton Road
Langley, WA 98260
360.221.5484
swparks@swparks.org

C/o ARC Architects
Aaron Warner, AIA, NCARB
119 S Main Street, Suite 200
Seattle, WA 98104-2579
206.276.6066
warner@arcarchitects.com

RE: Geotechnical Report
Parcel No. R32910-091-3750
Maxwelton Road • Langley, WA 98260
PGC Project 23014

Dear Ms. Cox:

Palmer Geotechnical Consultants, Inc. (PGC) is pleased to present this geotechnical report regarding proposed improvements at the subject property. This report was prepared in accordance with our proposal dated April 5, 2023.

We appreciate the opportunity to be of service to you. If you have questions regarding this report, please do not hesitate to call.

Sincerely,

Palmer Geotechnical Consultants, Inc.

Scott Palmer, P.E.
President

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Appendix A: Exploration Logs

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1.0 Introduction

A geotechnical report has been prepared for the design and construction of a proposed new community aquatic center at west side of the subject property, located on Maxwelton Road in Langley, Washington. The property is identified as parcel number R32910-091-3750 by the Island County Assessor and is approximately 148.51-acres, owned by the South Whidbey Parks and Recreation District. Seven hollow stem auger borings were advanced to depths ranging from 9.3 to 15.4 feet below current site grades on Thursday, July 20, 2023. Logs of the borings are provided in Appendix A.

2.0 Project Description

The project consists of constructing a new community aquatic center with associated utilities, asphaltic paving, and stormwater facilities. A report providing preliminary infiltration recommendations was provided to the design team on July 12, 2023. The new aquatic center is proposed to consist of one building, 192 feet wide and approximately 24,000 square feet (s.f.) with an asphaltic parking lot to the north. The proposed location of the facility is currently undeveloped.

Preliminary locations for the facility have been reviewed in support of this report, though no formal site plan has been developed. Additionally, no construction documents were available at the time of this report. PGC assumes construction for the buildings will be steel-framed with slab-on-grade floors and supported on shallow footings.

3.0 Scope of Services

The goal of our scope was to characterize existing subsurface conditions in the vicinity of the proposed improvements. Our services included visiting the site, observing the advancement of seven borings, and preparing this report.

4.0 Site Description and Subsurface Conditions

4.1 Surface Conditions

The proposed construction involves a single parcel identified by the Island County Assessor as parcel number R32910-091-3750. The parcel is approximately 148.51-acres and is currently partially developed to the east of the project site. The location of the proposed aquatic center was previously developed as a homestead. Indicators of the previous development include a concrete pad, septic tanks, power pole, and debris from electric fencing. The parcel has an existing administration building, sports complex, and multiple public trails. The remainder of the parcel is

covered with native deciduous and coniferous trees over a healthy understory of native bushes and shrubs. Wetlands have been delineated to the north. The parcel is approximately square in shape and undulates throughout the property.

Access to the property is along the west property boundary from Maxwelton Road and to the east from Langley Road. The parcel is bordered by developed commercial, industrial, and residential properties.

4.2 Subsurface Conditions

For this project, we observed the excavation of seven hollow stem augers utilizing a rubber track mini drill rig, operated by a third party. During advancement soils were classified and logged in accordance with the United Soil Classification System (USCS), bagged and discretely labeled to be transported to the laboratory for supplemental testing.

From the existing ground surface to depths between 0.6 and 1.2 feet below present ground (BPG) was a dark brown topsoil in all borings except B-4. This unit consisted of silty sand with gravel and organics that was loose to medium dense, moist, and dark brown in color. Beneath the topsoil, and from the existing ground surface in B-4, were 2.8 to 5.0-foot-thick units of silty sand with gravel. These units were yellow brown in color, medium dense becoming dense to very dense, and moist. Orange mottling was observed throughout. To the maximum depth explored were 4.3 to 10.0-foot-thick units of gravelly sand with varying amounts of silt to silty sand with varying amounts of gravel. these units had orange mottling in the upper reaches of the units and were very dense, moist, and gray in color. Groundwater was not observed in the test pits. Groundwater levels are expected to vary with seasonal conditions. See the exploration logs in Appendix A for additional information.

The Geologic Map of the Langley and Western part of the Tulalip 7.5-minute Quadrangle, Island County, Washington, published by the Washington State Division of Geology and Earth Resources (Schasse, et. al., 2009), maps the site surface geology of the parcel as Pleistocene Vashon Stade Till (Qgt_v). Qgt_v is generally described as overconsolidated and unsorted varying amounts of clay, sand, silt, boulders, and gravel. Layers of advance outwash sand and ablation till are located throughout this deposit. This unit is massive to thick and forms vertical slopes.

United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) online Web Soil Survey maps the soils of the project area as Utsalady-Uselessbay complex, 0 to 5 percent slopes.

The Utsalady complex is composed glacial outwash with more than 80 inches to a restrictive feature with a high to very high permeability. The Hydrologic Soil Group is A with a land capability classification of 4s. The Uselessbay complex is composed of glacial outwash with 20 to 39 inches to a restrictive feature with very low to moderately low permeability. The Hydrologic Soil Group is A/D with a land capability classification of 4s.

Soil conditions encountered in the field consist of gravelly sand to sand with varying amounts of sand, gravel, and silt. These conditions are typical of native and fill deposits in the region and are consistent with area geology sources.

4.3 Groundwater Conditions

During our exploration, a distinct groundwater surface representative of saturated flow in the phreatic zone was not encountered in any of the exploration locations. Mottled soils were observed during our exploration as described in Section 4.2. Mottled soils and low chroma colors generally indicate wetting and drying cycles that occur in the upper soil column from surface water and fluctuating interflow are transmitted through stratigraphic variations of permeability.

The project scope did not include any long-term measurement of groundwater level conditions. If ongoing groundwater level conditions are desired a direct monitoring program conducted during the wet months, from October to May should be undertaken. It should be understood that water level conditions within the soil column may fluctuate in conjunction with stratigraphic permeability variations.

A Department of Ecology search within the immediate vicinity of the subject property indicates observed static water levels at depths from 22.0 to 210.0 feet BPG on properties with similar elevations to the project site. Existing wells located within the property have Department of Ecology (DOE) Well Tag Number (WTN) of AGA-524 with an observed static water level of 192.0 feet BPG, WTN BPA-499 has an observed static water level of 34.2 feet BPG.

5.0 Conclusions

Based on our review of available data, soil conditions encountered during exploration, laboratory testing, and our analysis, we believe the site is suitable for the proposed improvements.

The proposed construction should be appropriately designed utilizing the recommendations set forth below.

6.0 Site Development Recommendations

6.1 Site Preparation

Initial grading shall include the removal of all vegetation within proposed construction areas. The actual depth of stripping should be reviewed by the Project Geotechnical Engineer of Record at the time of construction, with expected minimum stripping depths between approximately 0.6 to 1.5 feet to remove topsoil and organics. Subgrade preparation depths within the vicinity of foundation elements should be a minimum of 4.0 BPG, depending on location. Depths could vary from the recommended depths to approximately 1.0 feet if a significant amount of time lapses from the writing of this report.

All vegetation, trees and roots larger than ¼-inch diameter or any accumulation of organic matter that will result in an organic content of more than 3 percent should be removed and not used as engineered fill. Roots larger than ¼-inch diameter should not be disced into the soils. These materials should be raked and hand-picked, as necessary, to ensure proper removal of organic materials.

Any areas proposed for structural fill should be relatively level with appropriately prepared subgrade soils.

6.2 Construction Considerations

The near-surface fine-grained soil at the project site is easily disturbed during wet weather and may become difficult to work with. Haul roads and staging area improvements will be necessary for support of construction traffic during the rainy season or when the moisture content of the subgrade soil begins to elevate, generally within a few percentage points above optimum. If not carefully executed, site preparation and excavation activities can create extensive soft areas. Earthwork should be planned and executed to minimize subgrade disturbance if site improvements are performed during wet weather months. The thickness of the haul roads and staging areas should be selected by the contractor. Haul roads subjected to repeated construction traffic may require a minimum of 18 inches of imported granular material. For light staging areas, 12 inches of imported granular material may be required. We recommend that imported granular material for haul roads and staging areas consist of durable crushed rock that is well graded with less than 8 percent by dry weight passing the U.S. Standard No. 200 sieve.

6.3 Erosion Control

The on-site soil is susceptible to erosion. Thus, we recommend that all efforts are made to limit construction during periods of wet weather. However, if construction occurs during wet weather,

erosion control measures should be implemented prior to construction and all steep slopes should be covered with straw matting or loose straw and that all slope surfaces be planted as soon as practical to minimize erosion. Surface water runoff should be collected and directed away from slopes to prevent water from running down the slope face. Erosion control measures such as truck tire washers and temporary detention and settling basins should be used in accordance with local and state ordinances.

6.4 Drainage

Footing drains should be installed outside the footing at the lowest portion of the foundation elements. Footing drains should be installed in such a manner to prevent backflow from other drainage sources. Drainage from footing drains and roof tightlines should be collected in separate systems. Each could discharge to a Low Impact Development Feature (LID) discharging at least 10 feet from any foundation element.

PGC recommends ensuring that the connections are watertight and sealed and routine maintenance is conducted along the length of pipe. PGC also recommends that an annual inspection program is initiated to ensure no damage or disconnect of the pipe, or its accessories occurs.

If rain gardens are selected, PGC recommends either PGC designs the rain gardens, or a licensed civil engineer or landscape architect is contacted.

6.5 Structural Fill

Structural fill includes fill proposed for use beneath foundations, slabs, pavements, any other areas intended to support structures, or within the influence zones of structures. Structural fill shall be free of organic matter and other deleterious material and, in general, should consist of a maximum particle size no larger than 3 inches in diameter. Recommendations for suitable fill material are provided in the following sections.

6.5.1 On-Site Native Soil

The on-site native soil may not be suitable for use as structural fill. Due to the variability of fines content, our experience, and laboratory testing, the on-site soil will be sensitive to small changes in moisture content and may be difficult, if not impossible, to compact adequately during wet weather or when its moisture content is more than a few percentage points off optimum. However, this soil may require extensive wetting if it is used as structural fill.

We recommend using imported granular material for structural fill if the appropriate moisture content of the on-site soil cannot be achieved.

6.5.2 Imported Granular Material

Imported material can be used as structural fill. Imported structural fill material should conform to Section 9-03.14(2), Select Borrow, Section 9-03.9(3) Crushed Surfacing Base Course or Crushed Surfacing Top Course as outlined in the most recent edition of the State of Washington Department of Transportation *Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications),* or approved equal verified by the geotechnical engineer of record.

Trenches and other areas proposed for the waterline should be backfilled utilizing material that conforms to Section 9-03.12(3) Gravel Backfill for Pipe Zone Bedding as outlined in the most recent edition of *WSDOT Standard Specifications*.

All granular material must be durable such that there is no degradation of the material during and after installation as structural fill. The percentage of fines can be increased to 12 percent if the fill is placed during dry weather and provided the fill material is moisture conditioned, as necessary, for proper compaction. The material should be placed in lifts with a maximum uncompacted thickness of 8 inches and compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D 1557. During the wet season or when wet subgrade conditions exist, the initial lift should have a maximum thickness of 15 inches and should be compacted by rolling with a smooth-drum, non-vibratory roller.

6.6 Slab and Pool Underlayment

Structural slabs and pool areas should have select fill placed and compacted prior to concrete placement,

6.6.1 Slab underlayment (internal building areas)

If internal areas (such as offices and common areas) are to have floor coverings, PGC recommends the installation of slab underlayment consisting of a capillary break. We recommend the installation of 6 inches of crushed rock containing less than 5 percent by weight passing the No. 200 U.S. Sieve under a sheet of 12 mil (visqueen) plastic sheeting under 4 inches of ASTM-33 sand or approved equal.

6.6.2 Slab underlayment (pool areas)

To provide better long-term performance we recommend that the areas of the pool are over-excavated 12 inches and 12 inches of structural fill conforming to Section 6.5.2 is placed and compacted.

7.0 Foundation Design Recommendations

The site is expected to be underlain by medium dense becoming very dense gravelly sand with silt to silty sand with gravel. Subsurface conditions within the vicinity of TP-4 provided the most favorable conditions for infiltrations. Locations with a higher fines content will be difficult to work with in extreme dry or wet conditions. Any areas receiving fill or with recompacted soils should extend a minimum of 1.0 feet outside the foundation element.

We conclude that the proposed construction improvements for the new buildings can be supported on shallow footings.

7.1 Spread Footings

We recommend that footings be designed with a minimum depth of 24 inches and a minimum width of 18 inches. An allowable bearing capacity of 3,500 psf may be used for design assuming a total settlement of 1-inch and differential settlement of ½-inch in 50 feet. A one-third increase in allowable bearing pressure is also typical for such systems when resisting short-term loads such as wind and seismic forces.

Lateral loads can be resisted by passive pressure against buried portions of the footings, retaining earth walls for the daylight basement, and sliding resistance between the bottoms of the footings. Table 1 below provides our recommended allowable soil parameters for shallow foundation design.

Table 1. Soil Parameters

Parameter	Value	Factor of Safety
Allowable Bearing Capacity	3,500 psf	3.0
Active – Free to Rotate*	37 pcf	1.0
Active – At Rest*	56 pcf	1.0
Passive	195 pcf	2.0
Soil Frictional Coefficient	0.35	1.5

*Permanent, below-grade walls should be designed for an additional uniform lateral pressure of 9H psf for seismic loading, where H is the depth embedded.

These values assume footings are backfilled with native soils or structural fill. The upper 18 inches of soil should be ignored unless the area is paved or covered with concrete due to soil disturbance associated with freeze/thaw action.

Sliding resistance between subgrade soils and foundations value assumes concrete placed directly on the subgrade.

7.2 Pavement Section Recommendations

To perform pavement section design calculations, PGC estimated traffic counts based upon the proposed size of the facility proposed parking lot. PGC anticipates approximately 150 parking spaces with lanes of travel in between, as well as moderate to heavy use depending upon the season. PGC assigned traffic loading values of approximately 116,733 (18-kip ESALs) for automobiles, delivery trucks, service trucks and aid vehicle access. We recommend assumed design ESALs are utilized as a minimum and that they be verified by the design team to ensure the most appropriate criteria is applied.

Calculations were performed per AASHTO Flexible Pavement Design methods, with the following standard input parameters:

Table 2. Parameters used for pavement design

Pavement Design Life	20 Years
Terminal Serviceability Index	2.0
Reliability	95
Expected Growth Rate	2.0%
Subgrade CBR Value	10

Based upon the above data and input parameters, PGC provides the following minimum roadway section design:

- Subgrade shall be proof-rolled to confirm that it contains no soft or deflection areas.
- A minimum of 4 inches of crushed surfacing base course (CSBC) in accordance with WSDOT Standard Specification 9-03.9(3) shall be placed in two lifts and compacted to 95 percent of its dry density.
- A minimum of 4 inches of Hot Mix Asphalt (HMA) in accordance with WSDOT Standard Specifications

7.3 Preliminary Infiltration Recommendations

In compliance with the 2014 SWMMWW, updated 2018, PGC performed a grain-size analysis on select samples obtained during our field investigation. The results of laboratory analysis performed on selected soil samples are presented below in Table 3.

PGC understands infiltration facility design is in the preliminary stages and is proposed to be underground within the vicinity of the test pits. Typical conditions below a layer of topsoil, consist of gravelly silty sand, silty gravelly sand, and silty sand with varying amounts of gravel that is very dense with low to moderate permeability. The exception are the soils within the vicinity of TP-4 where soils were of medium density with no orange mottling below 2.0 feet BPG. No seepage or groundwater was observed in any location. A distinct restrictive layer was observed during exploration in all test pits except TP-4 beginning at approximately 2.0 to 4.0 feet BPG depending on location. The fines content within the restrictive layer was between 22.8 to 42.5 percent, and soil density was dense becoming very dense with depth and orange mottling was observed throughout. Therefore, rates applied for design of systems should use a value corresponding to the restricting conditions.

For design purposes, PGC recommends a preliminary K_{sat} infiltration rate of *1.5 in/hr* in all locations. Final design should also take into account the effect of seasonal high groundwater. Based on observations of mottling and soil coloration patterns, typical winter season perched interflow may be affected by the complex hydrostratigraphy of the near-surface soils and prevalence of overconsolidated soils that temporarily perch interflow, at least for an undeveloped and uncontrolled site condition. Therefore, due to the proposed improvements at the site, perched water conditions should be anticipated.

Table 3. Summary of Grain Size Analysis Method and Long-Term Infiltration Rate (LTIR)

Sample ID	Depth (BPG) (feet)	USCS Class	Fines %	D_{10} (mm)	D_{60} (mm)	D_{90} (mm)	CF	K_{sat} (in/hr.)	Moisture Content %
TP-1 @ 4.7'-4.9	4.7'-4.9'	**SM**	42.5	0.018	0.997	3.0	0.324	**1.7**	6.8
TP-2 @ 3.8'-4.0'	3.8'-4.0'	SM	17.2	0.044	1.820	18.0	0.324	**4.1**	12.3
TP-3 @ 4.8'-5.0'	4.8'-5.0'	**SM**	29	0.026	1.401	7.0	0.324	**2.9**	15.6
TP-4 @ 2.4'-2.6'	2.4'-2.6'	SM	12.4	0.060	1.747	22.0	0.324	**4.9**	3.1
TP-4 @ 4.2'-4.4'	4.2'-4.4'	**SM**	12.9	0.028	1.556	20.0	0.324	**4.4**	4.1
TP-4 @ 6.3'-6.5'	6.3'-6.5'	SM	16.3	0.046	1.268	3.6	0.324	**6.5**	15.2
TP-5 @ 3.8'-4.0'	3.8'-4.0'	**SM**	24.2	0.031	1.388	13.0	0.324	**3.2**	3.8
TP-5 @ 4.8'-5.0'	4.8'-5.0'	SM	22.8	0.033	1.248	11.0	0.324	**3.6**	4.5

While potentially variable horizons that are low to moderate in fines content and the interpreted presence of shallow seasonal interflow should be incorporated into the site-appropriate design of the infiltration facilities, PGC observed the soil conditions were generally uniform in the test pit locations below the topsoil.

The preliminary K_{sat} rate is based upon the most restrictive conditions observed during excavation. If actual infiltration rates are desired for design, a Small-Scale Pit Test (PIT) will likely need to be performed in the vicinity of the proposed facilities. Additionally, PGC recommends we be contacted to review design plans and specifications, to ensure design of the proposed stormwater facilities are consistent with the content and intent of recommendations presented herein. PGC may be contacted for additional consultation toward facility design at the request of the client and design engineer.

7.4 Wet weather conditions

If unstable conditions are encountered due to wet weather, windrowing, or mixing with dry materials may be required. In some cases, a sacrificial lift of unsuitable material may need to be used to cap the fill and removed later to continue fill process during more suitable weather conditions.

8.0 Seismic Design Criteria

The *Liquefaction Susceptibility Map of Island County* (Palmer et al., 2004) indicates that there is a very low (Site Class C) for liquefaction on the parcel in the vicinity of the proposed construction. All structures should be designed according to criteria outlined by the latest edition, at the time of construction, of the International Code Council® for Site Class C.

9.0 Construction Observation

We recommend that PGC is retained to review final design plans and to ensure conformance with our recommendations. Satisfactory earthwork and foundation performance depends to a large degree on the quality of construction. Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions often requires experience; therefore, qualified personnel should visit the site with sufficient frequency to detect whether subsurface conditions conform or have changed significantly from those anticipated.

10.0 General Comments

The analysis and recommendations presented in this report are based upon the data obtained from our exploration locations, available public records, and from other information and sources discussed in this report. This report does not reflect variations that may occur between known data points, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until construction begins or is completed. Should variations appear that differ from the data and recommendations contained within this report, PGC should be immediately notified so that further evaluation and supplemental recommendations can be provided. PGC is not responsible for ensuring that other members of the project team implement our recommendations.

The scope of our services does not include services related to construction safety precautions or dewatering operations. Our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with the generally accepted practices. This report has been prepared for the exclusive use of our client and their representatives for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices in this area at the time this report was prepared. This report may not be relied upon by third parties or for

other sites.

No warranties, either expressed or implied, are intended or made. Site safety and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless PGC reviews the changes and either verifies or modifies the conclusions of this report in writing.

If you have questions concerning this letter, please feel free to contact me at 360.929.5676.

Sincerely,

Palmer Geotechnical Consultants, Inc.

1-9-2024

Meghan Hallam

Scott A. Palmer, P.E.

Figure 1: Site Vicinity

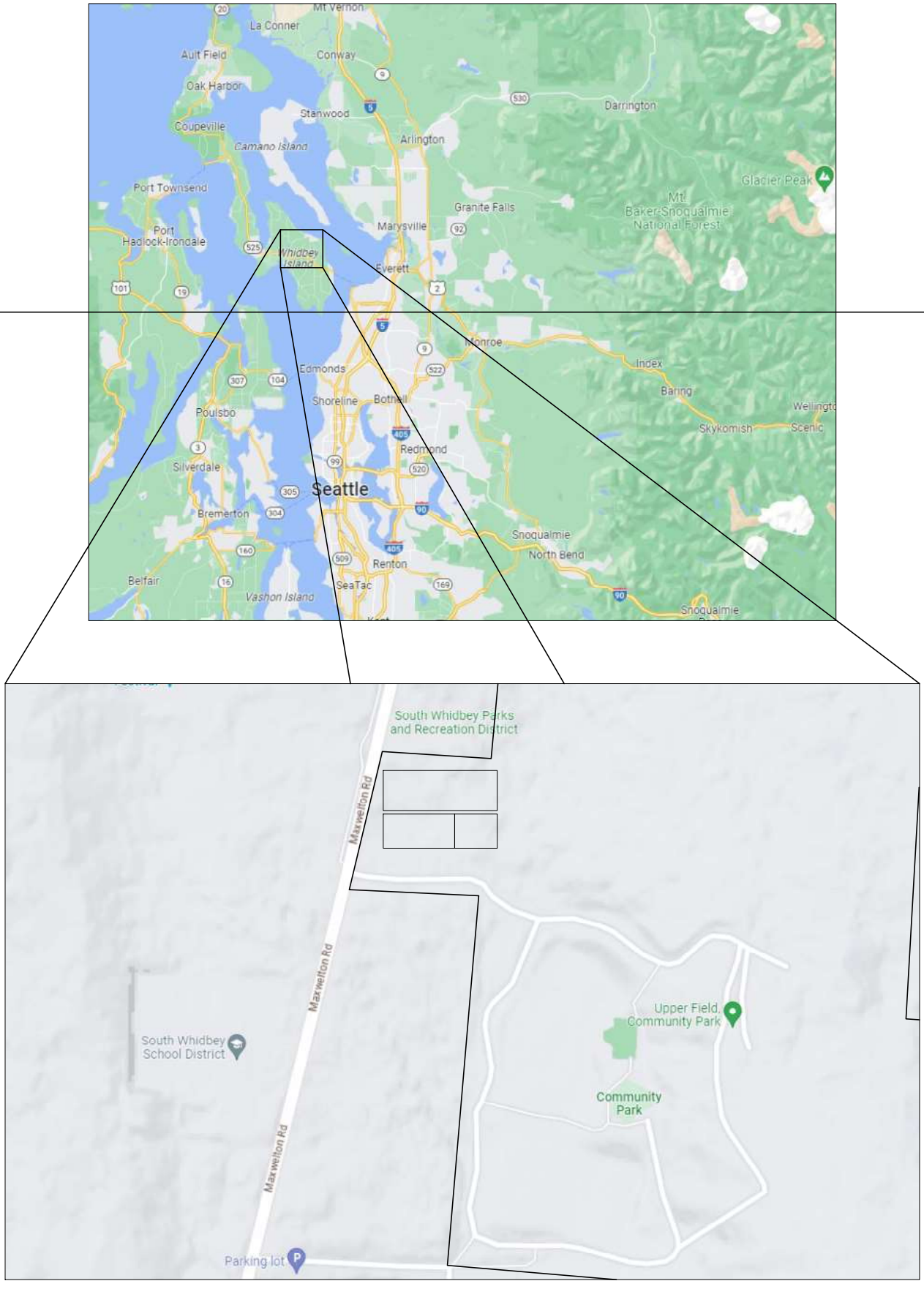

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Figure:
1

Figure 2: Exploration Locations

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Not to Scale
Not to be Used for Construction

Test Pits excavated on June 21, 2023

Hollow Stem Augers advanced on July 20, 2023

Figure:

2

Appendix A: Exploration Logs

B-1

SAMPLE DATA

SOIL PROFILE

Exploration Method: Hollow Stem Auger
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 1.0) TOPSOIL silty SAND with gravel, grass above and roots throughtout, loose, dry. DARK BROWN					
1'						(1.0 - 10.2) silty SAND with some gravel, some orange mottling throughout, dense, moist. GRAY					
2'											
3'											
4'											
5'											
6'			SPT		SM		44	14.8	7.0	63.0	30.0
7'											
8'											
9'											
10'							50/4"	5.5			
11'			SPT		SM	(10.2 - 11.2) silty SAND with trace gravel, very dense, damp becoming moist. GRAY		10.7	3.1	61.0	35.9
12'						Refusal at 11.2 feet BPG. No Groundwater Encountered.					

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South Whidbey Aquatic Center
Langley, WA

Log of:
B-1

B-2

SAMPLE DATA

SOIL PROFILE

Exploration Method: Hollow Stem Auger
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 5.1) silty SAND with gravel, orange mottling throughtout, loose, moist. YELLOW BROWN					
5'			SPT		SM	(5.1 - 9.0) silty SAND with gravel, some orange mottling throughout, very dense, moist. GRAY	50/5"	11.1 10.0	14.2	65.7	20.1
9'			SPT		SM	(9.0 - 9.9) silty SAND with some gravel, trace orange mottling throughout, very dense, moist. GRAY	50/6"	3.0	7.8	63.8	28.4
10'						Refusal at 9.9 feet BPG. No Groundwater Encountered.					

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South Whidbey Aquatic Center
Langley, WA

Log of:

B-2

B-3

SAMPLE DATA

SOIL PROFILE

Exploration Method: Hollow Stem Auger
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 0.9) TOPSOIL silty SAND with gravel, grass above and roots throughout, loose, dry. DARK BROWN					
1'					SM	(0.9 - 2.5) silty SAND with gravel, medium dense, damp becoming moist. YELLOW BROWN					
2'											
3'			SPT		SM	(2.5 - 5.4) silty SAND with gravel, orange mottling throughout, medium dense, damp becoming moist. YELLOW BROWN	14	4.8			
4'											
5'							40	1.6			
6'			SPT		SM	(5.4 - 10.0) silty SAND with some gravel, some orange mottling throughout, dense, moist. GRAY		5.9	9.6	62.6	27.8
7'											
8'											
9'											

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Log of:
B-3

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SAMPLE DATA

SOIL PROFILE

Exploration Method: Hollow Stem Auger
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
10'			SPT		SP	(10.0 - 14.0) SAND with gravel and silt, some orange mottling throughout, very dense, moist. GRAY	50/6"	1.6			
11'											
12'											
13'											
14'			SPT		SM	(14.0 - 15.4) silty SAND with some gravel, very dense, moist. GRAY	50/5"	12.1	8.5	70.6	20.9
15'						Refusal at 15.4 feet BPG. No Groundwater Encountered.					
16'											
17'											
18'											
19'											

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Log of:

B-3

B-4

SAMPLE DATA

SOIL PROFILE

Exploration Method: Hollow Stem Auger
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 5.0) silty SAND with gravel, orange mottling throughout, medium dense, moist. YELLOW BROWN					
1'											
2'											
3'											
4'											
5'			SPT		SM	(5.0 - 8.0) silty SAND with gravel, orange mottling throughout, very dense, moist. GRAY	88	15.4			
6'											
7'											
8'			SPT		SM	(8.0 - 9.3) silty SAND with gravel, very dense, moist. GRAY	50/6"	8.1	10.9	71.1	18.0
9'											
10'						Refusal at 9.3 feet BPG. No Groundwater Encountered.					
11'											
12'											

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Log of:

B-4

B-5

SAMPLE DATA

SOIL PROFILE

Exploration Method: Hollow Stem Auger
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 1.2) TOPSOIL silty SAND with gravel and organics, loose, moist. DARK BROWN					
1'											
2'						(1.2 - 5.0) silty SAND with gravel, orange mottling throughout, very dense, moist. YELLOW BROWN					
3'					SM						
4'											
5'						(5.0 - 9.4) gravelly SAND with some silt, orange mottling throughout, very dense, damp. GRAY	50/6"				
6'			SPT					3.4			
7'					SP - SM						
8'											
9'			SPT				50/5"	4.0	18.9	73.6	7.5
						Refusal at 9.4 feet BPG. No Groundwater Encountered.					
10'											
11'											
12'											

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Langley, WA

Log of:

B-5

B-6

SAMPLE DATA

SOIL PROFILE

Exploration Method: Hollow Stem Auger
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 0.9) TOPSOIL silty SAND with gravel and organics, loost, moist. DARK BROWN					
1'						(0.9 - 3.7) silty SAND with gravel, orange mottling throughout, medium dense, moist. YELLOW BROWN					
2'					SM						
3'			SPT				33	4.6			
4'					SP	(3.7 - 5.0) SAND with gravel and silt, orange mottling throughout, dense, moist. GRAY		14.3			
5'						(5.0 - 10.0) silty SAND with some gravel, some orange mottling throughout, very dense, moist. GRAY	56				
6'			SPT					7.1	8.7	69.6	21.7
7'					SM						
8'											
9'											
10'						Refusal at 10.0 feet BPG. No Groundwater Encountered.	50/5"				
11'											
12'											

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Langley, WA

Log of:

B-6

B-7

SAMPLE DATA

SOIL PROFILE

Exploration Method: Hollow Stem Auger
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 0.6) TOPSOIL silty SAND with gravel and organics, loose, moist. DARK BROWN					
1'						(0.6 - 5.3) silty SAND with gravel, orange mottling throughout, loose becoming dense, moist. YELLOW BROWN					
2'											
3'											
4'											
5'							43	6.3			
6'			SPT			(5.3 - 10.4) silty gravelly SAND becoming silty SAND with some gravel, orange mottling throughout, very dense, damp becoming moist. GRAY		5.7	15.3	62.4	22.3
7'					SP						
8'											
9'											
10'			SPT				50/5"	14.3	8.7	75.7	15.5
11'						Refusal at 10.4 feet BPG. No Groundwater Encountered.					
12'											

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Log of:

B-7

TP-1

SAMPLE DATA

SOIL PROFILE

Exploration Method: Test Pits
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 0.7) TOPSOIL silty SAND with organics, grass above and roots throughout, loose, damp. DARK BROWN					
1'						(0.7 - 5.0) silty SAND with some gravel, orange mottling and gray fine grained sand lenses throughout, very dense, moist. BROWN GRAY					
2'			Grab				67	11.4			
3'					SM						
4'			Grab				50/4"	8.9			
5'			Grab				50/4"	2.6	7.5	50.0	42.5
6'						Termination at 5.0 feet. No Groundwater Encountered					
7'											

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Log of:

TP-1

TP-2

SAMPLE DATA / SOIL PROFILE

Exploration Method: Test Pits
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 0.7) TOPSOIL SAND with silt, grass above and roots throughout, loose damp. ORANGE BROWN					
1'						(0.7 - 4.5) gravelly silty SAND, orange mottling and gray silt and sand lenses throughout, very dense, moist. GRAY BROWN					
2'											
					SM		50/4"				
3'			Grab					7.4			
4'			Grab			*{CEC=3.8 meq/100g; SAND=78.0%, SILT=17.0%, CLAY=5.0%}*	50/6"	12.3	26.3	56.5	17.2
5'						Termination at 4.5 feet. No Groundwater Encountered					
6'											
7'											

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Log of:
TP-2

TP-3

SAMPLE DATA / SOIL PROFILE

Exploration Method: Test Pits
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 0.8) TOPSOIL SAND with organics, loose, moist. DARK BROWN					
1'					SM	(0.8 - 3.3) silty SAND with gravel, orange mottling throughout, very dense, moist. YELLOW BROWN					
2'					SM						
3'			Grab		SM		58	2.0			
4'			Grab		SM	(3.3 - 5.2) silty SAND with gravel, orange mottling and gray silt and sand lenses throughout, very dense, moist. GRAY BROWN	50/6"	9.6			
5'			Grab		SM	*{CEC=4.8 meq/100g; SAND=80.0%, SILT=14.0%, CLAY=6.0%}*		15.6	14.7	56.2	29.0
6'						Termination at 5.2 feet. No Groundwater Encountered					
7'											

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South Whidbey Aquatic Center
Freeland, WA

Log of:
TP-3

TP-4

SAMPLE DATA

SOIL PROFILE

Exploration Method: Test Pits
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 0.2) TOPSOIL SAND with organics, loose, moist. DARK BROWN					
						(0.2 - 2.0) SAND with some gravel and trace silt, orange mottling throughout, medium dense, damp. YELLOW BROWN					
1'					SM						
			Grab					1.8			
2'						(2.0 - 7.0) gravelly SAND with silt becoming silty SAND with some gravel, medium dense becoming dense, damp becoming moist. GRAY					
			Grab				25	3.1	26.4	83.4	12.4
3'											
4'											
			Grab		SM		17	4.1	17.3	69.9	12.9
5'											
6'											
			Grab			*{CEC=4.6 meq/100g; SAND=90.0%, SILT=8.0%, CLAY=2.0%}*	38	15.2	7.9	75.7	16.3
7'						Termination at 7.0 feet. No Groundwater Encountered					

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Log of:
TP-4

TP-5

SAMPLE DATA / SOIL PROFILE

Exploration Method: Test Pits
Ground Surface Elev: Approx 200' AMSL

Depth	Groundwater	Sample Interval	Sampler Type	Graphic Symbol	USCS Symbol	SOIL DESCRIPTION	N_{60} Blows/Ft	Water Content Percent	Percent Gravel	Percent Sand	Percent Fines
0'					SM	(0.0 - 0.3) TOPSOIL SAND with organics with roots throughout, loose, moist. DARK BROWN					
						(0.3 - 2.8) SAND with gravel and trace silt, orange mottling throughout, medium dense, damp. YELLOW BROWN					
1'					SM						
2'			Grab			*{CEC=4.6 meq/100g; SAND=90.0%, SILT=8.0%, CLAY=2.0%}*	14	3.8			
3'						(2.8 - 5.0) silty gravelly SAND, orange mottling throughout,medium dense becoming very dense, moist. YELLOW BROWN					
4'			Grab		SM	*{CEC=3.0 meq/100g; SAND=84.0%, SILT=14.0%, CLAY=2.0%}*	50/3"	3.8	16.4	59.3	24.2
5'			Grab			Termination at 5.0 feet. No Groundwater Encountered		4.5	15.3	62.0	22.8
6'											
7'											

PALMER Geotechnical Consultants, Inc.

South Whidbey Aquatic Center
Freeland, WA

Log of:
TP-5

Appendix B: Laboratory Testing

PALMER
Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

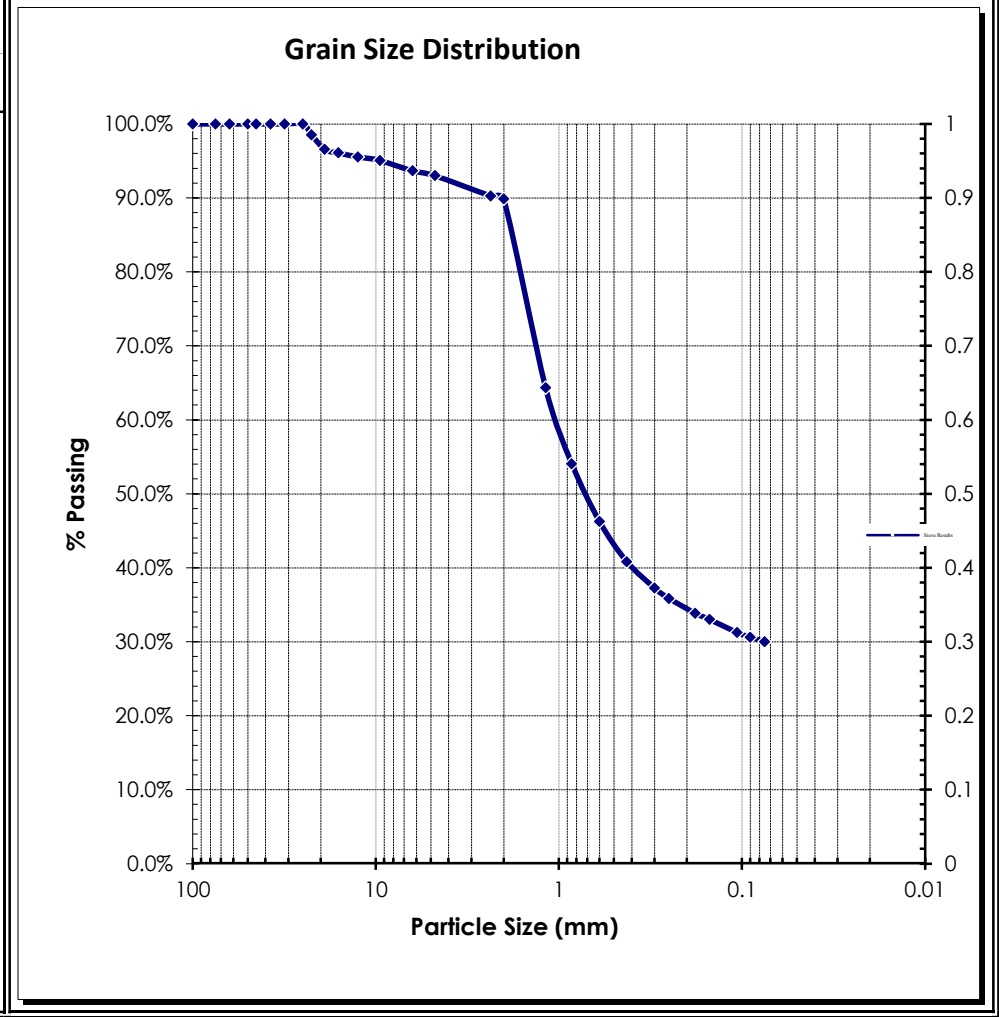
DateTested: 8/3/2023
Sample #: B-1
Depth: 5.0-6.5
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.025 mm
$D_{(30)}$= 0.075 mm
$D_{(60)}$= 1.041 mm
Liquid Limit= 0.0%

% Gravel = 7.0%
% Sand = 63.0%
% Silt & Clay = 30.0%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 0.22
Coeff. of Uniformity, C_U = 41.64
Fineness Modulus= 2.44
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		98.5%	100.0%	0.0%
3/4"	19.00	96.6%	96.6%	100.0%	0.0%
5/8"	16.00		96.1%	100.0%	0.0%
1/2"	12.50		95.5%	100.0%	0.0%
3/8"	9.50	95.1%	95.1%	100.0%	0.0%
1/4"	6.30		93.7%	100.0%	0.0%
#4	4.75	93.0%	93.0%	100.0%	0.0%
#8	2.360		90.3%	100.0%	0.0%
#10	2.000	89.9%	89.9%	100.0%	0.0%
#16	1.180		64.3%	100.0%	0.0%
#20	0.850		54.1%	100.0%	0.0%
#30	0.600		46.3%	100.0%	0.0%
#40	0.425	40.8%	40.8%	100.0%	0.0%
#50	0.300		37.3%	100.0%	0.0%
#60	0.250		35.9%	100.0%	0.0%
#80	0.180		33.9%	100.0%	0.0%
#100	0.150	33.0%	33.0%	100.0%	0.0%
#140	0.106		31.2%	100.0%	0.0%
#170	0.090		30.6%	100.0%	0.0%
#200	0.075	30.0%	30.0%	100.0%	0.0%



PALMER
Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

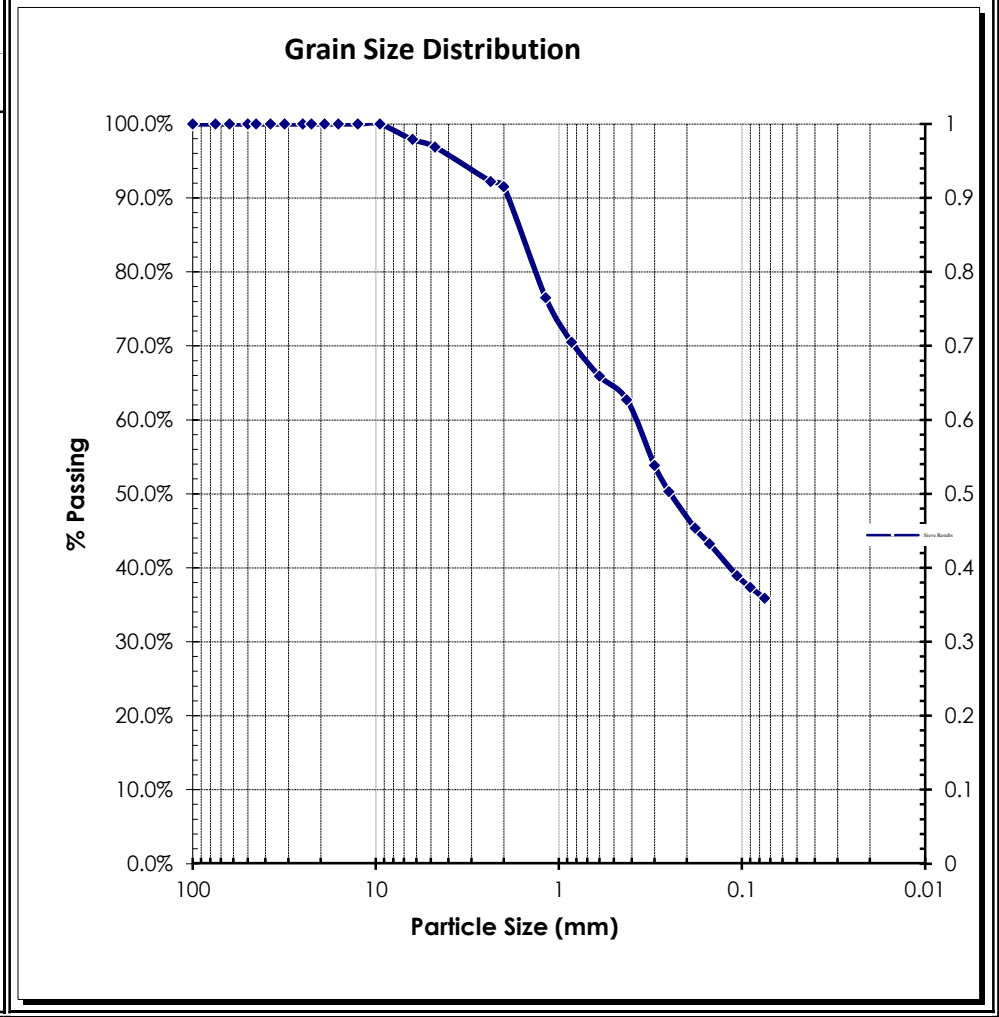
DateTested: 8/3/2023
Sample #: B-1
Depth: 10.2-11.2
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.021 mm
$D_{(30)}$= 0.063 mm
$D_{(60)}$= 0.387 mm
Liquid Limit= 0.0%

% Gravel = 3.1%
% Sand = 61.0%
% Silt & Clay = 35.9%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 0.49
Coeff. of Uniformity, C_U = 18.50
Fineness Modulus= 1.71
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		100.0%	100.0%	0.0%
3/4"	19.00	100.0%	100.0%	100.0%	0.0%
5/8"	16.00		100.0%	100.0%	0.0%
1/2"	12.50		100.0%	100.0%	0.0%
3/8"	9.50	100.0%	100.0%	100.0%	0.0%
1/4"	6.30		97.9%	100.0%	0.0%
#4	4.75	96.9%	96.9%	100.0%	0.0%
#8	2.360		92.2%	100.0%	0.0%
#10	2.000	91.5%	91.5%	100.0%	0.0%
#16	1.180		76.5%	100.0%	0.0%
#20	0.850		70.5%	100.0%	0.0%
#30	0.600		65.9%	100.0%	0.0%
#40	0.425	62.7%	62.7%	100.0%	0.0%
#50	0.300		53.9%	100.0%	0.0%
#60	0.250		50.3%	100.0%	0.0%
#80	0.180		45.3%	100.0%	0.0%
#100	0.150	43.2%	43.2%	100.0%	0.0%
#140	0.106		38.9%	100.0%	0.0%
#170	0.090		37.3%	100.0%	0.0%
#200	0.075	35.9%	35.9%	100.0%	0.0%



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Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

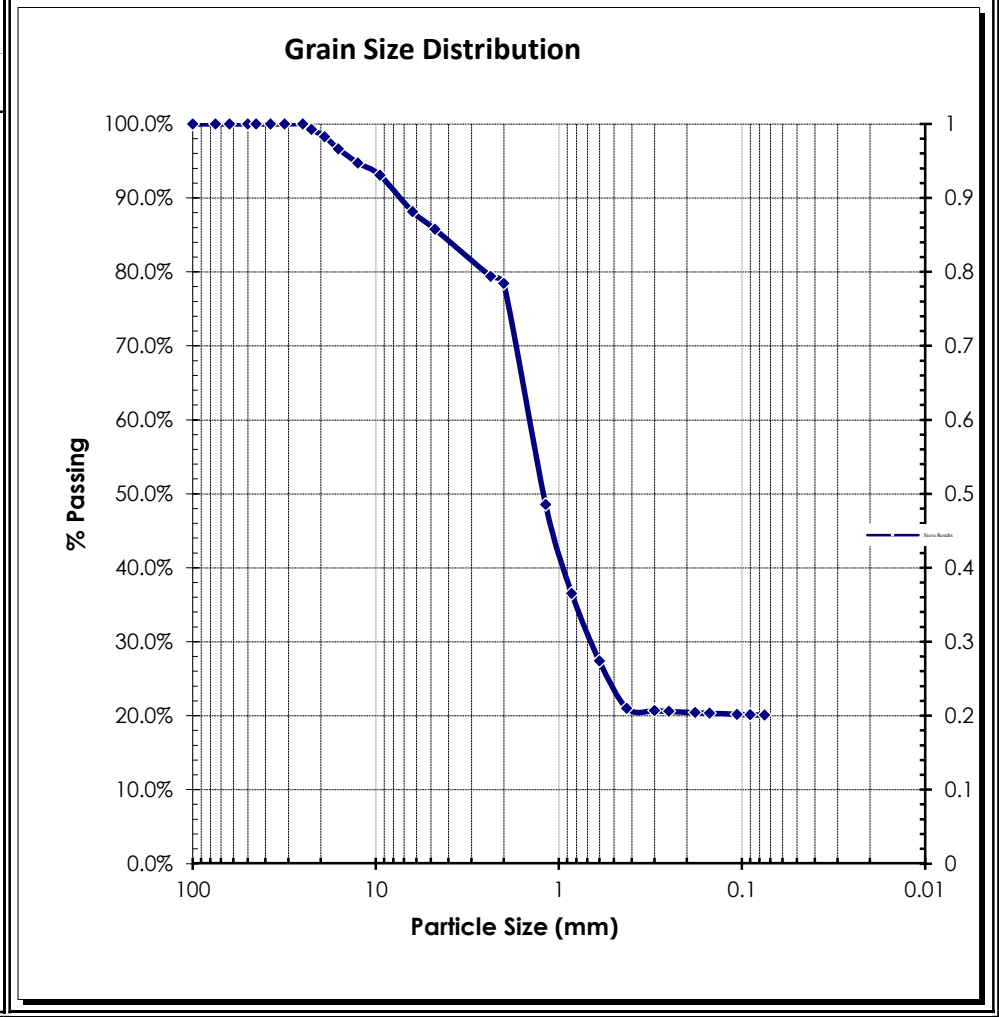
DateTested: 8/3/2023
Sample #: B-2
Depth: 5.1-5.4
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.037 mm
$D_{(30)}$= 0.671 mm
$D_{(60)}$= 1.494 mm
Liquid Limit= 0.0%

% Gravel = 14.2%
% Sand = 65.7%
% Silt & Clay = 20.1%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 8.08
Coeff. of Uniformity, C_U = 40.00
Fineness Modulus= 3.26
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		99.3%	100.0%	0.0%
3/4"	19.00	98.3%	98.3%	100.0%	0.0%
5/8"	16.00		96.6%	100.0%	0.0%
1/2"	12.50		94.7%	100.0%	0.0%
3/8"	9.50	93.1%	93.1%	100.0%	0.0%
1/4"	6.30		88.2%	100.0%	0.0%
#4	4.75	85.8%	85.8%	100.0%	0.0%
#8	2.360		79.4%	100.0%	0.0%
#10	2.000	78.5%	78.5%	100.0%	0.0%
#16	1.180		48.5%	100.0%	0.0%
#20	0.850		36.5%	100.0%	0.0%
#30	0.600		27.4%	100.0%	0.0%
#40	0.425	21.0%	21.0%	100.0%	0.0%
#50	0.300		20.7%	100.0%	0.0%
#60	0.250		20.6%	100.0%	0.0%
#80	0.180		20.4%	100.0%	0.0%
#100	0.150	20.3%	20.3%	100.0%	0.0%
#140	0.106		20.2%	100.0%	0.0%
#170	0.090		20.1%	100.0%	0.0%
#200	0.075	20.1%	20.1%	100.0%	0.0%



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Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

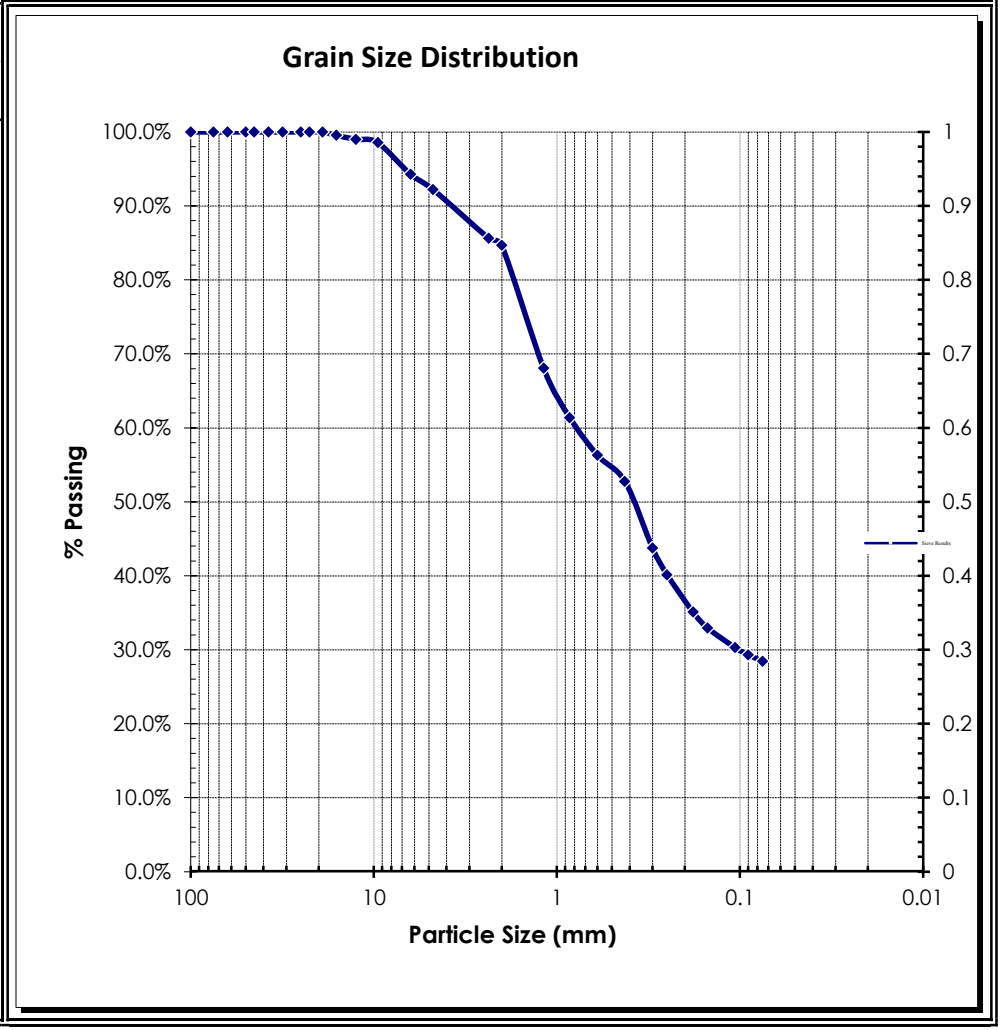
DateTested: 8/3/2023
Sample #: B-2
Depth: 9.0-9.8
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.026 mm
$D_{(30)}$= 0.101 mm
$D_{(60)}$= 0.782 mm
Liquid Limit= 0.0%

% Gravel = 7.8%
% Sand = 63.8%
% Silt & Clay = 28.4%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 0.50
Coeff. of Uniformity, C_U = 29.65
Fineness Modulus= 2.23
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		100.0%	100.0%	0.0%
3/4"	19.00	100.0%	100.0%	100.0%	0.0%
5/8"	16.00		99.5%	100.0%	0.0%
1/2"	12.50		99.0%	100.0%	0.0%
3/8"	9.50	98.6%	98.6%	100.0%	0.0%
1/4"	6.30		94.3%	100.0%	0.0%
#4	4.75	92.2%	92.2%	100.0%	0.0%
#8	2.360		85.7%	100.0%	0.0%
#10	2.000	84.7%	84.7%	100.0%	0.0%
#16	1.180		68.1%	100.0%	0.0%
#20	0.850		61.4%	100.0%	0.0%
#30	0.600		56.3%	100.0%	0.0%
#40	0.425	52.8%	52.8%	100.0%	0.0%
#50	0.300		43.7%	100.0%	0.0%
#60	0.250		40.1%	100.0%	0.0%
#80	0.180		35.1%	100.0%	0.0%
#100	0.150	32.9%	32.9%	100.0%	0.0%
#140	0.106		30.3%	100.0%	0.0%
#170	0.090		29.3%	100.0%	0.0%
#200	0.075	28.4%	28.4%	100.0%	0.0%



PALMER
Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

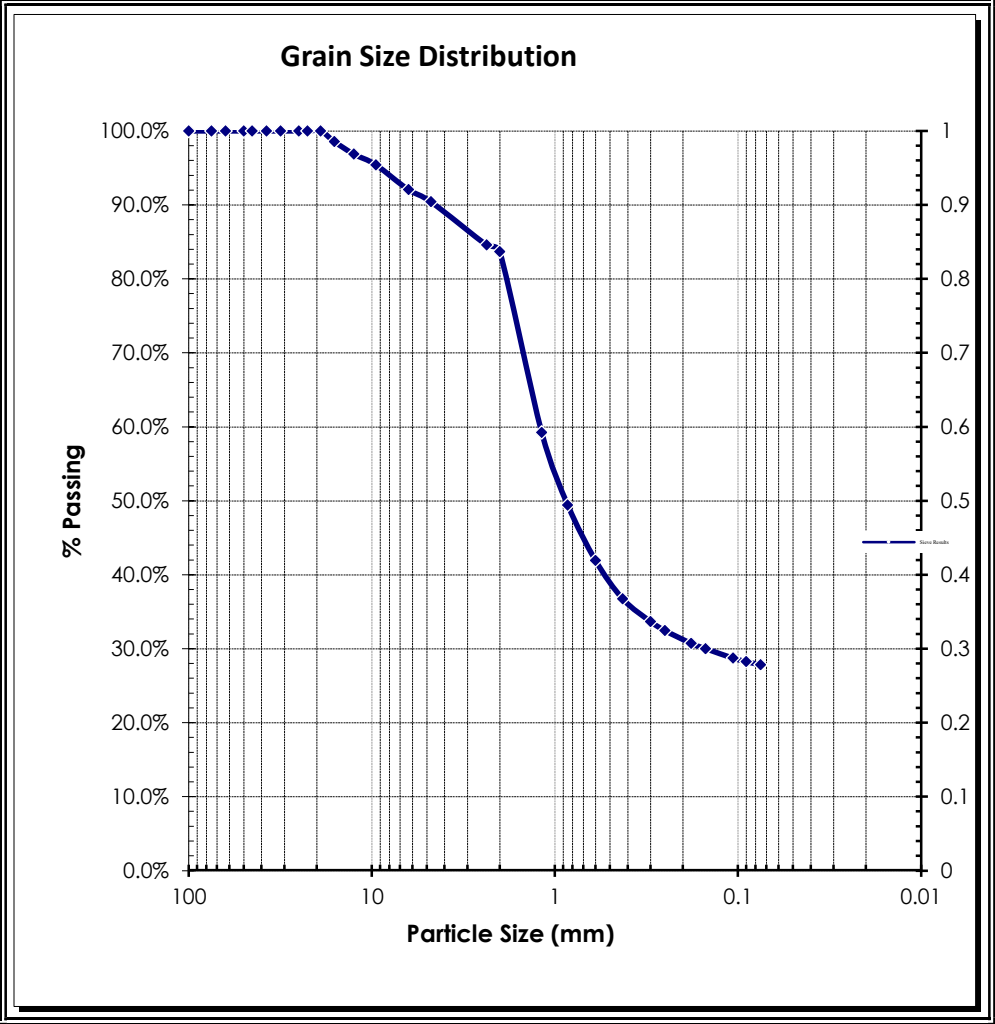
DateTested: 8/3/2023
Sample #: B-3
Depth: 5.4-6.4
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.027 mm
$D_{(30)}$= 0.150 mm
$D_{(60)}$= 1.205 mm
Liquid Limit= 0.0%

% Gravel = 9.6%
% Sand = 62.6%
% Silt & Clay = 27.8%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 0.69
Coeff. of Uniformity, C_U = 44.71
Fineness Modulus= 2.65
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		100.0%	100.0%	0.0%
3/4"	19.00	100.0%	100.0%	100.0%	0.0%
5/8"	16.00		98.6%	100.0%	0.0%
1/2"	12.50		96.9%	100.0%	0.0%
3/8"	9.50	95.4%	95.4%	100.0%	0.0%
1/4"	6.30		92.1%	100.0%	0.0%
#4	4.75	90.4%	90.4%	100.0%	0.0%
#8	2.360		84.6%	100.0%	0.0%
#10	2.000	83.7%	83.7%	100.0%	0.0%
#16	1.180		59.2%	100.0%	0.0%
#20	0.850		49.4%	100.0%	0.0%
#30	0.600		42.0%	100.0%	0.0%
#40	0.425	36.7%	36.7%	100.0%	0.0%
#50	0.300		33.7%	100.0%	0.0%
#60	0.250		32.5%	100.0%	0.0%
#80	0.180		30.7%	100.0%	0.0%
#100	0.150	30.0%	30.0%	100.0%	0.0%
#140	0.106		28.7%	100.0%	0.0%
#170	0.090		28.3%	100.0%	0.0%
#200	0.075	27.8%	27.8%	100.0%	0.0%



PALMER
Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

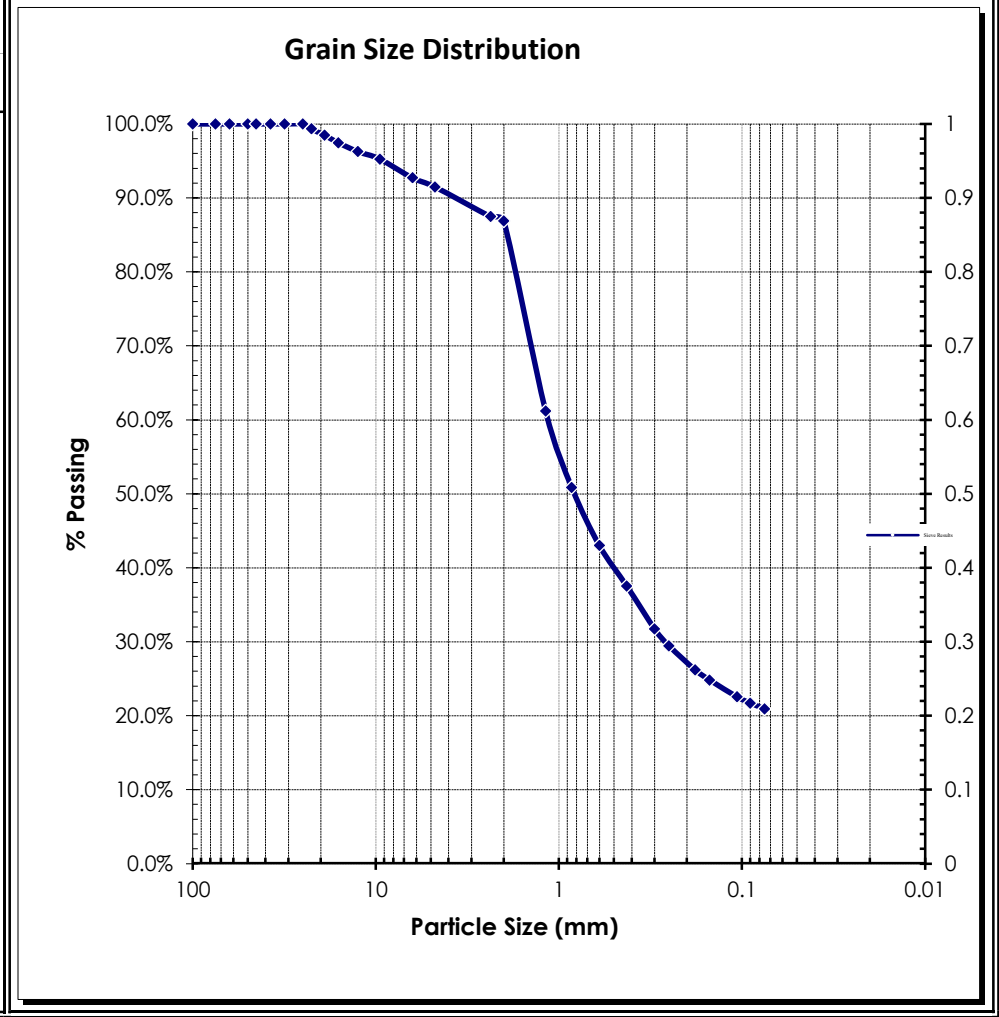
DateTested: 8/3/2023
Sample #: B-3
Depth: 14.0-15.4
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.036 mm
$D_{(30)}$= 0.262 mm
$D_{(60)}$= 1.142 mm
Liquid Limit= 0.0%

% Gravel = 8.5%
% Sand = 70.6%
% Silt & Clay = 20.9%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 1.68
Coeff. of Uniformity, C_U = 31.86
Fineness Modulus= 2.67
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		99.3%	100.0%	0.0%
3/4"	19.00	98.5%	98.5%	100.0%	0.0%
5/8"	16.00		97.5%	100.0%	0.0%
1/2"	12.50		96.3%	100.0%	0.0%
3/8"	9.50	95.3%	95.3%	100.0%	0.0%
1/4"	6.30		92.7%	100.0%	0.0%
#4	4.75	91.5%	91.5%	100.0%	0.0%
#8	2.360		87.5%	100.0%	0.0%
#10	2.000	86.9%	86.9%	100.0%	0.0%
#16	1.180		61.2%	100.0%	0.0%
#20	0.850		50.8%	100.0%	0.0%
#30	0.600		43.0%	100.0%	0.0%
#40	0.425	37.5%	37.5%	100.0%	0.0%
#50	0.300		31.7%	100.0%	0.0%
#60	0.250		29.4%	100.0%	0.0%
#80	0.180		26.2%	100.0%	0.0%
#100	0.150	24.8%	24.8%	100.0%	0.0%
#140	0.106		22.5%	100.0%	0.0%
#170	0.090		21.7%	100.0%	0.0%
#200	0.075	20.9%	20.9%	100.0%	0.0%



PALMER Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

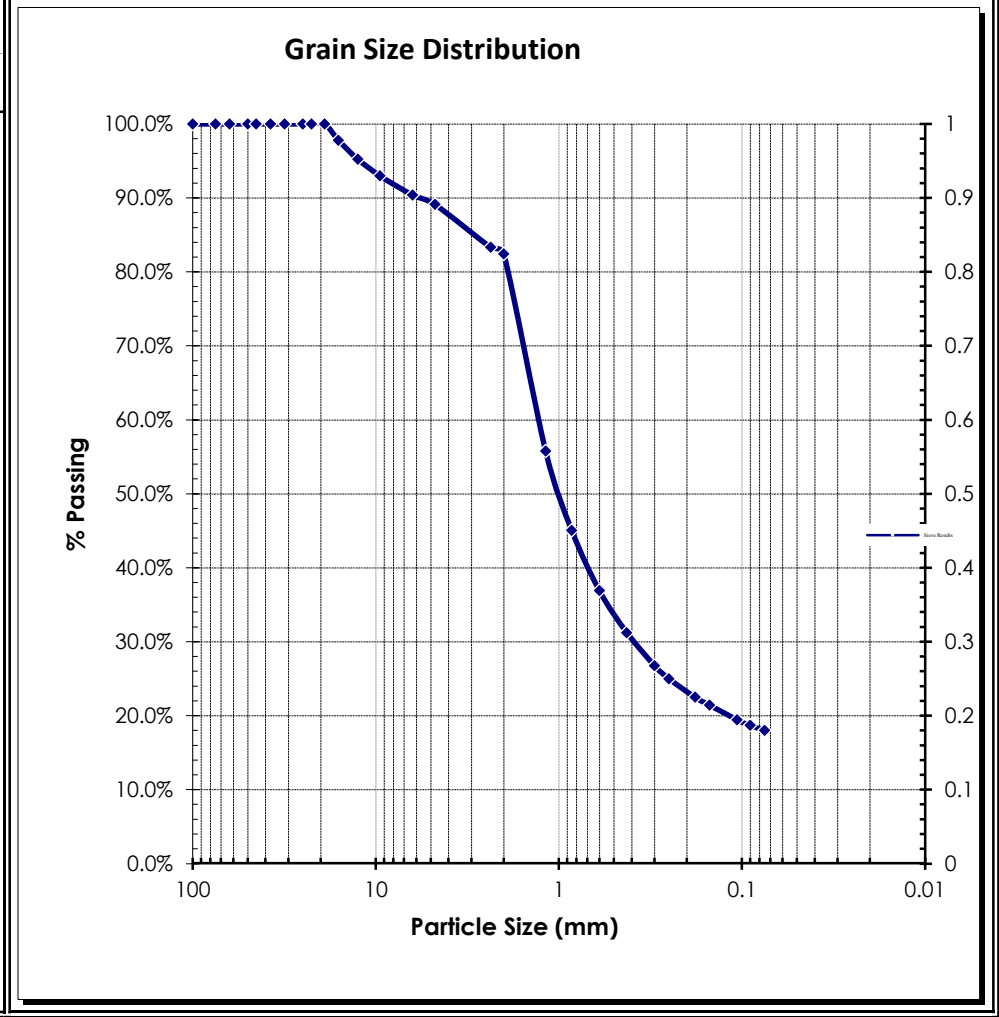
DateTested: 8/3/2023
Sample #: B-4
Depth: 8.0-9.3
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.042 mm
$D_{(30)}$= 0.391 mm
$D_{(60)}$= 1.310 mm
Liquid Limit= 0.0%

% Gravel = 10.9%
% Sand = 71.1%
% Silt & Clay = 18.0%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 2.80
Coeff. of Uniformity, C_U = 31.46
Fineness Modulus= 2.94
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		100.0%	100.0%	0.0%
3/4"	19.00	100.0%	100.0%	100.0%	0.0%
5/8"	16.00		97.8%	100.0%	0.0%
1/2"	12.50		95.2%	100.0%	0.0%
3/8"	9.50	93.0%	93.0%	100.0%	0.0%
1/4"	6.30		90.4%	100.0%	0.0%
#4	4.75	89.1%	89.1%	100.0%	0.0%
#8	2.360		83.3%	100.0%	0.0%
#10	2.000	82.5%	82.5%	100.0%	0.0%
#16	1.180		55.8%	100.0%	0.0%
#20	0.850		45.0%	100.0%	0.0%
#30	0.600		36.9%	100.0%	0.0%
#40	0.425	31.2%	31.2%	100.0%	0.0%
#50	0.300		26.8%	100.0%	0.0%
#60	0.250		25.0%	100.0%	0.0%
#80	0.180		22.5%	100.0%	0.0%
#100	0.150	21.4%	21.4%	100.0%	0.0%
#140	0.106		19.4%	100.0%	0.0%
#170	0.090		18.7%	100.0%	0.0%
#200	0.075	18.0%	18.0%	100.0%	0.0%



PALMER Geotechnical Consultants, Inc.

Unified Soils Classification System
SP-SM

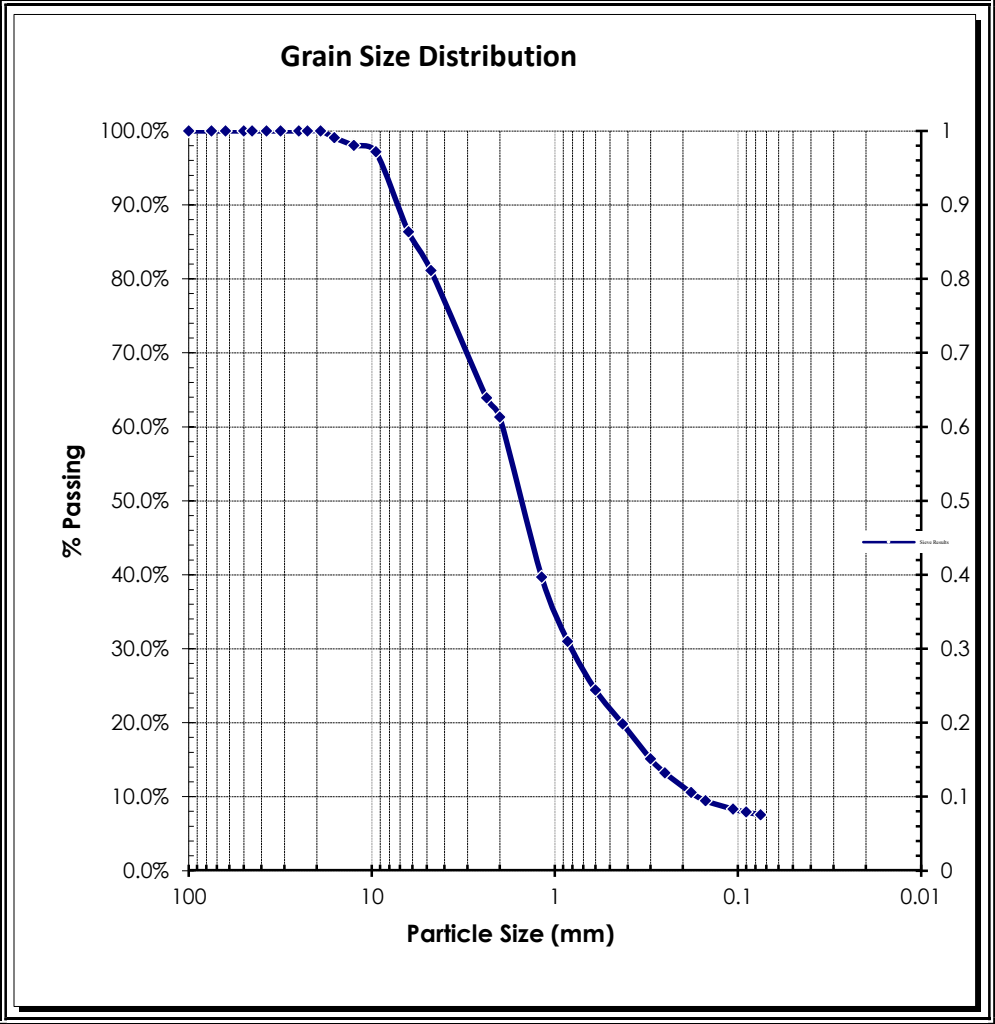
DateTested: 8/3/2023
Sample #: B-5
Depth: 9.0-9.4
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.165 mm
$D_{(30)}$= 0.812 mm
$D_{(60)}$= 1.950 mm
Liquid Limit= 0.0%

% Gravel = 18.9%
% Sand = 73.6%
% Silt & Clay = 7.5%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 2.05
Coeff. of Uniformity, C_U = 11.82
Fineness Modulus= 3.69
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		100.0%	100.0%	0.0%
3/4"	19.00	100.0%	100.0%	100.0%	0.0%
5/8"	16.00		99.1%	100.0%	0.0%
1/2"	12.50		98.1%	100.0%	0.0%
3/8"	9.50	97.2%	97.2%	100.0%	0.0%
1/4"	6.30		86.4%	100.0%	0.0%
#4	4.75	81.1%	81.1%	100.0%	0.0%
#8	2.360		63.9%	100.0%	0.0%
#10	2.000	61.3%	61.3%	100.0%	0.0%
#16	1.180		39.7%	100.0%	0.0%
#20	0.850		31.0%	100.0%	0.0%
#30	0.600		24.4%	100.0%	0.0%
#40	0.425	19.8%	19.8%	100.0%	0.0%
#50	0.300		15.1%	100.0%	0.0%
#60	0.250		13.2%	100.0%	0.0%
#80	0.180		10.6%	100.0%	0.0%
#100	0.150	9.4%	9.4%	100.0%	0.0%
#140	0.106		8.3%	100.0%	0.0%
#170	0.090		7.9%	100.0%	0.0%
#200	0.075	7.5%	7.5%	100.0%	0.0%



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Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

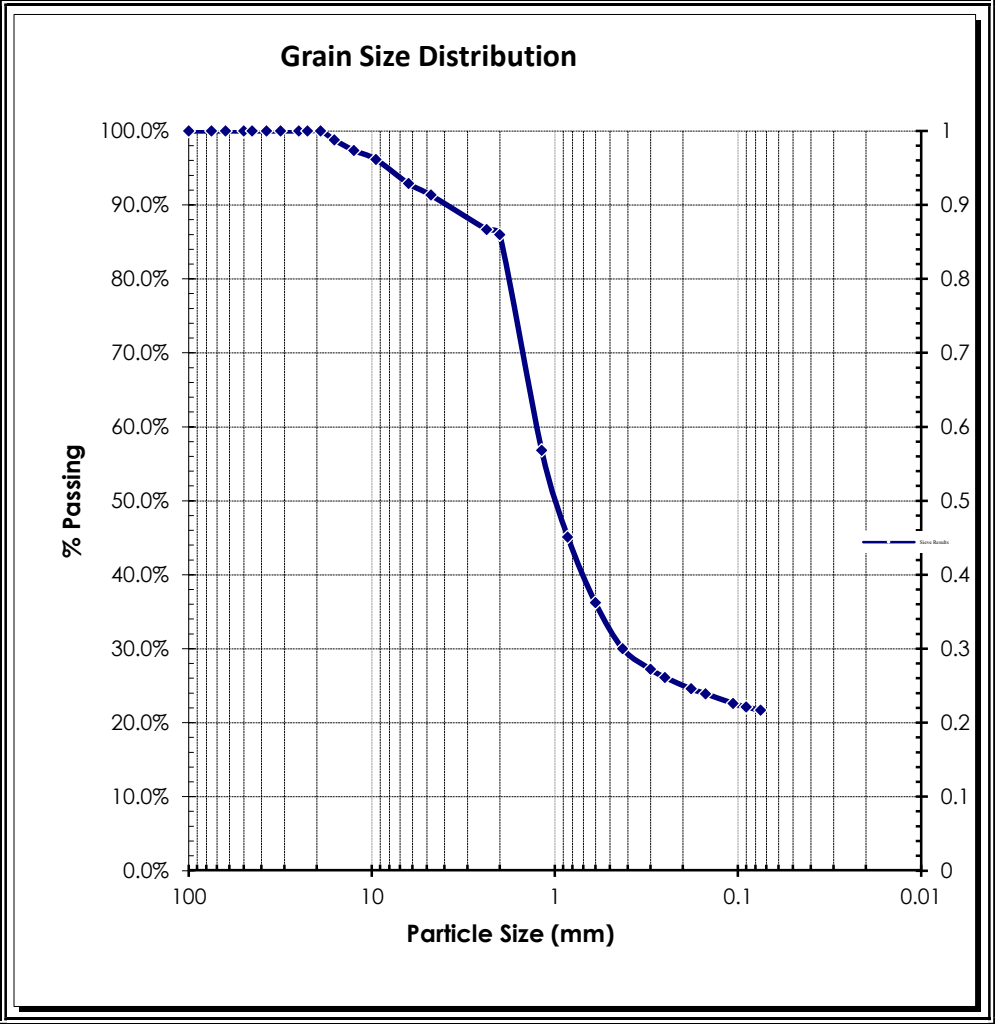
DateTested: 8/3/2023
Sample #: B-6
Depth: 5.0-6.4
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.035 mm
$D_{(30)}$= 0.425 mm
$D_{(60)}$= 1.269 mm
Liquid Limit= 0.0%

% Gravel = 8.7%
% Sand = 69.6%
% Silt & Clay = 21.7%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 4.12
Coeff. of Uniformity, C_U = 36.69
Fineness Modulus= 2.82
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		100.0%	100.0%	0.0%
3/4"	19.00	100.0%	100.0%	100.0%	0.0%
5/8"	16.00		98.8%	100.0%	0.0%
1/2"	12.50		97.4%	100.0%	0.0%
3/8"	9.50	96.2%	96.2%	100.0%	0.0%
1/4"	6.30		92.9%	100.0%	0.0%
#4	4.75	91.3%	91.3%	100.0%	0.0%
#8	2.360		86.7%	100.0%	0.0%
#10	2.000	86.0%	86.0%	100.0%	0.0%
#16	1.180		56.8%	100.0%	0.0%
#20	0.850		45.1%	100.0%	0.0%
#30	0.600		36.2%	100.0%	0.0%
#40	0.425	30.0%	30.0%	100.0%	0.0%
#50	0.300		27.2%	100.0%	0.0%
#60	0.250		26.1%	100.0%	0.0%
#80	0.180		24.6%	100.0%	0.0%
#100	0.150	23.9%	23.9%	100.0%	0.0%
#140	0.106		22.6%	100.0%	0.0%
#170	0.090		22.1%	100.0%	0.0%
#200	0.075	21.7%	21.7%	100.0%	0.0%



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Unified Soils Classification System
SM

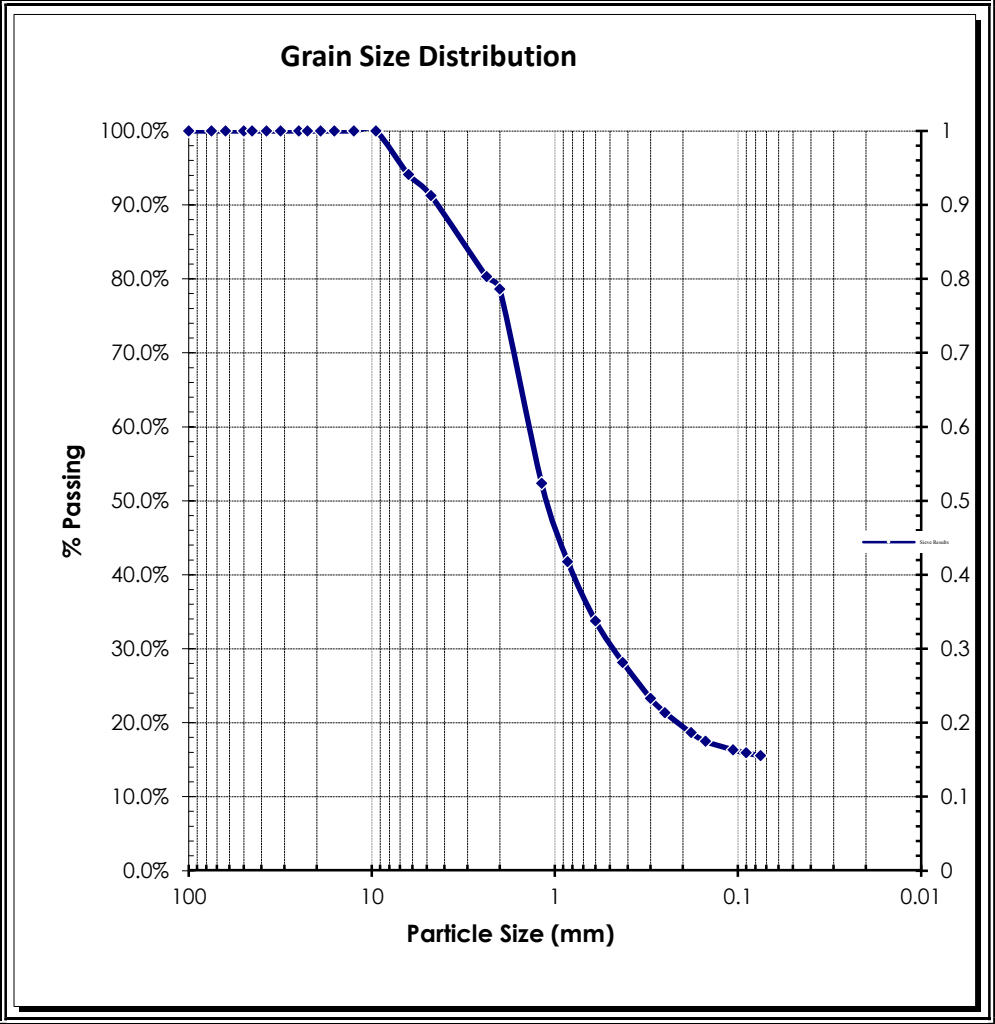
DateTested: 8/3/2023
Sample #: B-7
Depth: 10.0-10.4
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.048 mm
$D_{(30)}$= 0.483 mm
$D_{(60)}$= 1.418 mm
Liquid Limit= 0.0%

% Gravel = 8.7%
% Sand = 75.7%
% Silt & Clay = 15.5%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 3.40
Coeff. of Uniformity, C_U = 29.38
Fineness Modulus= 3.02
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		100.0%	100.0%	0.0%
3/4"	19.00	100.0%	100.0%	100.0%	0.0%
5/8"	16.00		100.0%	100.0%	0.0%
1/2"	12.50		100.0%	100.0%	0.0%
3/8"	9.50	100.0%	100.0%	100.0%	0.0%
1/4"	6.30		94.1%	100.0%	0.0%
#4	4.75	91.3%	91.3%	100.0%	0.0%
#8	2.360		80.3%	100.0%	0.0%
#10	2.000	78.6%	78.6%	100.0%	0.0%
#16	1.180		52.4%	100.0%	0.0%
#20	0.850		41.8%	100.0%	0.0%
#30	0.600		33.8%	100.0%	0.0%
#40	0.425	28.2%	28.2%	100.0%	0.0%
#50	0.300		23.3%	100.0%	0.0%
#60	0.250		21.4%	100.0%	0.0%
#80	0.180		18.6%	100.0%	0.0%
#100	0.150	17.5%	17.5%	100.0%	0.0%
#140	0.106		16.3%	100.0%	0.0%
#170	0.090		15.9%	100.0%	0.0%
#200	0.075	15.5%	15.5%	100.0%	0.0%



PALMER
Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

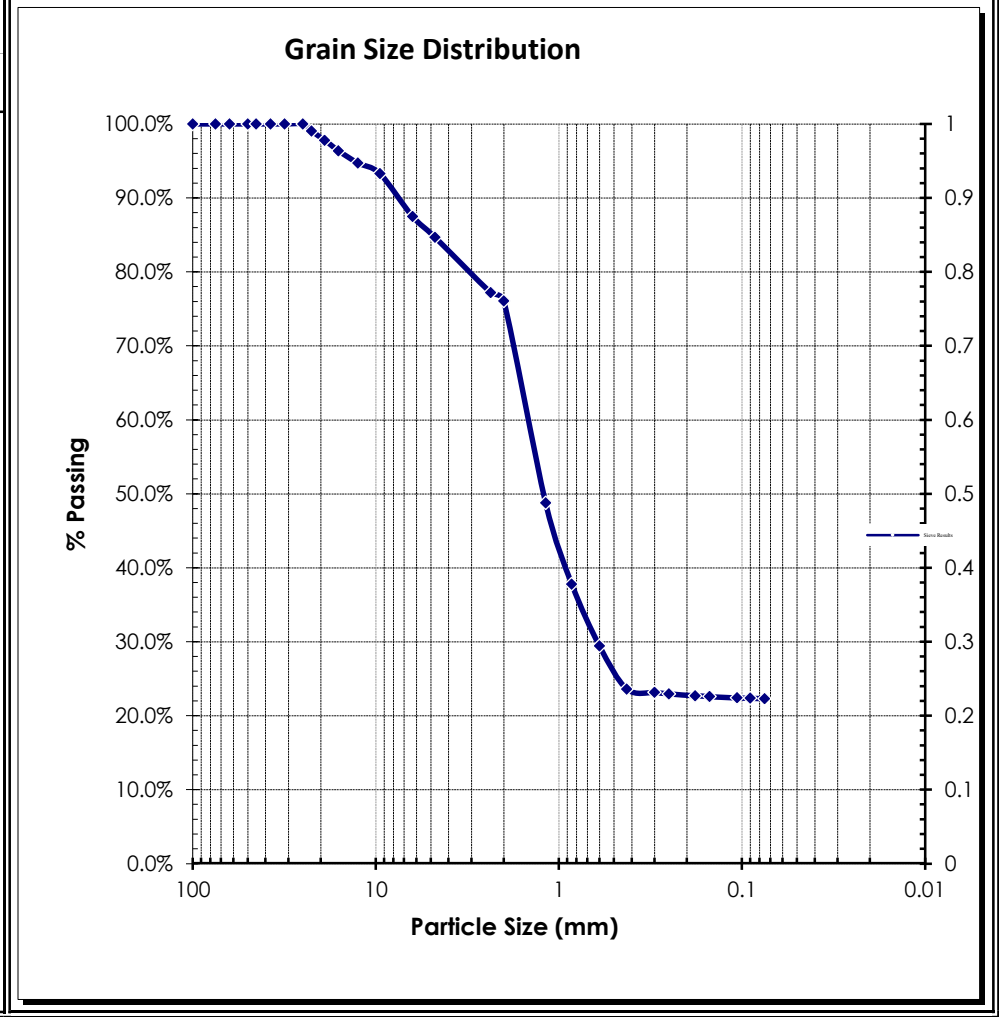
DateTested: 8/3/2023
Sample #: B-7
Depth: 5.3-6.5
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.034 mm
$D_{(30)}$= 0.617 mm
$D_{(60)}$= 1.517 mm
Liquid Limit= 0.0%

% Gravel = 15.3%
% Sand = 62.4%
% Silt & Clay = 22.3%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 7.45
Coeff. of Uniformity, C_U = 45.11
Fineness Modulus= 3.23
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		99.1%	100.0%	0.0%
3/4"	19.00	97.8%	97.8%	100.0%	0.0%
5/8"	16.00		96.4%	100.0%	0.0%
1/2"	12.50		94.7%	100.0%	0.0%
3/8"	9.50	93.3%	93.3%	100.0%	0.0%
1/4"	6.30		87.5%	100.0%	0.0%
#4	4.75	84.7%	84.7%	100.0%	0.0%
#8	2.360		77.2%	100.0%	0.0%
#10	2.000	76.1%	76.1%	100.0%	0.0%
#16	1.180		48.8%	100.0%	0.0%
#20	0.850		37.8%	100.0%	0.0%
#30	0.600		29.4%	100.0%	0.0%
#40	0.425	23.6%	23.6%	100.0%	0.0%
#50	0.300		23.2%	100.0%	0.0%
#60	0.250		23.0%	100.0%	0.0%
#80	0.180		22.7%	100.0%	0.0%
#100	0.150	22.6%	22.6%	100.0%	0.0%
#140	0.106		22.4%	100.0%	0.0%
#170	0.090		22.4%	100.0%	0.0%
#200	0.075	22.3%	22.3%	100.0%	0.0%



PALMER Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

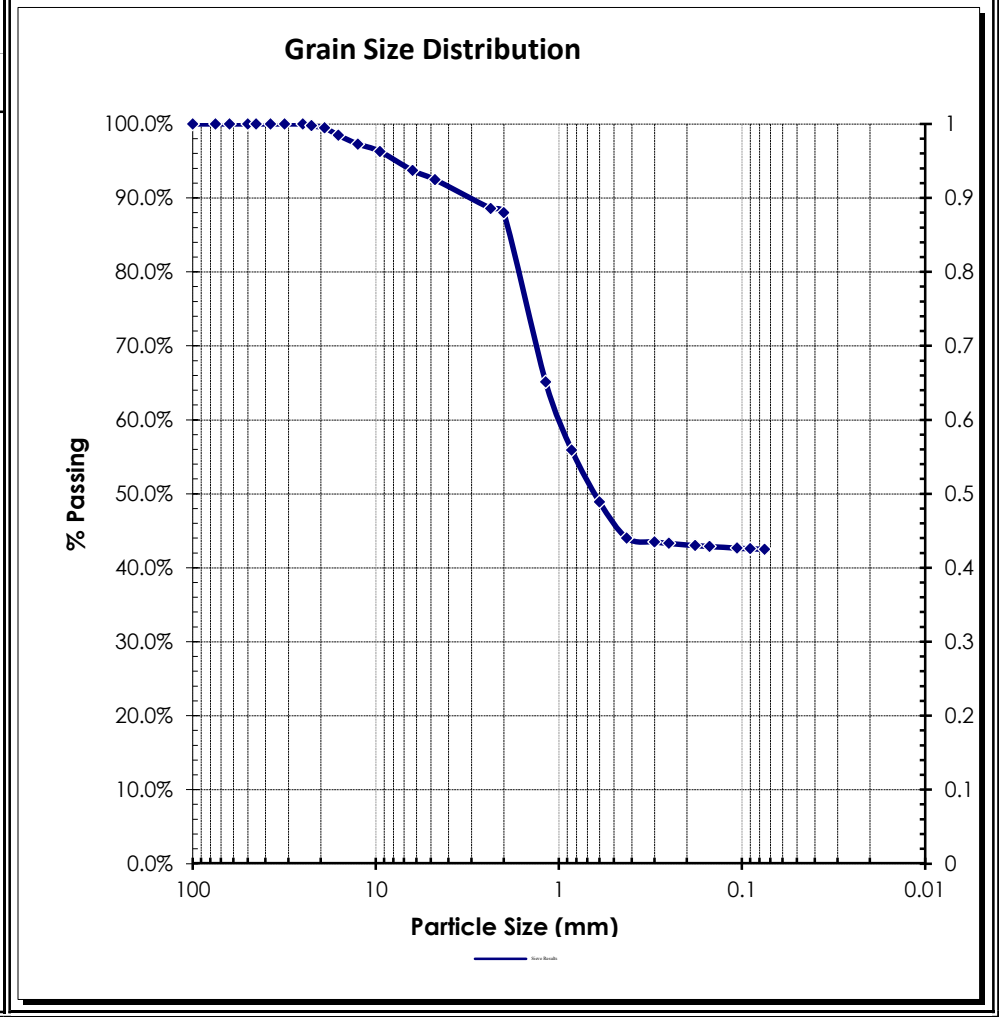
DateTested: 7/3/2023
Sample #: TP-1
Depth: 4.7-4.9
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.018 mm
$D_{(30)}$= 0.053 mm
$D_{(60)}$= 0.997 mm
Liquid Limit= 0.0%

% Gravel = 7.5%
% Sand = 50.0%
% Silt & Clay = 42.5%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 0.16
Coeff. of Uniformity, C_U = 56.52
Fineness Modulus= 2.23
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		99.8%	100.0%	0.0%
3/4"	19.00	99.5%	99.5%	100.0%	0.0%
5/8"	16.00		98.5%	100.0%	0.0%
1/2"	12.50		97.3%	100.0%	0.0%
3/8"	9.50	96.3%	96.3%	100.0%	0.0%
1/4"	6.30		93.7%	100.0%	0.0%
#4	4.75	92.5%	92.5%	100.0%	0.0%
#8	2.360		88.6%	100.0%	0.0%
#10	2.000	88.0%	88.0%	100.0%	0.0%
#16	1.180		65.1%	100.0%	0.0%
#20	0.850		55.9%	100.0%	0.0%
#30	0.600		48.9%	100.0%	0.0%
#40	0.425	44.0%	44.0%	100.0%	0.0%
#50	0.300		43.5%	100.0%	0.0%
#60	0.250		43.3%	100.0%	0.0%
#80	0.180		43.0%	100.0%	0.0%
#100	0.150	42.9%	42.9%	100.0%	0.0%
#140	0.106		42.7%	100.0%	0.0%
#170	0.090		42.6%	100.0%	0.0%
#200	0.075	42.5%	42.5%	100.0%	0.0%



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Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

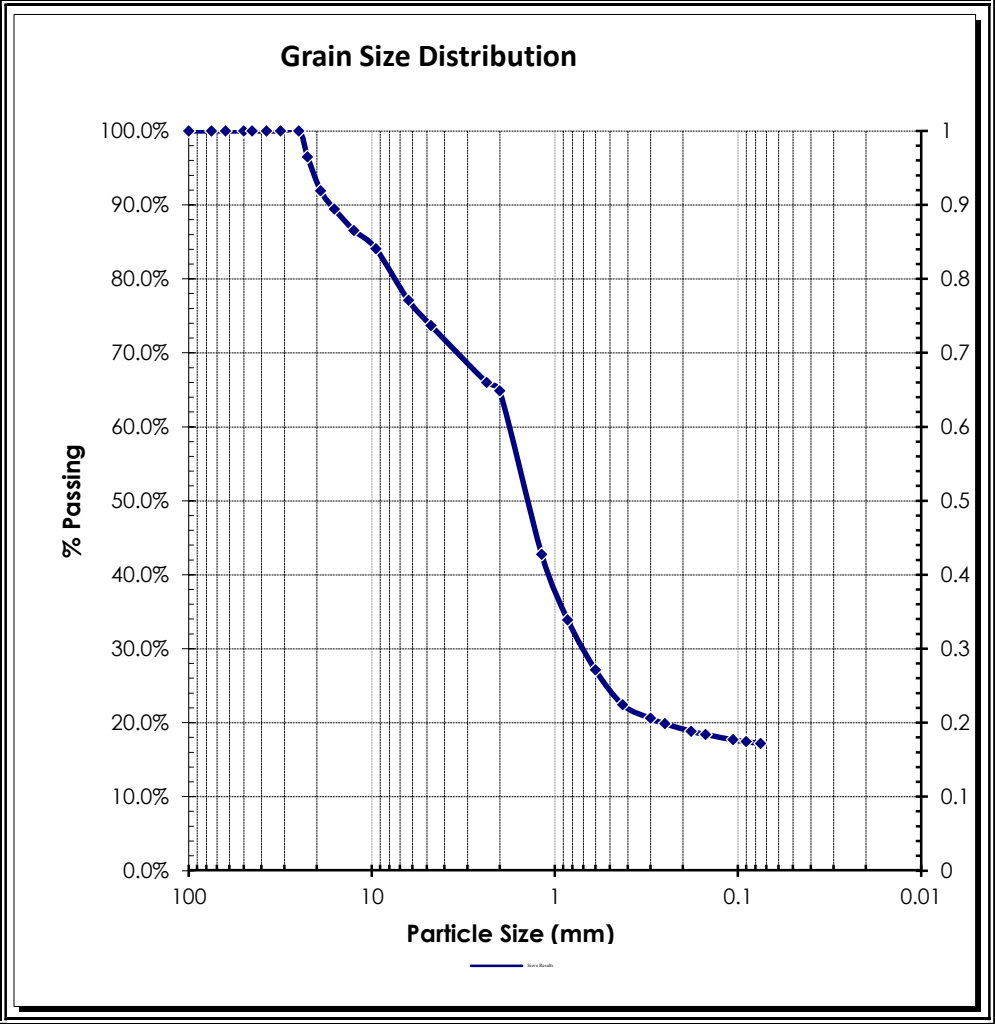
DateTested: 7/3/2023
Sample #: TP-2
Depth: 3.8-4.0
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.044 mm
$D_{(30)}$= 0.706 mm
$D_{(60)}$= 1.820 mm
Liquid Limit= 0.0%

% Gravel = 26.3%
% Sand = 56.5%
% Silt & Clay = 17.2%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 6.28
Coeff. of Uniformity, C_U = 41.73
Fineness Modulus= 3.75
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		96.5%	100.0%	0.0%
3/4"	19.00	91.9%	91.9%	100.0%	0.0%
5/8"	16.00		89.4%	100.0%	0.0%
1/2"	12.50		86.6%	100.0%	0.0%
3/8"	9.50	84.1%	84.1%	100.0%	0.0%
1/4"	6.30		77.1%	100.0%	0.0%
#4	4.75	73.7%	73.7%	100.0%	0.0%
#8	2.360		66.0%	100.0%	0.0%
#10	2.000	64.8%	64.8%	100.0%	0.0%
#16	1.180		42.8%	100.0%	0.0%
#20	0.850		33.9%	100.0%	0.0%
#30	0.600		27.1%	100.0%	0.0%
#40	0.425	22.4%	22.4%	100.0%	0.0%
#50	0.300		20.6%	100.0%	0.0%
#60	0.250		19.9%	100.0%	0.0%
#80	0.180		18.8%	100.0%	0.0%
#100	0.150	18.4%	18.4%	100.0%	0.0%
#140	0.106		17.7%	100.0%	0.0%
#170	0.090		17.4%	100.0%	0.0%
#200	0.075	17.2%	17.2%	100.0%	0.0%



soiltest farm consultants, inc.
2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

PALMER GEOTECHNICAL
P.O. BOX 1562

FREELAND , WA 98249

Laboratory #: S23-11469

Date Received: 6/26/2023
Grower: SOUTH WIDBEY AQUATIC CE
Field: TP-2 3.8-4FT
Sampled By: PROJ 23014
Customer Account #:
Customer Sample ID:

Soil Test Results

Cation Exchange	CEC	meq/100g	3.8

pH 1:1
E.C. 1:1 m.mhos/cm
Est Sat Paste E.C. m.mhos/cm
Effervescence

Ammonium - N mg/kg
Organic Matter W.B. %

Other Tests:

Texture: 78.0 % Sand, 5.0 % Clay, 17.0 % Silt

USDA TEXTURE: LOAMY SAND

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of soil, our liability is limited to the price of the tests. Recommendations are to be used as general guides and should be modified for specific field conditions and situations. Note: "u" indicates that the element was analyzed for but not detected

This is your Invoice #: S23-11469 Account #: 261200 Reviewed by: B.Thyssen, CP List Cost: $42.00

PALMER Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

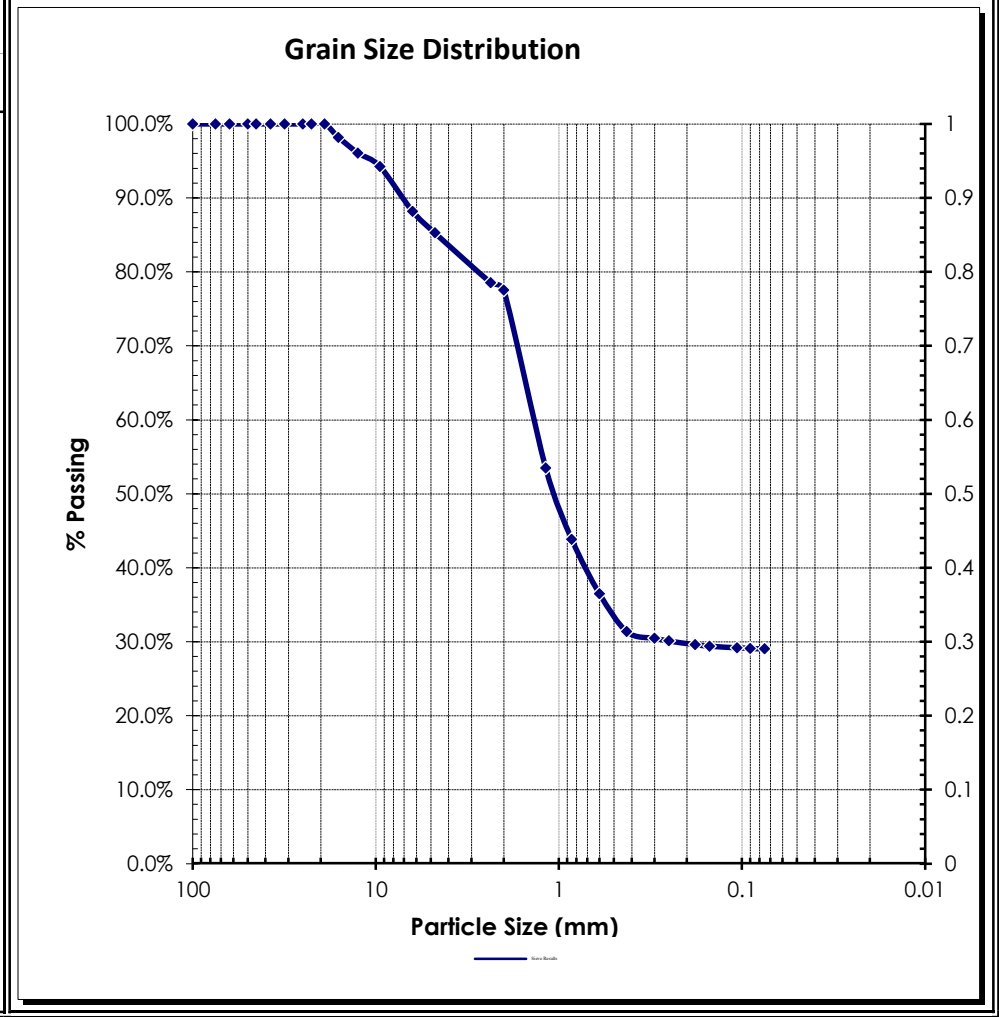
DateTested: 7/3/2023
Sample #: TP-3
Depth: 4.8-5.0
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.026 mm
$D_{(30)}$= 0.234 mm
$D_{(60)}$= 1.401 mm
Liquid Limit= 0.0%

% Gravel = 14.7%
% Sand = 56.2%
% Silt & Clay = 29.0%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 1.52
Coeff. of Uniformity, C_U = 54.26
Fineness Modulus= 2.92
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		100.0%	100.0%	0.0%
3/4"	19.00	100.0%	100.0%	100.0%	0.0%
5/8"	16.00		98.2%	100.0%	0.0%
1/2"	12.50		96.1%	100.0%	0.0%
3/8"	9.50	94.3%	94.3%	100.0%	0.0%
1/4"	6.30		88.2%	100.0%	0.0%
#4	4.75	85.3%	85.3%	100.0%	0.0%
#8	2.360		78.6%	100.0%	0.0%
#10	2.000	77.5%	77.5%	100.0%	0.0%
#16	1.180		53.5%	100.0%	0.0%
#20	0.850		43.8%	100.0%	0.0%
#30	0.600		36.5%	100.0%	0.0%
#40	0.425	31.4%	31.4%	100.0%	0.0%
#50	0.300		30.5%	100.0%	0.0%
#60	0.250		30.1%	100.0%	0.0%
#80	0.180		29.6%	100.0%	0.0%
#100	0.150	29.4%	29.4%	100.0%	0.0%
#140	0.106		29.2%	100.0%	0.0%
#170	0.090		29.1%	100.0%	0.0%
#200	0.075	29.0%	29.0%	100.0%	0.0%



soiltest farm consultants, inc.
2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

Soil PAP NAPT 2023

Soil & Plant Program 2023 NAPT Participating Laboratory

PALMER GEOTECHNICAL
P.O. BOX 1562

FREELAND , WA 98249

Laboratory #: S23-11470

Date Received: 6/26/2023
Grower: SOUTH WIDBEY AQUATIC CE
Field: TP-3 4.8-5FT
Sampled By: PROJ 23014
Customer Account #:
Customer Sample ID:

Soil Test Results

Cation Exchange	CEC	meq/100g	4.8

pH 1:1
E.C. 1:1 m.mhos/cm
Est Sat Paste E.C. m.mhos/cm
Effervescence

Ammonium - N mg/kg
Organic Matter W.B. %

Other Tests:

Texture: 80.0 % Sand, 6.0 % Clay, 14.0 % Silt

USDA TEXTURE: LOAMY SAND

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of soil, our liability is limited to the price of the tests. Recommendations are to be used as general guides and should be modified for specific field conditions and situations. Note: "u" indicates that the element was analyzed for but not detected

This is your Invoice #: S23-11470 Account #: 261200 Reviewed by: B.Thyssen, CP List Cost: $42.00

PALMER
Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

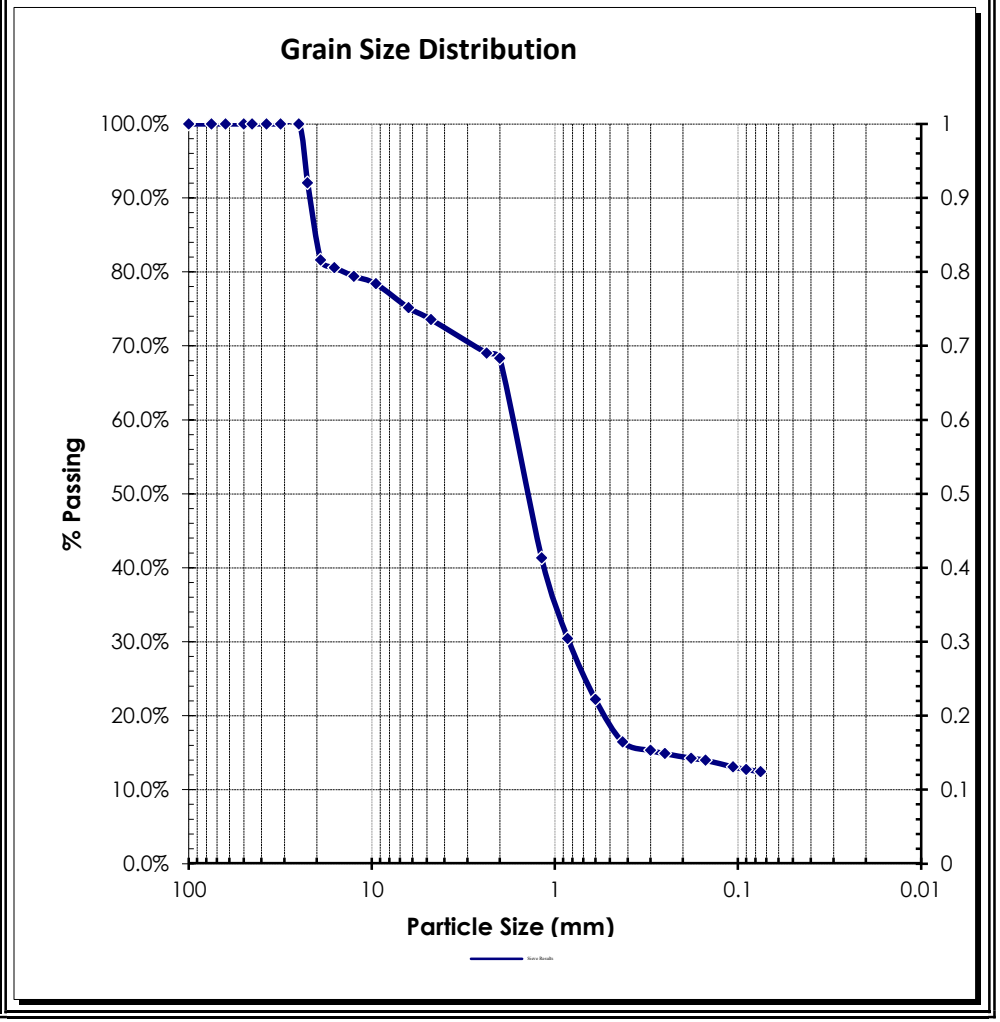
DateTested: 7/3/2023
Sample #: TP-4
Depth: 2.4-2.6
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.060 mm
$D_{(30)}$= 0.837 mm
$D_{(60)}$= 1.747 mm
Liquid Limit= 0.0%

% Gravel = 26.4%
% Sand = 61.2%
% Silt & Clay = 12.4%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 6.64
Coeff. of Uniformity, C_U = 28.95
Fineness Modulus= 4.05
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		92.0%	100.0%	0.0%
3/4"	19.00	81.6%	81.6%	100.0%	0.0%
5/8"	16.00		80.6%	100.0%	0.0%
1/2"	12.50		79.4%	100.0%	0.0%
3/8"	9.50	78.4%	78.4%	100.0%	0.0%
1/4"	6.30		75.2%	100.0%	0.0%
#4	4.75	73.6%	73.6%	100.0%	0.0%
#8	2.360		69.0%	100.0%	0.0%
#10	2.000	68.3%	68.3%	100.0%	0.0%
#16	1.180		41.3%	100.0%	0.0%
#20	0.850		30.4%	100.0%	0.0%
#30	0.600		22.2%	100.0%	0.0%
#40	0.425	16.4%	16.4%	100.0%	0.0%
#50	0.300		15.3%	100.0%	0.0%
#60	0.250		14.9%	100.0%	0.0%
#80	0.180		14.3%	100.0%	0.0%
#100	0.150	14.0%	14.0%	100.0%	0.0%
#140	0.106		13.1%	100.0%	0.0%
#170	0.090		12.7%	100.0%	0.0%
#200	0.075	12.4%	12.4%	100.0%	0.0%



PALMER Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

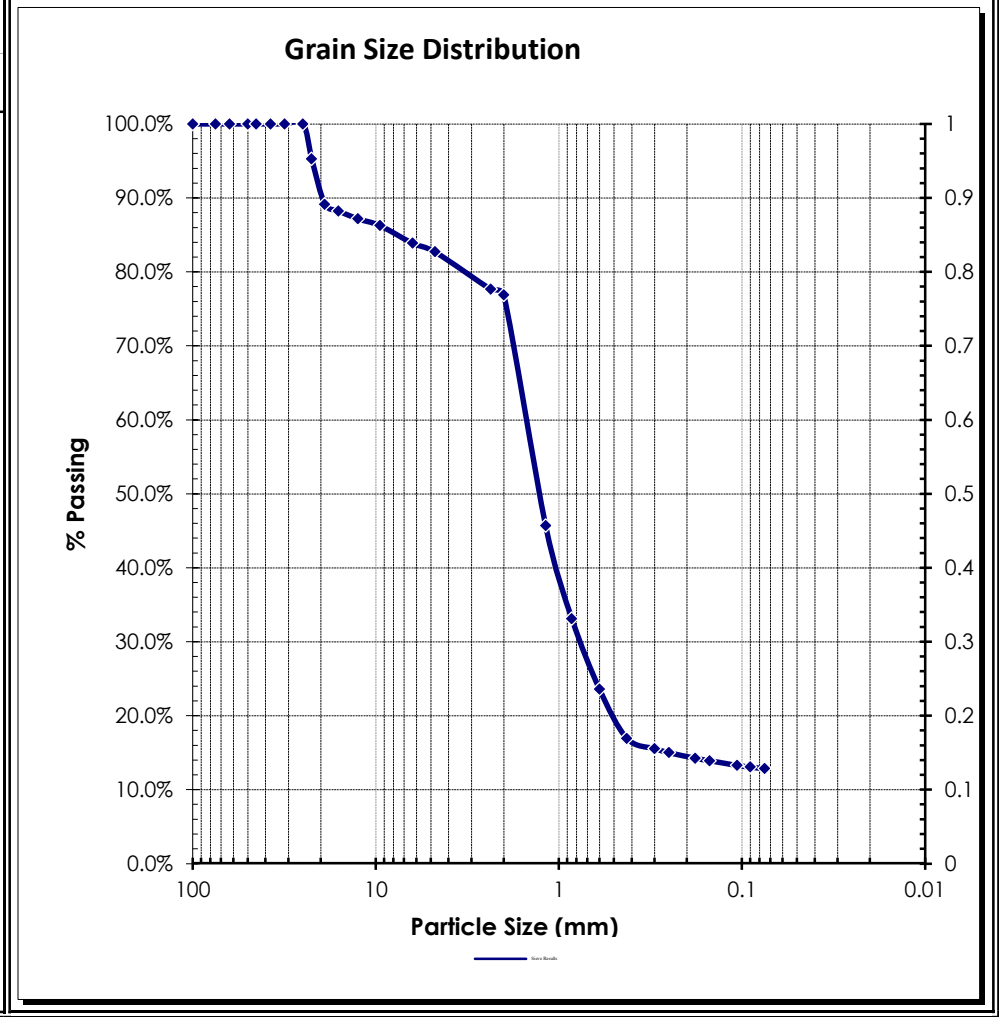
DateTested: 7/3/2023
Sample #: TP-4
Depth: 4.2-4.4
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.058 mm
$D_{(30)}$= 0.768 mm
$D_{(60)}$= 1.556 mm
Liquid Limit= 0.0%

% Gravel = 17.3%
% Sand = 69.9%
% Silt & Clay = 12.9%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 6.50
Coeff. of Uniformity, C_U = 26.66
Fineness Modulus= 3.65
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		95.3%	100.0%	0.0%
3/4"	19.00	89.2%	89.2%	100.0%	0.0%
5/8"	16.00		88.2%	100.0%	0.0%
1/2"	12.50		87.2%	100.0%	0.0%
3/8"	9.50	86.3%	86.3%	100.0%	0.0%
1/4"	6.30		83.9%	100.0%	0.0%
#4	4.75	82.7%	82.7%	100.0%	0.0%
#8	2.360		77.7%	100.0%	0.0%
#10	2.000	76.9%	76.9%	100.0%	0.0%
#16	1.180		45.7%	100.0%	0.0%
#20	0.850		33.1%	100.0%	0.0%
#30	0.600		23.6%	100.0%	0.0%
#40	0.425	16.9%	16.9%	100.0%	0.0%
#50	0.300		15.6%	100.0%	0.0%
#60	0.250		15.0%	100.0%	0.0%
#80	0.180		14.3%	100.0%	0.0%
#100	0.150	13.9%	13.9%	100.0%	0.0%
#140	0.106		13.3%	100.0%	0.0%
#170	0.090		13.1%	100.0%	0.0%
#200	0.075	12.9%	12.9%	100.0%	0.0%



PALMER
Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

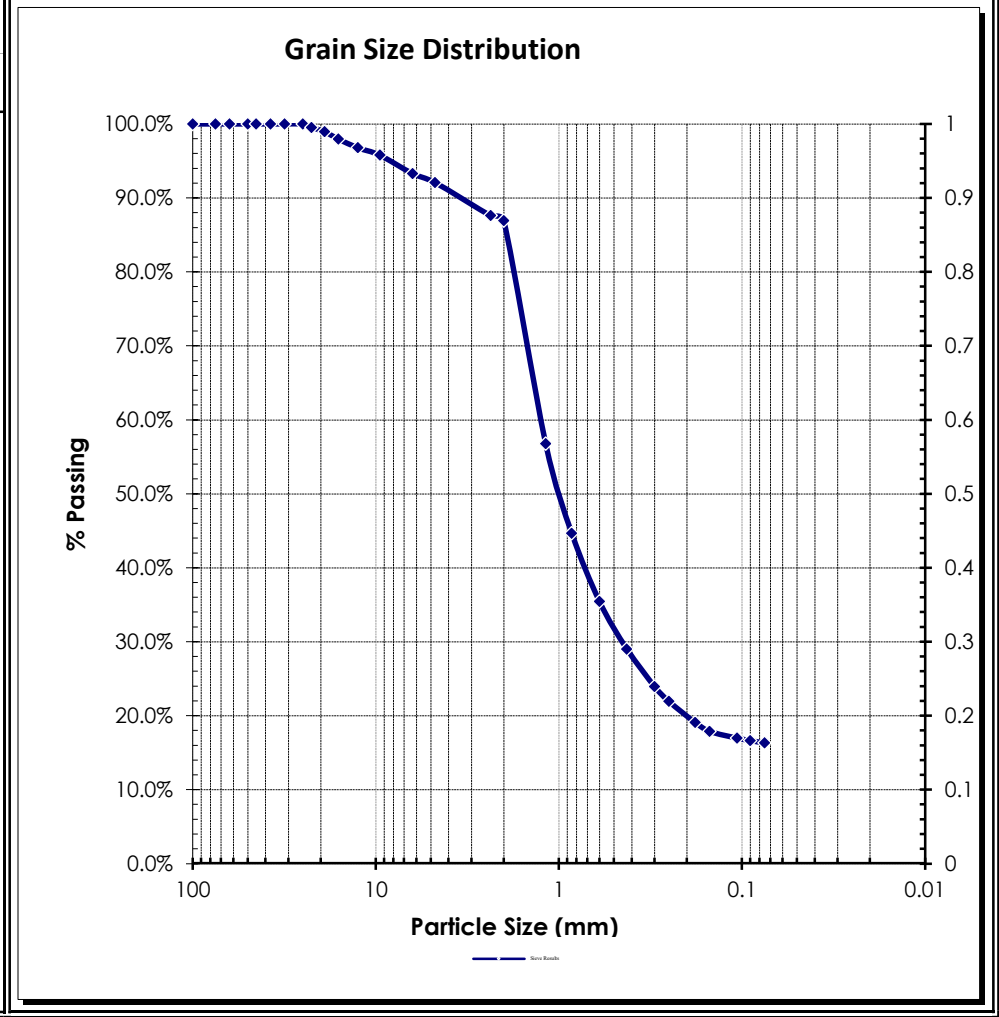
DateTested: 7/3/2023
Sample #: TP-4
Depth: 6.3-6.5
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.046 mm
$D_{(30)}$= 0.452 mm
$D_{(60)}$= 1.268 mm
Liquid Limit= 0.0%

% Gravel = 7.9%
% Sand = 75.7%
% Silt & Clay = 16.3%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 3.51
Coeff. of Uniformity, C_U = 27.61
Fineness Modulus= 2.92
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		99.5%	100.0%	0.0%
3/4"	19.00	98.9%	98.9%	100.0%	0.0%
5/8"	16.00		98.0%	100.0%	0.0%
1/2"	12.50		96.8%	100.0%	0.0%
3/8"	9.50	95.8%	95.8%	100.0%	0.0%
1/4"	6.30		93.3%	100.0%	0.0%
#4	4.75	92.1%	92.1%	100.0%	0.0%
#8	2.360		87.6%	100.0%	0.0%
#10	2.000	86.9%	86.9%	100.0%	0.0%
#16	1.180		56.8%	100.0%	0.0%
#20	0.850		44.6%	100.0%	0.0%
#30	0.600		35.4%	100.0%	0.0%
#40	0.425	29.0%	29.0%	100.0%	0.0%
#50	0.300		24.0%	100.0%	0.0%
#60	0.250		21.9%	100.0%	0.0%
#80	0.180		19.1%	100.0%	0.0%
#100	0.150	17.9%	17.9%	100.0%	0.0%
#140	0.106		17.0%	100.0%	0.0%
#170	0.090		16.6%	100.0%	0.0%
#200	0.075	16.3%	16.3%	100.0%	0.0%



soiltest farm consultants, inc.
2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

PALMER GEOTECHNICAL
P.O. BOX 1562

FREELAND , WA 98249

Laboratory #: S23-11473

Date Received: 6/26/2023
Grower: SOUTH WIDBEY AQUATIC CE
Field: TP-4 6.3-6.5FT
Sampled By: PROJ 23014
Customer Account #:
Customer Sample ID:

Soil Test Results

Cation Exchange	CEC	meq/100g	4.6

pH 1:1
E.C. 1:1 m.mhos/cm
Est Sat Paste E.C. m.mhos/cm
Effervescence

Ammonium - N mg/kg
Organic Matter W.B. %

Other Tests:

Texture: 90.0 % Sand, 2.0 % Clay, 8.0 % Silt

USDA TEXTURE: SAND

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of soil, our liability is limited to the price of the tests. Recommendations are to be used as general guides and should be modified for specific field conditions and situations. Note: "u" indicates that the element was analyzed for but not detected

This is your Invoice #: S23-11473 Account #: 261200 Reviewed by: B.Thyssen, CP List Cost: $42.00

PALMER
Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

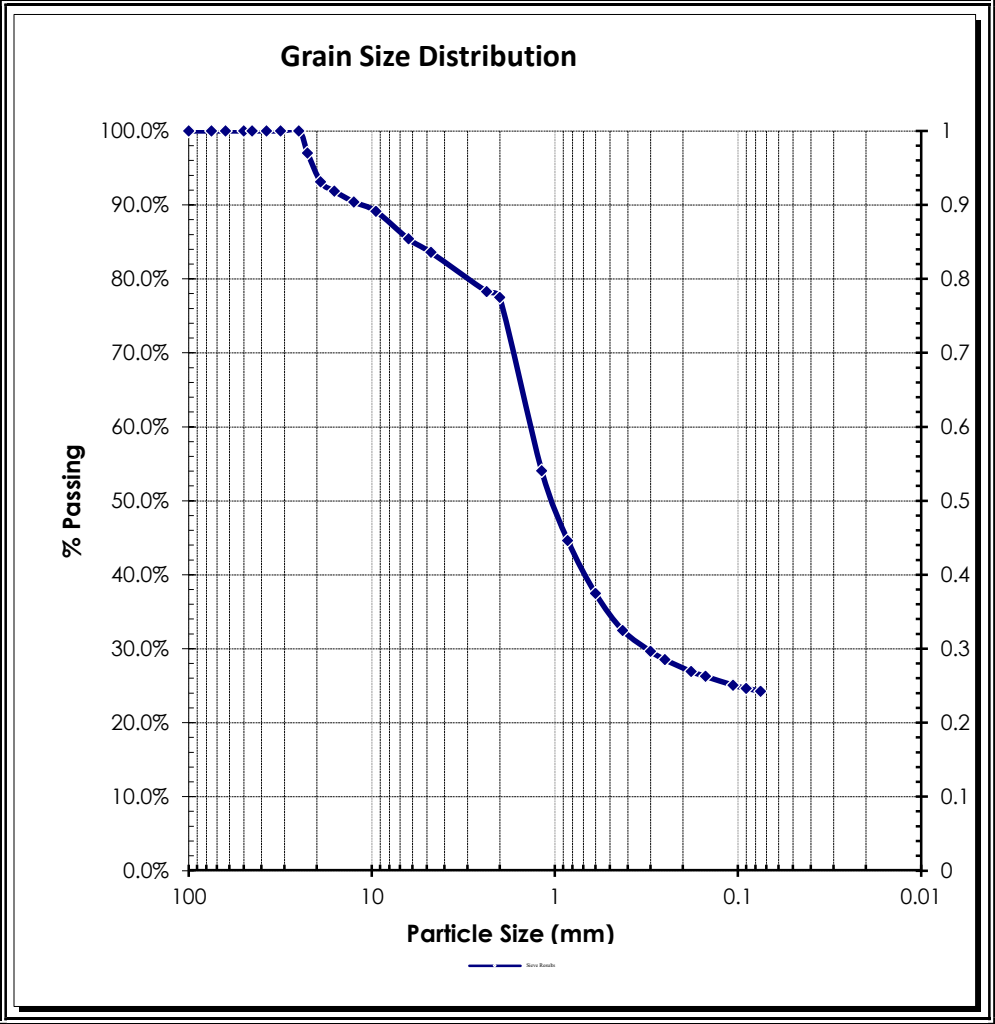
DateTested: 7/3/2023
Sample #: TP-5
Depth: 3.8-4.0
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.031 mm
$D_{(30)}$= 0.315 mm
$D_{(60)}$= 1.388 mm
Liquid Limit= 0.0%

% Gravel = 16.4%
% Sand = 59.3%
% Silt & Clay = 24.2%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 2.32
Coeff. of Uniformity, C_U = 44.87
Fineness Modulus= 3.08
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		97.0%	100.0%	0.0%
3/4"	19.00	93.1%	93.1%	100.0%	0.0%
5/8"	16.00		91.9%	100.0%	0.0%
1/2"	12.50		90.4%	100.0%	0.0%
3/8"	9.50	89.1%	89.1%	100.0%	0.0%
1/4"	6.30		85.4%	100.0%	0.0%
#4	4.75	83.6%	83.6%	100.0%	0.0%
#8	2.360		78.3%	100.0%	0.0%
#10	2.000	77.5%	77.5%	100.0%	0.0%
#16	1.180		54.1%	100.0%	0.0%
#20	0.850		44.6%	100.0%	0.0%
#30	0.600		37.5%	100.0%	0.0%
#40	0.425	32.5%	32.5%	100.0%	0.0%
#50	0.300		29.7%	100.0%	0.0%
#60	0.250		28.5%	100.0%	0.0%
#80	0.180		26.9%	100.0%	0.0%
#100	0.150	26.3%	26.3%	100.0%	0.0%
#140	0.106		25.1%	100.0%	0.0%
#170	0.090		24.6%	100.0%	0.0%
#200	0.075	24.2%	24.2%	100.0%	0.0%



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PALMER GEOTECHNICAL
P.O. BOX 1562

FREELAND , WA 98249

Laboratory #: S23-11471

Date Received: 6/26/2023
Grower: SOUTH WIDBEY AQUATIC CE
Field: TP-5 3.8-4FT
Sampled By: PROJ 23014
Customer Account #:
Customer Sample ID:

Soil Test Results

Cation Exchange	CEC	meq/100g	3.0

pH 1:1
E.C. 1:1 m.mhos/cm
Est Sat Paste E.C. m.mhos/cm
Effervescence

Ammonium - N mg/kg
Organic Matter W.B. %

Other Tests:

Texture: 84.0 % Sand, 2.0 % Clay, 14.0 % Silt

USDA TEXTURE: LOAMY SAND

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of soil, our liability is limited to the price of the tests. Recommendations are to be used as general guides and should be modified for specific field conditions and situations. Note: "u" indicates that the element was analyzed for but not detected

This is your Invoice #: S23-11471 Account #: 261200 Reviewed by: B.Thyssen, CP List Cost: $42.00

PALMER Geotechnical Consultants, Inc.

Unified Soils Classification System
SM

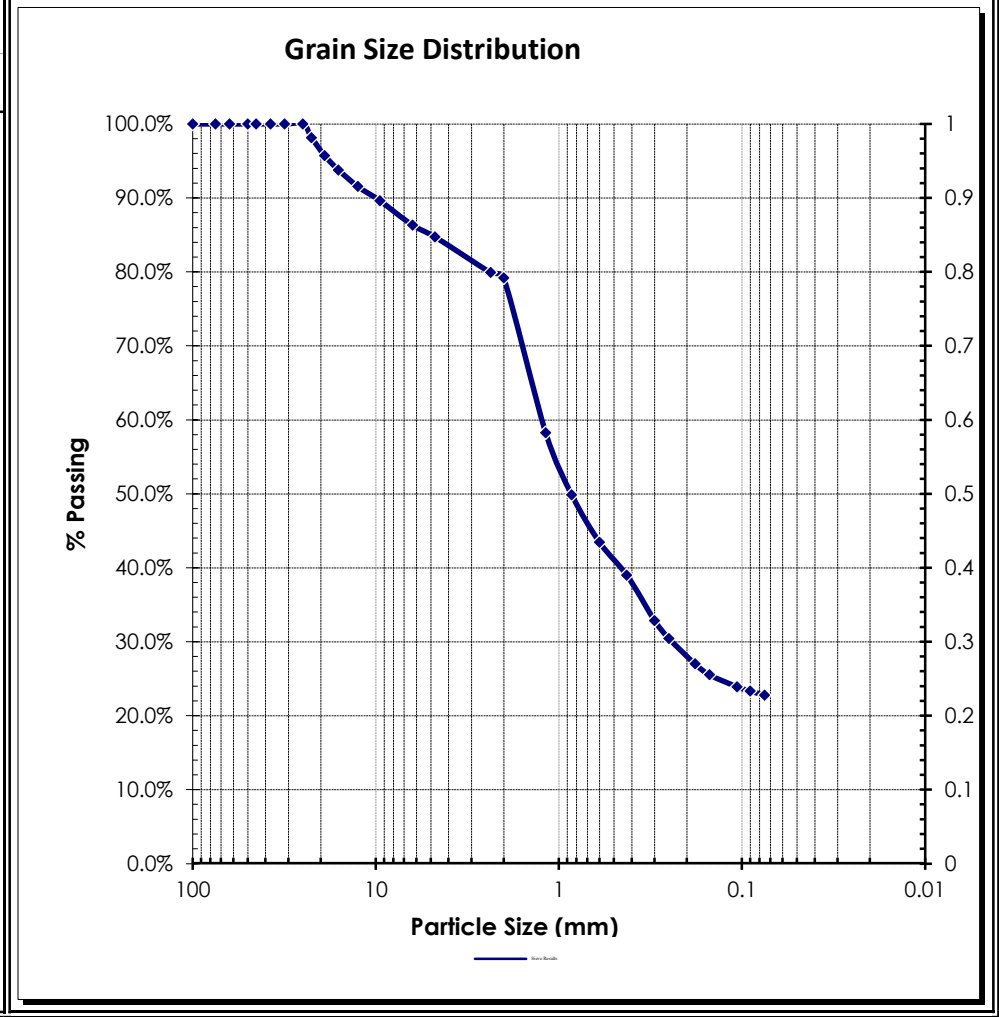
DateTested: 7/3/2023
Sample #: TP-5
Depth: 4.8-5.0
Project South Whidbey Aquatic Center

$D_{(10)}$= 0.033 mm
$D_{(30)}$= 0.241 mm
$D_{(60)}$= 1.248 mm
Liquid Limit= 0.0%

% Gravel = 15.3%
% Sand = 62.0%
% Silt & Clay = 22.8%
Plastic Limit= 0.0%

Coeff. of Curvature, C_C = 1.42
Coeff. of Uniformity, C_U = 37.89
Fineness Modulus= 2.90
Plasticity Index= 0.0%

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%	100.0%	0.0%
4.00"	100.00		100.0%	100.0%	0.0%
3.00"	75.00		100.0%	100.0%	0.0%
2.50"	63.00	100.0%	100.0%	100.0%	0.0%
2.00"	50.00	100.0%	100.0%	100.0%	0.0%
1.75"	45.00		100.0%	100.0%	0.0%
1.50"	37.50		100.0%	100.0%	0.0%
1.25"	31.50		100.0%	100.0%	0.0%
1.00"	25.00	100.0%	100.0%	100.0%	0.0%
7/8"	22.40		98.1%	100.0%	0.0%
3/4"	19.00	95.7%	95.7%	100.0%	0.0%
5/8"	16.00		93.8%	100.0%	0.0%
1/2"	12.50		91.5%	100.0%	0.0%
3/8"	9.50	89.6%	89.6%	100.0%	0.0%
1/4"	6.30		86.3%	100.0%	0.0%
#4	4.75	84.7%	84.7%	100.0%	0.0%
#8	2.360		79.9%	100.0%	0.0%
#10	2.000	79.2%	79.2%	100.0%	0.0%
#16	1.180		58.3%	100.0%	0.0%
#20	0.850		49.8%	100.0%	0.0%
#30	0.600		43.5%	100.0%	0.0%
#40	0.425	39.0%	39.0%	100.0%	0.0%
#50	0.300		32.9%	100.0%	0.0%
#60	0.250		30.4%	100.0%	0.0%
#80	0.180		27.0%	100.0%	0.0%
#100	0.150	25.5%	25.5%	100.0%	0.0%
#140	0.106		23.9%	100.0%	0.0%
#170	0.090		23.3%	100.0%	0.0%
#200	0.075	22.8%	22.8%	100.0%	0.0%



FACET

Formerly DCG/Watershed

Water System Analysis Report

South Whidbey Parks & Recreation District

PWS ID NO. 02660 E
LANGLEY, WA

JANUARY 31, 2025

System Owner Representative

South Whidbey Parks
and Recreation District
Brian Tomisser, Executive Director
5495 Maxwelton Road
Langley, WA 98260
Email: director@swparks.com
Phone: (360) 221-6488

System Operator

Jeffrey J. Olson
NW Natural Water Services
PO Box 699
Newberg, OR 97132
Phone: (503) 554-8333

For Submittal to:

Washington State
Department of Health
Northwest Regional Office
Drinking Water Operations
PO Box 47800
MS 47822
Olympia WA 98504

Facet Project Number: 2401.0397.00

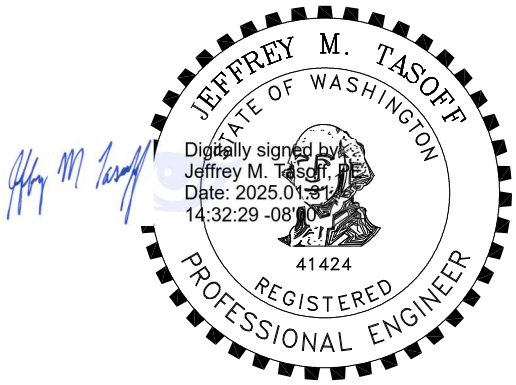
CERTIFICATE OF ENGINEER

Prepared by:

Jeffrey M. Tasoff, P.E.
Principal Civil Engineer
jtasoff@facetnw.com

FACET

PO Box 1132
Freeland, WA 98249
Tel 360.331.4131



The technical material and data contained within this report have been prepared by or under the direction of registered professional engineer(s), licensed in accordance with the laws of the State of Washington to practice in the State of Washington.

QUICK REFERENCE PROJECT INFORMATION

General Project Information

Water System Name	South Whidbey Parks & Recreation District
Public Water System ID	02660 E
Water System Type	Group A, Transient Non-Community
Water System Location	5475 Maxwelton Road, Langley, WA 98260 Island County
Project Description	Analysis of water system and improvements to support the proposed aquatic center.
System Owner	South Whidbey Parks and Recreation District
System Owner Contact	Brian Tomisser, Executive Director South Whidbey Parks & Recreation District 5495 Maxwelton Road Langley, WA 98260 Email: director@swparks.com Phone: (360) 221-6488
System Operator	Jeffrey J. Olson NW Natural Water Services PO Box 699 Newberg, OR 97132 Phone: (503) 554-8333
Consulting Engineer	Jeffrey M. Tasoff, P.E. Facet P.O. Box 1132 Freeland, WA 98249 Email: JTasoff@facetnw.com Phone: (360) 331-4131, ext. 203

Project Summary

Service Connections	Pressure Zone: Newer Maintenance Building Gravity Zone: Older Maintenance Buildings, Castle Park Restrooms, & Concession Stand, Aquatic Center (Proposed) Irrigation Zones: Upper Soccer Fields Mid Soccer Fields Lower Baseball Fields
Water Rights	G1-25547C, Priority Date: November 15, 1989 Instantaneous = 60 gpm & Annual = 25.5 Ac-Ft/year G1-28084P, Priority Date: August 4, 2000 Instantaneous = 60 gpm & Annual = 40.2 Ac-Ft/year Combined Total: Instantaneous = 120 gpm & Annual = 65.7 Ac-Ft/year
Source Production	S01-AGA424 Well #2 Capacity: 120 gpm, Well Depth: 308 feet S02-AGA525 Well #1 Capacity: 50 gpm, Well Depth: 200 feet; Emergency Usage
System Design Values	PHD – 90 gpm Summer ADD – 95,000 gallons Design MDD – 162,000 gallons
Reservoir Specifications	Existing (irrigation): Capacity –106,000 Gallons Interior Diameter 30', Height 20' Proposed (potable): Capacity –99,000 Gallons Interior Diameter 26', Height 25'
System Pressures	Gravity Zone: HGL: 285 feet Pressure Zone: HGL: 350 feet, Pressure setting: 40 psi (Maintenance Building)- Existing
Domestic Booster Pump (Existing)	Grundfos MQ3-45, 40 psi pressure setting (Maintenance Building)

Project Summary - continued

Irrigation Booster Pumps Existing	(1) 5-HP Irrigation Pump (Lower Baseball Fields) (1) 5-HP Irrigation Pump (Mid Soccer Fields) (1) 20-HP Irrigation Pump (Upper Soccer Fields)
Well Pump Controls	Reservoir Level Sensors
Submersible Pumps Existing	Well #1: Unknown Well #2: Goulds 100H15; 15 HP; 120 gpm @ 30 psi & 300 feet
Distribution Mains Existing	Pressurized Service Line: 2", 6" and 8" PVC Gravity Service Line: 1", 2", 3", 6" and 8" PVC
Submersible Pumps Proposed	Well #2: Grundfos 160S150-9, 15 HP, 3 phase, 6" diameter motor Operating Point: 120 gpm @ 350 ft head, 96% VFD motor speed
Treatment System Proposed	35 gpm Manganese Dioxide-Adsorption Treatment System • Filter Vessels: (4) 18" diameter, 60" tall sidewalls • Filter Media: Pyrolox advantage (manganese dioxide coated silica sand) • Oxidant: Chlorine (sodium hypochlorite chemical metering system)
Distribution Mains Proposed	Reservoir Fill Line: 4" HDPE Gravity Service Line: 8" and 12" HDPE

ABBREVIATIONS

ADD	Average Day Demand
AWWA	American Water Works Association
BDS	Bottom Dead Storage
CF	Cubic Feet (or Cubic Foot)
Diam	Diameter
District	South Whidbey Parks & Recreation District
DOC	Dissolved Organic Carbon
DOE	Washington State Department of Ecology
DOH	Washington State Department of Health
DS	Dead Storage
ES	Equalizing Storage
FSS	Fire Suppression Storage
ft	Feet
gal	Gallons
gpd	Gallons per Day
gpd	Gallons per Hour
gpm	Gallons per Minute
HAA5	Haloacetic Acids (Five)
HDPE	High Density Polyethylene
HP	Horsepower
ID	Identification
LCR	Lead & Copper Rule
Max.	Maximum
MCL	Maximum Contaminant Level
MDD	Maximum Day Demand
Mg/l	Milligrams per liter
min	Minutes
N/A	Not Applicable
No.	Number
O&M	Operation and Maintenance
OS	Operational Storage
Park	South Whidbey Community Park
PPM	Parts per Million
PF	Peak Factor
PHD	Peak Hour Demand
Psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
PWS ID #	Public Water System Identification Number
SB	Standby Storage
SF	Square Feet (or Square Foot)
SMA	Satellite Management Agency
SMCL	Secondary Maximum Contaminant Level
System	South Whidbey Parks & Recreation Water System

TDH	Total Dynamic Head
TDS	Top Dead Storage
TOC	Total Organic Carbon
TNC	Transient Non-Community
TTHM	Total Trihalomethanes
USEPA	United States Environmental Protection Agency
VFD	Variable Frequency Drive
WA	Washington
WFI	Water Facilities Inventory Form
WSDM	WA State Department of Health Water System Design Manual, 2020 Edition
WSDOT	Washington State Department of Transportation
yr	Year

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1. Introduction

1.1 Water System Overview

The South Whidbey Parks & Rec District water system (the System) is a group A Transient Non-Community (TNC) water system owned by the South Whidbey Parks and Recreation District (the District) and operated by licensed satellite management agency (SMA) NW Natural (formally King Water Company). The System is located in South Whidbey Community Park (the Park) on the south end of Whidbey Island in Island County, Washington, approximately three miles northwest of the town of Clinton.

The System is currently approved by the Washington State Department of Health (DOH) to serve up to four non-residential service connections. According to its Water Facilities Inventory (WFI) form, the System is currently serving four non-residential service connections and approximately 37,000 users per year. A summary of the System's contact information, source information, connections, and service population is provided in the WFI form included in **Appendix A**.

1.2 Project Overview

The District is planning the development of an aquatic center which will house a public pool and other recreation facilities. This report describes water system improvements needed to support the planned development. The identified improvements to fully support the proposed aquatic center include:

- 99,000-gallon dedicated reservoir to support domestic and fire flow needs
- Reservoir fill line
- Distribution piping from the reservoir to the aquatic center
- Water quality treatment

The location and elevation of the reservoir will allow the aquatic center to be gravity fed, so no new pumping facilities will be required. Construction of the actual aquatic center is not covered under the scope of this report. A brief overview of the project scope is provided in **Sections 1.2.1** through **1.2.4.**

Figure 1 shows the site and vicinity, along with select elements of the existing water system and proposed improvements.

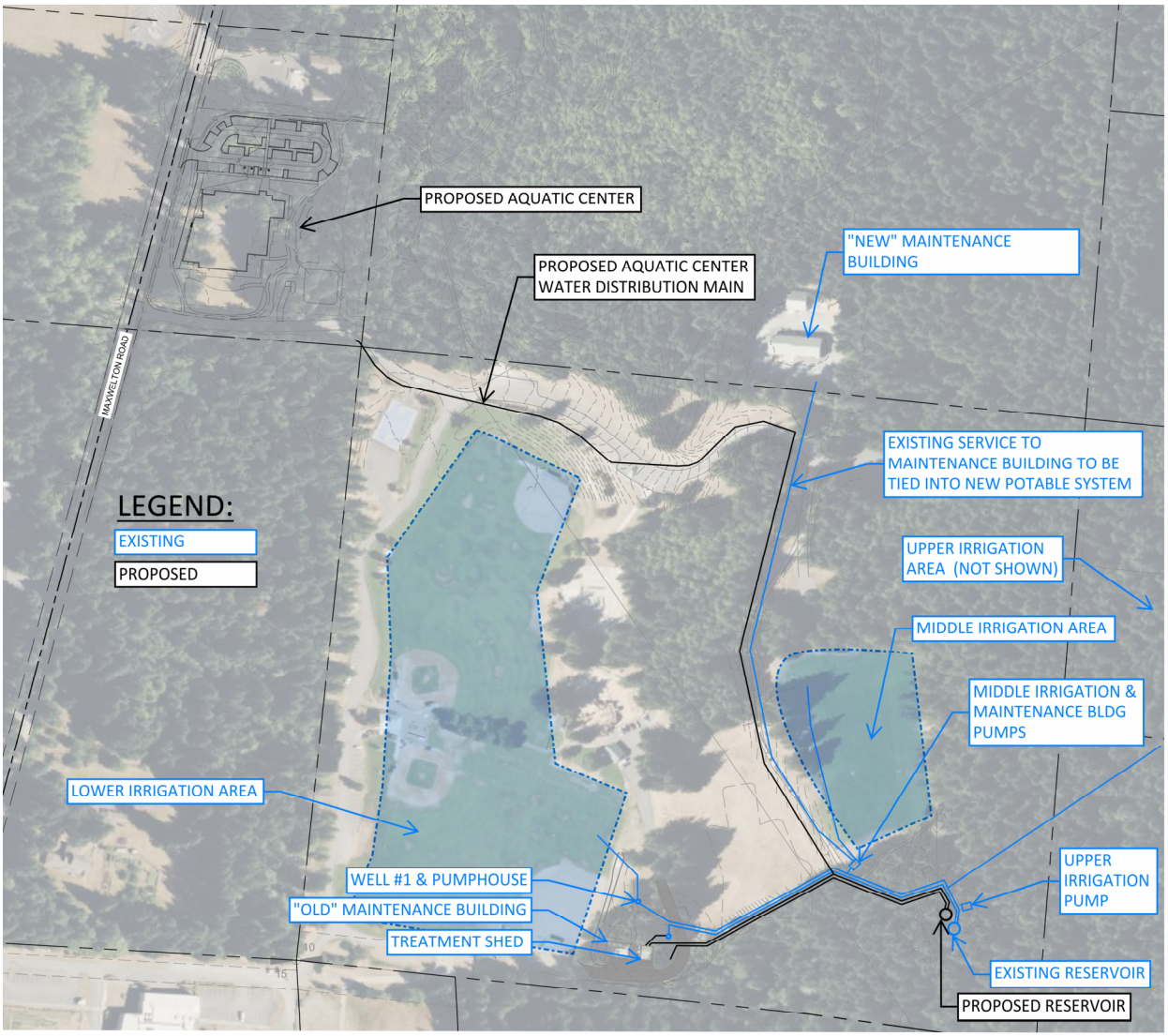

Figure 1. Vicinity Map and System Overview

1.2.1 System Capacity

The aquatic center will increase the System's water demand. A capacity analysis was prepared to demonstrate the System has adequate capacity to meet the increased water demand associated with the aquatic center. That capacity analysis is included in **Section 5**.

1.2.2 System Improvements: Storage Reservoir

The System has an existing reservoir which provides storage for both domestic and irrigation needs at the Park. A new reservoir is proposed to provide a dedicated storage tank for domestic and fire flow demands of the aquatic center. The existing storage reservoir (hereafter referred to as the irrigation reservoir) will mainly serve the park's irrigation system. The proposed reservoir (hereafter referred to as the storage reservoir) will provide storage for only the park's domestic and fire flow demands.

1.2.3 System Improvements: Watermains

A 12-inch HDPE watermain is proposed to provide water to the Aquatic Center site. This watermain is sized for domestic service, hydrant fire flow, and a fire sprinkler system in the aquatic center.

An 8-inch HDPE watermain is proposed to provide water near the older maintenance buildings. This watermain is sized for hydrant fire flow and could be extended for future use to serve a proposed campground.

1.2.4 Well Pump Replacement and VFD Controls

The submersible well pump in the System's active well was installed approximately 35 years ago. To ensure proper performance for future use, the well will be refurbished and the pump will be replaced with a new, 3-phase submersible pump and motor controlled by a variable frequency drive (VFD).

1.2.5 System Improvements: Treatment

1.2.5.1 Description of the Problem

The System's active source is a groundwater well which produces water with iron and manganese concentrations above the secondary Maximum Contaminant Levels (MCL). The District desires to provide treatment to reduce the levels of iron and manganese in the water delivered to the proposed aquatic center.

Iron and manganese are naturally occurring metals in groundwater and are currently classified as secondary drinking water contaminants by the Environmental Protection Agency (EPA), meaning they are regulated for aesthetic reasons such as taste, odor, and discolored water which can stain plumbing fixtures like bathtubs and sinks.

There are also emerging concerns regarding possible negative health effects from elevated levels of manganese in drinking water. Manganese is currently being considered for possible inclusion as a primary drinking water contaminant, which are regulated for their potential adverse effects on human health.

The secondary maximum contaminant levels (SMCLs) for iron and manganese are 0.3 mg/L and 0.05 mg/L, respectively. These SMCLs were established by the EPA and are enforced by the DOH in Washington. Laboratory test results for raw water samples from the System's active well are summarized in **Table 1**. Raw water concentrations exceed the SMCL for both iron and manganese.

Table 1. : Raw Water Iron and Manganese Concentrations

Analyte	Concentration (mg/L)	SMCL (mg/L)
Iron	1.21	0.3
Manganese	0.201	0.05

1.2.5.2 Proposed Solution

To reduce the concentrations of iron and manganese in the water produced by the System's well, it is proposed to install a manganese dioxide adsorption treatment system. A sodium hypochlorite chemical feed system will be provided to oxidize the iron and manganese and maintain the oxidative state of the catalytic media. The treatment system will be installed in an existing maintenance building (hereafter referred to as the treatment building) located near the System's active well. Finished water quality targets for iron and manganese are 50% of the SMCLs or 0.15 mg/L for iron and 0.025 mg/L for manganese.

2. Existing System Configuration

The water system currently consists of two wells, a concrete reservoir, pressurized and gravity fed potable water distribution systems, and three different irrigation zones. The potable water system appears to be properly isolated from the irrigation systems by backflow prevention devices.

2.1 Existing System Schematic

A schematic diagram of the existing System is provided in **Figure 2**.

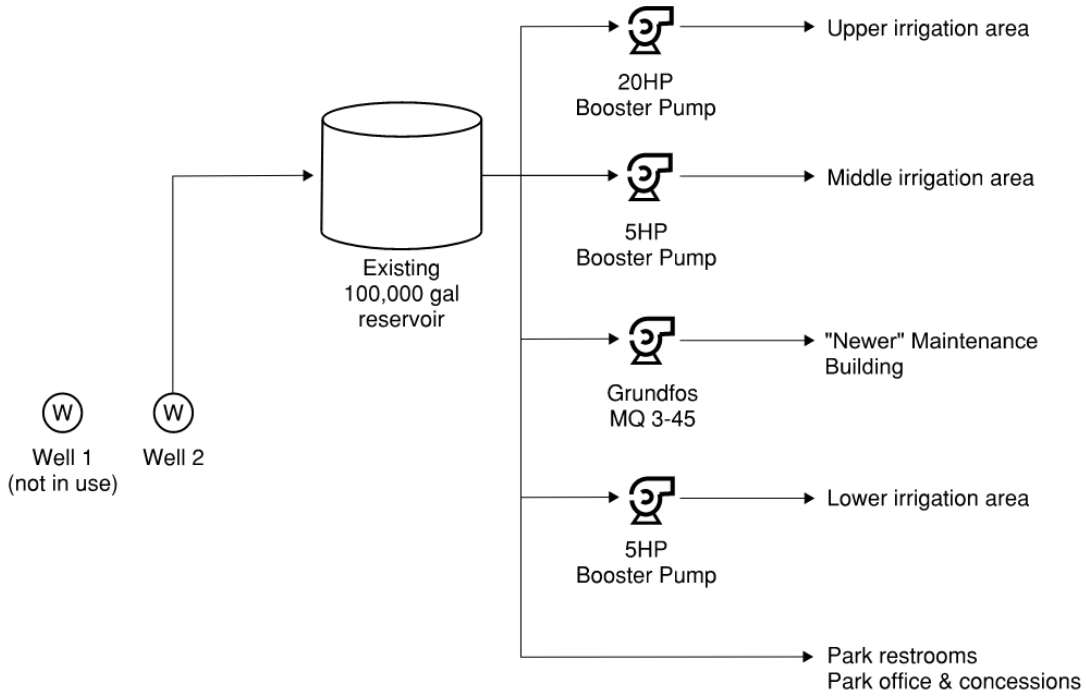

Figure 2. Existing Water System Schematic

2.2 Sources

The system's primary well is Well #2, installed in 1990 and capable of providing 120 gallons per minute (gpm) with a 15-horsepower (hp) Goulds 100H15 submersible pump. This well is currently listed as S01 on the Water Facilities Inventory (WFI). A copy of the well log and the WFI is provided in **Appendix A**. The WFI lists two more wells, a secondary emergency water source Well #1 (S02) and an inactive Well #3 (S03). The WFI lists the production of Well #1 as 50 gpm. Well #1 is currently not in use and is disconnected from the gravity distribution system. Another well previously installed near the proposed aquatic center (previously listed as Well #3) has been decommissioned.

Source information is summarized in **Table 2**. Copies of the well logs are provided in **Appendix A**.

Table 2. Well Parameters

Parameter	Well #2 (Primary)	Well #1 (Emergency)
Source (WFI)	S01	S02
Drill Date	4/2/1990	No data
Well Tag ID #	AGA 524	AGA 525
Current Well Production (gpm)	120	50
Water Right Qi (gpm)	60	60
WFI Listed Capacity (gpm)	120	50
Depth (feet)	308	200
Casing Diameter	6"	6"
Well Head Elevation	200'	200'
Screened Interval	299-308'	no data
Static Water Level	192'	no data
Pump Test (gpm)	50	no data
Drawdown (feet)	9.5	no data
Yield (gpm/foot of drawdown)	5.3	no data

2.3 Storage

The well pump for Well #2 is connected to a 3-inch polyvinyl chloride (PVC) dedicated reservoir fill line that top-fills the system's reservoir. The reservoir volume is 100,000 gallons and is located at an elevation of approximately 275 feet. The concrete reservoir is 30 feet in diameter and 20 feet tall. The reservoir was installed in 1993 and was lined in 2003 to address a leak. Float level switches at the reservoir control the operation of the well pump.

2.4 Distribution System

An 8-inch C900 PVC line leaves the bottom of the reservoir, then tees to feed a pump house adjacent to the reservoir and heads downhill paralleling the reservoir fill line.

The pump house adjacent to the reservoir houses a 20-HP pump that is used to irrigate the upper soccer fields. The pump discharge line contains a backflow prevention device which isolates the upper irrigation system from the potable water system. The irrigation pump and irrigation zones are manually controlled.

The 8-inch C900 PVC line also feeds a small pump enclosure that contains a 5-HP irrigation booster pump and a Grundfos MQ 3-45 variable speed drive booster pump (Grundfos pump). The 5-HP irrigation booster pump supplies water to the mid soccer fields. The pump's discharge line contains a backflow prevention device which isolates the mid irrigation system from the potable water system. The irrigation pump and irrigation zones are manually controlled. The Grundfos pump supplies water to the newer maintenance office building via a 2-inch PVC pipe. The Grundfos pump is set to maintain a discharge pressure of 40 psi.

The 8-inch C900 PVC line terminates at a valve cluster that feeds the lower pump house. This pump house contains Well #1 and a 5-HP booster pump that is used to provide irrigation water on the lower baseball fields. When irrigation is needed in this zone the pump is activated to provide additional pressure for proper sprinkler head operation. The irrigation laterals are protected by a backflow prevention device installed shortly after the line tap of the potable distribution piping.

A 6-inch PVC pipe leaves the lower pumphouse to feed the concession stand and restrooms via gravity. A 1-inch and 2-inch PVC pipe services the restrooms and concession stand from the 6-inch PVC line, respectively.

3. Water System Planning

The existing water system is registered with the Washington State Department of Health (DOH). The system is known as the South Whidbey Parks and Rec District Water System and was assigned a Public Water System Identification Number of 02660 E. The system currently has a Green Operating Permit, which indicates that the system is adequate for the existing connections.

This report includes a capacity analysis of the existing park water system and documents water system improvements needed to support the development of a new aquatic recreation center with community pools, wellness/physical therapy/rehabilitation center, and gym near the park's entrance from Maxwelton Road. Construction drawings for water system improvements to support the aquatic center are included in **Appendix D**.

The treatment system will be sized to support the System's domestic demand only; water used for irrigation will not be treated. A nominal design capacity of 35 gpm was selected for the treatment system. This capacity is sufficient to meet domestic demand as demonstrated in **Section 5.7**.

4. System Improvements Summary

Proposed improvements to the water system include new treatment improvements, a new potable water storage reservoir, and distribution improvements to existing and proposed potable water points of use.

4.1 Storage Reservoir

This project proposes preservation of the existing 100,000-gallon concrete reservoir and construction of a new 99,000-gallon concrete reservoir in the same vicinity. The existing reservoir will maintain its existing configuration of storing untreated (raw) water from Well #2 prior to use by the park's existing irrigation system. The proposed reservoir will be used for storage of treated, potable water from Well #2, for use at the proposed aquatic center. More information on storage capacity is included in **Section 5.8** and **Appendix B**.

4.2 Site Piping

System piping improvements are proposed to convey raw water from Well #2 to the new treatment equipment, treated water from the treatment facility to the proposed potable water reservoir, and distribution piping from the proposed reservoir to the aquatic center. More information on proposed site piping improvements is included in **Section 5.8**.

4.3 Well Pump Replacement and VFD Controls

The existing submersible well pump in Well 2 will be replaced with a new, three-phase submersible well pump and motor. The motor will be controlled with a VFD pump controller. The VFD will enable the well to pump at 120 gpm into the irrigation reservoir or 35 gpm through the proposed treatment system and into the proposed storage reservoir. When pumping at 35 gpm through treatment, the VFD will reduce the motor speed to only provide adequate pressure to maintain this lower flowrate. VFD controllers are a more energy efficient method of providing flow control than a throttling valve. Information on the proposed well pump is provided in **Table 3** and product information, including a pump curve, is included in **Appendix E.**

Table 3. Proposed Well Pump and VFD Information

Parameter	Value
Nominal Head	360 feet
Nominal Pumping Rate	160 gpm
Operating Point	120 gpm @ 350 ft head, 96% VFD motor speed
Phase	3
Voltage	230 or 430
Motor Horsepower	15
Motor Diameter	6"

4.4 Treatment

A 35-gpm manganese dioxide-adsorption treatment system is proposed to remove iron and manganese from Well #2 raw water.

4.5 Proposed System Schematic

A schematic diagram of the proposed water system is provided in Figure 3.

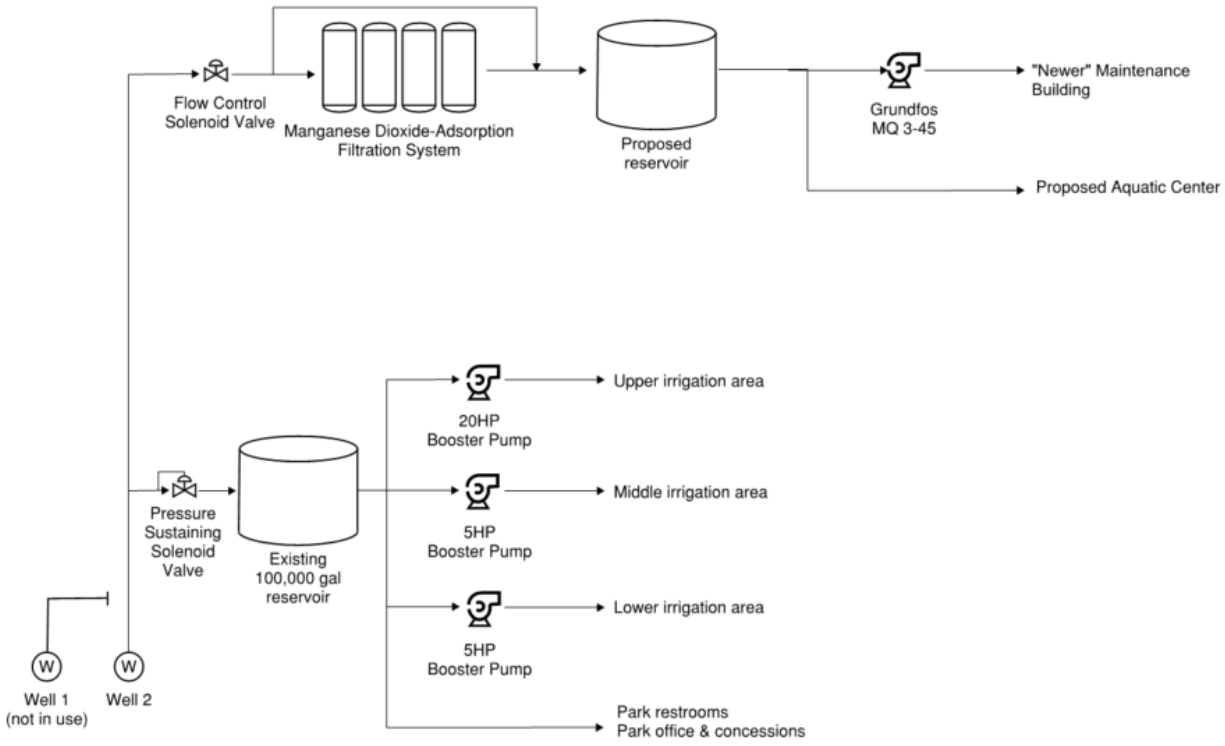

Figure 3. Proposed Water System Schematic

4.6 Construction Plans

Construction plans for the proposed improvements are included in **Appendix** D**.**

5. Capacity Analysis

5.1 Overview

This capacity analysis demonstrates the System has the legal and physical capacity to serve the proposed aquatic center, in addition to existing demands. Capacity analysis calculations are summarized in this section and provided in full in **Appendix B**.

To determine the overall capacity of the System, the capacity of each system component was determined individually. The following legal and physical capacities were determined.

Legal Capacities: *Water Rights*

Physical Capacities: Source, Storage, Treatment, and Distribution

This capacity analysis considers the demands of all water uses in the system (existing and proposed) with respect to water rights and source capacity. The capacities of the proposed storage reservoir, treatment system, and potable water distribution system are considered with respect to existing and proposed domestic and identified fire flow needs only.

This project proposes to create a separate reservoir and distribution system for the aquatic center. Storage capacity of the existing reservoir is therefore not addressed in this report.

5.2 Connections

To support the proposed aquatic center improvements, the system needs to demonstrate adequate capacity for the following connections:

Table 4. Water System Connections

Existing	Proposed
Old maintenance building Park restrooms Park office/concessions building New maintenance building Irrigation zones (upper, middle, lower)	Aquatic center

5.3 Water System Demand

Monthly water usage data from 2011 through 2015 was provided by the system. System water usage from 2015 through present is not available. The water usage data is provided in **Appendix B**. The water system usage is seasonal, with most of the usage occurring during summer irrigation. system typically has little water usage from November through February when three maintenance staff are the primary users. The development of the aquatic center will change the seasonal usage trends.

The capacity analysis for the existing facility is based on a summer usage scenario using data from 2011 through 2015. **Figure 4** shows the monthly water usage for the system from 2011 to 2015.

The annual average day demand (ADD) for the existing system is 31,000 gallons per day (gpd). The summer ADD is approximately 90,000 gpd. The ADD during non-summer months is approximately 7,000 gpd.

The maximum month average daily demand (MMADD) is 110,000 gpd. Since the majority of the sites water usage is due to irrigation demands an alternative method of determining the MDD was used. The standard method of multiplying the MMADD by a factor of 1.65, resulting in the MDD exceeding the physical capacity of the well pump, so this method was not valid. The anticipated maximum daily demand (MDD) was determined by multiplying the non-irrigation MMADD demands by a factor of 1.65. The irrigation demands were multiplied by 7/5 to represent irrigation for 5 days of a 7day week since irrigation is manual operation by park staff. Using this method the MDD for the existing facility is approximately 156,000 gpd.

Peak Hour Demand (PHD) determination is discussed in **Section 5.4.3**, including determination of PHD for existing uses.

Water System Demands for the developed site, inclusive of existing demands plus proposed aquatic center is discussed in **Section 5.4**.

Table 5. Existing System Demand Summary

Parameter	Value
ADD (annual)	31,000 gpd
ADD (summer)	90,000 gpd
ADD (domestic/non-irrigation)	7,000 gpd
MDD (estimated)	156,000 gpd
PHD (irrigation)	225 gpm
PHD (domestic/non-irrigation)	50 gpm

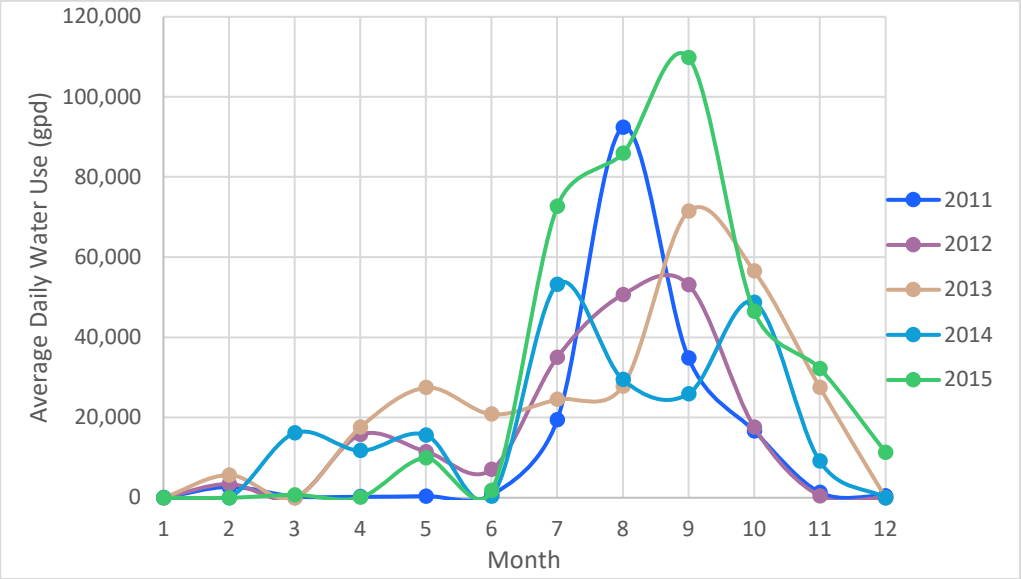

Figure 4. 2011-2015 Average Daily Water Use Per Month

5.4 Proposed Water System Demand

5.4.1 Maximum Day Demand (MDD)

The aquatic center will likely have fairly consistent usage throughout the year, since this system will not have irrigation system demands. The aquatic center MDD was estimated based on the anticipated number of aquatic center users, staff, and pool maintenance water requirements. The maximum number of users of the aquatic center is approximately 1,000 people including staff. The Design Manual was referenced to estimate the amount of water used per person. A daily demand of 10 gpd/person was selected for facility users and 15 gpd/person for facility staff. To determine pool maintenance water requirements, Table 3-2 was referenced. Table 3-2 suggests 10 gpd of water is needed for every 100 square feet of pool area. The aquatic center MDD is estimated at 11,000 gpd.

The proposed additional facilities are a minor portion of the site's overall current and anticipated future MDD. Irrigation demands in the summer months are estimated at 83,000 gallons per day on average. The design MDD limited by the well production is 141,700 gpd.

The MDD calculations are included in **Appendix B** and summarized in **Table 6.**

Table 6. Maximum Day Demand (Proposed)

Parameter	Value
MDD (total system, estimated)	162,500 gpd
MDD of irrigation	141,700 gpd
MDD of Aquatic Center	11,000 gpd
MDD (other existing domestic needs)	9,800 gpd

5.4.2 Average Day Demand (ADD)

The ADD for the aquatic center was calculated by multiplying the MDD by 40% (the assumed yearly occupancy percentage). The demand for pool maintenance remained the same as MDD demand. The aquatic center ADD is 5,000 gpd.

As discussed in **Section 5.3**, the existing water system summer ADD is 90,000 gpd. The system's anticipated summer ADD (worst case scenario) which would include the existing buildings, irrigation demand, and the proposed aquatic center is 95,000 gpd. The system's anticipated domestic ADD (inclusive of existing non-irrigation demand plus aquatic center) is 16,400 gpd.

ADD calculations for the water system under proposed build-out conditions are included in **Appendix B** and summarized in **Table 7**.

Table 7. Average Day Demand (Proposed)

Parameter	Value
ADD (annual)	36,000 gpd
ADD (summer)	95,000 gpd
ADD (domestic)	12,000 gpd

5.4.3 Peak Hour Demand (PHD)

PHDs were determined for the domestic uses in the proposed build-out condition (inclusive of demands from both maintenance buildings) which will rely on the proposed potable reservoir. Irrigation PHD was not included in this analysis because the irrigation system will be supplied by the existing reservoir.

PHD of the system was determined using a fixture count analysis. The analysis estimates PHD based on the number of plumbing fixtures in each building, including: older maintenance building, newer maintenance building, and the proposed aquatic center.

The PHD of the combined existing plus proposed facilities is 90 gpm. See **Appendix B** for the system analysis calculations.

5.4.4 Fire Flow Demand

South Whidbey Fire Department determined fire flow requirements for the aquatic center. These requirements are summarized below.

Table 8. Fire Flow Requirements

Parameter	Requirement
Fire Flow	1,200 gpm
Duration	60 min
Volume	72,000 gal

5.4.5 Demand Design Value Summary

The design values used for analyzing the system are summarized in Table 9 below.

Table 9. Proposed System Demand Summary

Parameter	Existing	Proposed
ADD (annual)	31,000 gpd	36,000 gpd
ADD (summer)	90,000 gpd	95,000 gpd
ADD (domestic/non-irrigation)	7,000 gpd	12,000 gpd
MDD (estimated)	151,500 gpd	162,000 gpd
PHD (irrigation)	225 gpm	225 gpm
PHD (domestic/non-irrigation)	47	90 gpm

5.5 Water Right Capacity

The system owns two water rights; G1-25547P from November 15, 1989, which allows 60 gpm and 25.5 acre-ft/year, and G1-28084P from August 4, 2000, which allows 60 gpm and 40.2 acre-ft/year. Permit G1-28084P states that the combined quantity of the two permits shall not exceed 120 gpm, or 65.7 acre-ft/year (21,400,000 gal/year). The water rights are adequate for the full pump capacity of Well #2 since the withdrawal rate is 120 gpm. The system has used up to 34 acre-feet (ac-ft) in the past and it is

anticipated that the system would use 41 ac-ft with aquatic center in full operation. The current usage type specified on the water rights are municipal, continuous. This is consistent with proposed usage. See **Appendix A** for a copy of the system's water rights and water rights self-assessment form.

5.5.1 Annual Withdrawal Water Right

The maximum annual withdrawal rate of 65.7 acre-ft/yr in the System's water right results in a maximum average daily withdrawal of 5,356 gpd as shown below:

$$Max.\,Annual\,Withdrawal = 65.7\,acre \cdot ft/yr \times \frac{43{,}560\,ft^2}{acre} \times \frac{7.48\,gal}{ft^2}$$

$$= 21{,}400{,}000\ \ gal/year$$

The System's ADD after the proposed improvements is 36,000 gpd, or 13,140,000 gal/year. Therefore, the System's annual withdrawal water right is sufficient to support the ADD associated with the improvements proposed in this report.

5.5.2 Instantaneous Withdrawal Water Right

The maximum instantaneous withdrawal rate of 120 gpm in the System's water right results in a maximum daily withdrawal of 172,800 gpd as shown below:

$$Max.\,Daily\,Withdrawal = 120\,gal/min \times 1{,}440\,min/day = 172{,}800\ \ gal/day$$

The System's estimated MDD after the proposed improvements is 162,000 gpd. This demand, which is predominantly based on existing park irrigation usage, is adjustable based on watering frequency and duration.

The maximum allowable daily irrigation volume allowed by the water right can be determined by subtracting the MDDs of the aquatic center and existing park domestic connections from the maximum daily withdrawal allowed by the water right. As determined in **Section 5.4.1**Error! Reference source not found., the total system domestic MDD is 20,800 gpd (including aquatic center MDD of 11,000 gpd and existing park domestic MDD of 9,800 gpd).

$$Max.\,Daily\,Irrigation\,Withdrawal = 172{,}800\ gal/day - 20{,}800\ gal/day = 152{,}000\ \ gal/day$$

For future irrigation scheduling, the maximum daily irrigation withdrawal limit, as allowed by the instantaneous withdrawal water right, is 152,000 gal/day.

5.6 Source Capacity

The System's source capacity was calculated assuming a pump run time of 24 hours per day.

$$Max.\,Daily\,Withdrawal = 120\,gal/min \times 1{,}440\,\text{min}\,pumping\ /day = 172{,}000\ \ gal/day$$

This is longer than the recommended 20 hours per day of pumping noted in the WSDM due to how the well is used to support park services. Park staff manually operate the irrigation system and typically only irrigate no more than 5 days per week. Therefore, the well will have 48-hour rest period each week. This equates to 17 hour per day run time. This calculation is shown below:

$$Average\ Daily\ pumping = \ 5days\frac{x\,\frac{24hours}{day}}{7\ days} = 17.1\ hours\ per\ day$$

The System's estimated MDD after the proposed improvements is 162,000 gpd. The source is adequate to support the proposed additional demand. Regardless of the water system's choice of how long to run their well pump, we recommend that irrigation water usage be measured and recorded to determine an accurate MDD.

5.7 Treatment Capacity

The proposed water treatment system can treat water from Well #2 at a maximum rate of 35 gpm. 2.5% of this water is expected to be used for backwashing the filters and lost from the system. With a pump run of 20 hours per day, the treatments system will yield 40,650 gal/day.

$$Daily\ Treatment\ Capacity = (35\ gal/\,\text{min} \times\ 97.5\%) \times 1{,}200\,\text{min}\,pumping\ /day = 40{,}950\ \ gal/day$$

The proposed treatment system provides adequate capacity to meet the domestic MDD of 20,800 gal/day.

5.8 Storage Capacity

The System's existing 100,000-gallon reservoir contains insufficient storage volume for the improvements proposed in this report but it is proposed to remain in place to support the existing irrigation system. Existing domestic connections will be disconnected from the existing reservoir, and a new 120,000-gal reservoir is proposed for storage of treated water prior to distribution to existing domestic connections within the park, as well as the new aquatic center. The new reservoir will also be sized to accommodate fire flows to the aquatic center as required by the fire department. The rest of this section refers to sizing and capacity of the **proposed reservoir** only.

Reservoir sizing was completed according to the *WSDM* to provide the system with adequate storage capacity to meet the anticipated system demands. The five following storage components were considered in the design process:

1. Operational Storage (OS)
2. Equalizing Storage (ES)
3. Dead Storage (DS)
4. Standby Storage (SB)
5. Fire Suppression Storage (FSS)

The proposed reservoir consists of reinforced circular concrete with a 26-foot diameter and 25-foot height. This equates to approximately 99,200 gallons of proposed reservoir storage (V_{PR}) and 3,971 gallons of storage per foot of proposed reservoir height (V_{Pf}).

Operational storage (OS) is the height difference between the water levels in the reservoir where the well pump is turned on and off. Adequate operational storage will prevent excess cycling of the well pump by minimizing the number of times it needs to start. For efficient treatment operations it is recommended to run the treatment system for a minimum of one hour.

$$Treatment\ Run\ Time\ one\ hour = 35\ gal \times 60 = 2{,}100\ gallons$$

$$Minimum\ OS = 2{,}100\ gallons\ or\ 0.55\ feet\ of\ storage$$

A full one foot of elevation will be provided between the well pump on and off signal to provide for an extended run time for the treatment system. Therefore, the operation storage is calculated as follows:

$$OS = 1.0\ ft \times 3{,}971\ gal/ft \cong 3{,}971\ gal$$

Equalizing storage (ES) is the volume of water that is needed to meet the peak demand period for the water system. Equalizing storage was calculated using equation 7-1 from the *WSDM* as follows:

$$ES = (PHD - Q_s)(150\ minutes)$$

Where:
PHD = Peak Hour Demand
Q_s = Well Pump Capacity (as limited by the proposed treatment system)

$$ES = (90\ gpm - 35\ gpm)(150\ minutes) = 8{,}250\ gal\ (or\ 2.1\ ft\ of\ storage)$$

The HGL of the gravity system will be set on the bottom of equalizing storage in the reservoir. The elevation of the base of the reservoir is 265 feet and the bottom of ES equates to 20.9 feet. The HGL will be is listed as 285 feet.

Dead storage (DS) is the unusable volume at the top (TDS) and bottom (BDS) of the reservoir. One foot of freeboard will be provided at the top of the reservoir over the well pump off water level. The reservoir outlet will be raised six inches above the bottom of the reservoir to prevent silt and other

material that may collect in the reservoir from entering the distribution system. Therefore, dead storage can be calculated as follows:

$$TDS = 1.0\ ft \times 3{,}971\ gal/ft \cong 3{,}971\ gal\ (or\ 1.0\ ft\ of\ storage)$$

$$BDS = 0.5\ ft \times 3{,}971\ gal/ft \cong 1{,}986\ gal\ (or\ 0.5\ ft\ of\ storage)$$

$$DS = TDS + BDS \cong 5{,}960\ gal\ (or\ 1.5\ ft\ of\ storage)$$

Standby storage (SB) is the volume of water available to supply the System in case of abnormal operating conditions that prevent the source from properly functioning. The standby storage provided by the proposed reservoir can be calculated as the remaining volume after operational storage, equalizing storage, and dead storage are accounted for. The provided standby storage is calculated as follows:

$$SB = V_R - OS - ES - DS = 99{,}200\ gal - 3{,}790\ gal - 8{,}250\ gal - 5{,}960\ gal$$

$$SB \cong 81{,}105\ gal\ (or\ 20.4\ ft\ of\ storage)$$

Fire suppression storage is calculated using equation 7-3 from the DOH *Water System Design Manual*.

Water System Design Manual Equation 7-3:

$$FSS = (FF)(t_m)$$

Where:

FF = Fire flow rate (1,200 gpm, see **Table 8**)
t_m = duration of fire flow rate in minutes (60 minutes, see **Table 8**)

FSS is therefore calculated as follows.

$$FSS = (1{,}200\ gpm)(60\ min) = 72{,}000\ gal$$

Fire suppression storage may be nested within standby storage. Because the standby storage provided by the reservoir is greater than the required fire suppression storage, all fire suppression storage is considered nested in standby storage.

The provided storage volumes are summarized in **Table 10.**

Table 10. Proposed Reservoir: Storage Component Summary

Storage Component	Volume (gal)	Depth (ft)
Top Dead	3,971	1.0
Operational	3,971	1.0
Equalizing	8,250	2.1
Fire Suppression/Standby	81,105	20.4
Bottom Dead	1,986	0.5
Total	99,200	25.0

5.8.1 Reservoir Water Age

Water age may sometimes be a problem when large fire suppression storage requirements must be met. The reservoir water age was calculated using the aquatic center ADD. The winter water age was calculated as 20 days.

$$Winter\ Water\ Age = \frac{Storage\ Volume}{ADD} = \frac{99{,}200\ gal}{5{,}000\ gpd} = 19.8\ days$$

5.9 Distribution System Capacity

Distribution systems must be adequately sized to meet minimum residual pressure requirements at service connections. It is further recommended that maximum pressures and velocities are limited. These requirements and recommendations are as follows (DOH 2020):

1. Minimum design pressure of 30 psi at service connections under PHD conditions
2. Minimum design pressure of 20 psi in distribution system under fire flow plus MDD conditions, if applicable
3. Maximum recommended design velocity in watermains of 8 feet per second (fps)
4. System pressure should typically be no less than 40 psi and no higher than 80 psi.
5. Water pressure should drop no more than 25 percent between static and peak flow conditions.

A hydraulic model for the System was prepared and modeling results are included in **Appendix C**.

5.9.1 Static Hydraulic Model

The static model simulates a zero-demand scenario and therefore represents the highest pressures the System will experience under normal operating conditions. To simulate high pressures, the static model assumes reservoirs are filled to the top of operational storage, no demands are placed on the system, and all booster pumps are turned off.

The model indicates that in this scenario, Service pressures in the distribution system will range between 40 to 50 psi in the gravity-fed pressure zones. Pressures below 30 psi occur in the higher elevation areas near the reservoir, but all connections in the higher elevation areas are served by existing booster pumps.

5.9.2 Peak Hour Demand Hydraulic Model

The peak hour demand model simulates a peak demand scenario and therefore represents the lowest pressures the System will experience under normal operating conditions. Water systems should be able to provide peak hour demand at no less than 30 psi at all service connections throughout the distribution system when all equalizing storage is depleted (DOH 2020). For this reason, the peak hour demand model assumes reservoir depths at the bottom of the equalizing storage components for each reservoir as described in **Table 10**.

The model indicates that in this scenario, System pressures will range between 35 to 40 psi in the gravity-fed zones. Once again, pressures below 30 psi occur in the higher elevation areas near the reservoir, but all connections in the higher elevation areas are served by existing booster pumps. Pressures at all other service connections exceed 30 psi. The highest pressures occur upstream of the treatment system at 49 psi.

5.9.3 Fire Flow Plus MDD Model

The fire flow plus MDD model simulates a fire flow plus maximum day demand scenario. Water systems supplied through gravity storage must provide fire suppression storage with a bottom level in the reservoir that produces no less than 20 psi at all points throughout the distribution system under the maximum day demand plus fire flow conditions (DOH 2020). Fire suppression storage is nested with standby storage and the bottom of fire suppression storage is assumed to be at the bottom of standby storage. Accordingly, the water levels in all three reservoirs were placed at the bottom of the standby storage water levels in **Table 10**. Fire flow demand was placed at the aquatic center, to represent the hydrant proposed at that site.

The model indicates that in this scenario, System pressures will range between 25 to 40 psi in the gravity-fed zones, including 25 psi at the aquatic center, where the demand is set to 1208 gpm.

5.9.4 Pipe Sizing

The EPANet modeling prepared for this project determined that a 12-inch HDPE distribution main was sufficient for delivery of the required fire flow to the aquatic center, by gravity alone, at 20 psi minimum. 4" HDPE was determined to be sufficient for the new reservoir fill line.

Other Considerations

The capacity analysis revealed that if irrigation is monitored, the water right, source, and storage are adequate for serving Phase 1 and Phase 2 build out with pumping and distribution system upgrades.

5.10 System Capacity Summary

The capacity of each system component is summarized in **Table 11**.

Table 11. Capacity Summary

System Component	Capacity	Demand	Result
Water Rights (Annual)	21,400,000 gal/yr	13,140,000 gal/yr	Sufficient capacity
Water Rights (Instantaneous)	173,000 gpd	162,000 gpd	Sufficient capacity
Source Production	173,000 gpd	162,000 gpd	Sufficient capacity
Treatment	41,580 gpd	20,800 gpd	Sufficient capacity
Storage	99,200 gal	various	Sufficient capacity for required components
Distribution System	n/a	n/a	Adequate Pressure

Based on the source meter readings made available for this analysis, it is possible that system demands will exceed capacity. The system should take daily source meter readings for two summers to determine an accurate MDD.

6. Water Quality

6.1 Raw Water Quality

Raw water quality samples were taken by Facet staff and sent to a lab for testing. Water quality lab test results are summarized in **Table 12**. Full test lab results are included in **Appendix F**.

Table 12. Raw Water Quality Summary

Analyte	Sample Date	Concentration (mg/L)	MCL (mg/L)
Arsenic	11/15/24	0.0010	0.010
Iron	11/15/24	1.21	0.3
Manganese	11/15/24	0.201	0.05
Hardness (as $CaCO_3$)	11/15/24	98.3	N/A
Ammonia (as N)	11/15/24	0.60	N/A
Nitrite (NO_2^- as N)	12/17/24	ND	1.0
Nitrate (NO_3^- as N)	12/17/24	ND	10.0
Sulfide (as S)	11/15/24	ND	N/A
Total Organic Carbon (TOC)	11/15/24	1.80	N/A
Dissolved Organic Carbon (DOC)	12/17/24	1.32	N/A

7. Analysis of Treatment Alternatives

7.1 Iron and Manganese Treatment

Three alternative treatment methods for iron, and manganese were considered: sequestration, ion-exchange, and manganese dioxide-adsorption. These alternatives are discussed in the following three sections.

7.1.1 Alternative #1: Sequestration

Polyphosphates are used in drinking water treatment as sequestration agents to prevent iron and manganese from precipitating out of solution, including in the presence of an oxidant. This can minimize the undesirable aesthetic effects of iron and manganese by preventing the formation of the iron and manganese particulate matter that may cause taste, odor, color, and water staining issues. Polyphosphates are typically introduced to drinking water by injection of a diluted polyphosphate solution with a chemical metering system.

Disposal of filter backwash wastewater, which is associated with other treatment methods, is not required with sequestration. Consequently, provisions for backwash disposal such as an infiltration area or piping to a roadside ditch are not required.

Sequestration is a relatively inexpensive treatment method compared to other alternatives. It requires little initial capital investment, typically only minor alterations to the existing system, and long-term operation and maintenance costs are comparatively low.

According to the DOH, sequestration should not be used when the combined iron and manganese concentration exceeds 0.5 mg/L (DOH 2020). Furthermore, DOH will not approve sequestration if the combined iron and manganese concentration exceeds 1.0 mg/L or if the manganese concentration exceeds 0.1 mg/L (DOH 2020).

The polyphosphates used as sequestering agents are a nutrient source for bacteria. As a result, a chlorine disinfectant residual must be maintained throughout the distribution system to control bacterial growth. Chlorine is an oxidant and will precipitate iron and manganese from the water. Polyphosphates will not dissolve iron and manganese precipitate back into solution, they will only prevent precipitation from occurring in the first place. Therefore, chlorine injection must be downstream of polyphosphate injection to prevent iron and manganese precipitation before polyphosphate is added to the water.

The effectiveness of sequestration agents decreases with time. Therefore, systems with a high average water age due to large storage reservoirs, large distribution systems, or low water usage, may require larger polyphosphate doses or find sequestration impractical altogether. Pool water at the aquatic center may be recycled at low frequencies; as a result, sequestered iron and manganese could precipitate out in the pool water and cause staining.

Sequestration also becomes less effective in higher temperature water. While this is not typically a problem in distribution piping, it can lead to iron and manganese precipitation in hot water domestic piping. Consequently, sequestration may not be effective at preventing iron and manganese precipitation and staining for aquatic center facilities such as hot tubs.

Sequestration does not remove iron and manganese from the water. As a result, the potential for negative health consequences due to manganese in drinking water are not addressed.

A summary of the pros and cons associated with sequestration of iron and manganese is provided in **Table 13**.

Table 13. Sequestration Pros and Cons

Pros	Cons
1. Lower initial capital investment. 2. Low O&M costs. 3. Minor alterations to existing system. 4. Does not require backwash waste disposal.	1. Requires chlorination. 2. Effectiveness decreases with time and higher temperatures; this could lead to iron and manganese precipitation in pool water and staining of pools/hot tubs. 3. Does not actually remove iron and manganese from the water, potential adverse health effects due to manganese remain. 4. Combined iron and manganese concentration is above 1.0 mg/L, DOH will not approve sequestration. 5. The manganese concentration exceeds 0.1 mg/L, DOH will not approve sequestration.

7.1.2 Ion Exchange

Ion exchange treatment systems are commonly referred to as water softeners and are mostly used as point of use treatment systems at individual households to reduce water hardness. Ion exchange can also be used to reduce iron and manganese concentrations in drinking water.

Ion exchange treatment systems consist of a brine tank and vessels containing an ion exchange resin. For iron and manganese removal, a resin with positively charged sodium ions attached to its surface is used. When water containing iron and manganese comes into contact with the resin, the positively charged iron and manganese ions preferentially "exchange" places with the sodium ions on the surface of the resin. Following this exchange, the iron and manganese are bound to the resin, and the sodium is present in aqueous form in the water. In some cases, potassium is used instead of sodium where there may be concerns regarding dietary sodium intake from drinking water.

Periodically, the resin must undergo a backwash regeneration cycle to remove the iron and manganese built up on the resin. In this process, a brine solution consisting of sodium chloride (also known as table salt) or potassium chloride is pumped into the ion exchange vessel and sodium or potassium ions replace the iron and manganese ions on the resin. The brine solution used in the backwash regeneration, which now contains the iron and manganese removed from the resin, is typically diverted to a swale, roadside ditch, or a municipal sewer.

For large systems, the quantity of salt needed to make the brine solution can make operating ion exchange treatment systems cost prohibitive. Furthermore, larger ion exchange treatment systems may require a Washington State Department of Ecology (DOE) waste discharge permit.

Ion exchange treatment can reduce the pH and alkalinity of water, potentially making it more corrosive. In some instances, corrosion control treatment may be required in conjunction with ion exchange treatment.

Ion exchange is only suitable for low concentrations of iron and manganese; high concentrations can foul the resin and cause decreased treatment performance over time. Ion exchange should not be used when the combined iron and manganese concentration exceeds 0.3 mg/L (GLUMRB 2018).

A summary of the pros and cons associated with ion exchange treatment for iron and manganese removal is provided in **Table 14**.

Table 14. Ion Exchange Pros and Cons

Pros	Cons
1. Reduces water hardness. 2. Reduces iron and manganese concentrations.	1. High operational cost due to salt requirements. 2. Disposal of backwash regeneration waste brine solution. 3. May require DOE waste discharge permit. 4. Combined iron and manganese concentration exceeds maximum recommended level of 0.3 mg/L.

7.1.3 Alternative #3: Manganese Dioxide-Adsorption

Manganese dioxide-adsorption is one of the most common treatment methods for iron and manganese removal. In this method, an oxidant is continuously applied to a manganese dioxide-based filter media to maintain the media's oxidative state. As water containing iron and manganese in solution passes through the filter vessels, the iron and manganese are adsorbed onto the surface of the oxidized filter media, oxidized in place by the media, precipitated, and removed from the water.

Commonly used filter media for manganese dioxide-adsorption treatment systems include manganese greensand, manganese dioxide ore (also known as pyrolusite), and manganese dioxide coated substrate media. Chlorine is the most commonly used oxidant, but permanganate is also used.

Manganese dioxide-adsorption is typically more effective than other treatment alternatives at removing iron and manganese when concentrations are high. These treatment systems also have a history of successfully removing iron, manganese, and other contaminants from ground water sources on Whidbey Island. Furthermore, the System's operator, NW Natural Water, has extensive experience operating manganese dioxide-adsorption treatment systems in other water systems.

Periodically, the filter media must undergo a backwash cycle to remove the iron and manganese precipitate and other contaminants that have adsorbed onto the surface of the filter media. Well water

or pressurized distribution water is pumped through the filters in reverse direction to accomplish this. The backwash waste is typically diverted to an infiltration swale/pond.

A summary of the pros and cons associated with manganese dioxide-adsorption treatment for iron and manganese removal is provided in **Table 15**.

Table 15. Manganese Dioxide-Adsorption Pros and Cons

Pros	Cons
1. Effective at removing iron and manganese at high concentrations in source water. 2. History of success on Whidbey Island. 3. System operator has experience with these types of treatment systems.	1. Disposal of backwash waste. 2. Oxidant chemical costs contribute to operational costs.

7.1.4 Selected Alternative

The selected alternative is Alternative #3: manganese dioxide-adsorption. This alternative is preferred primarily because iron and manganese concentrations are too high for sequestration and ion exchange, manganese dioxide-adsorption's history of success on Whidbey Island, and the operator's familiarity with manganese dioxide-adsorption treatment systems.

7.2 Oxidant Selection

Two oxidant alternatives were considered for the proposed manganese dioxide-adsorption treatment system: chlorine (in the form of sodium hypochlorite) and permanganate (in the form of potassium permanganate). These alternatives are discussed in the following two sections.

7.2.1 Alternative #1: Sodium Hypochlorite

Sodium hypochlorite is the most commonly used oxidant for manganese dioxide-adsorption treatment processes for small water systems on Whidbey Island, and the System's operator has extensive experience with this oxidant. A chemical metering system injects a diluted sodium hypochlorite solution into the process piping upstream of the filters. This continuous oxidant application continuously regenerates the filter media and maintains its oxidative state.

Using sodium hypochlorite as the oxidant has the added benefit of providing a free chlorine or chloramine disinfectant residual, which can help control bacterial growth in the system. However, it may also result in taste and odor issues associated with chloramine formation in the presence of ammonia and disinfection byproduct formation in the presence of dissolved organic carbon (DOC). The System has moderately high raw water ammonia concentrations, so chloramine taste and odor issues could be a concern if the proper chlorine dose is not maintained; this is discussed further in **Section**

7.3.1. Furthermore, the System's DOC levels are above the threshold at which disinfection byproducts are a concern; this is discussed further in **Section 7.3.2**.

Maintaining an adequate chlorine residual on the filter outlet is essential for optimal treatment performance and ensuring continuous regeneration of the filter media's oxidative state. A post-filter free chlorine residual of 1.0 mg/L is recommended.

A summary of the pros and cons associated with sodium hypochlorite oxidation is provided in **Table 16**.

Table 16. Sodium Hypochlorite Oxidation Pros and Cons

Pros	Cons
1. Provides a disinfectant residual. 2. System operator has extensive experience with this oxidant.	1. Moderately high ammonia levels could lead to taste and odor issues associated with chloramine formation if chlorine dosage is not correct. 2. High DOC levels could lead to disinfection byproduct formation.

7.2.2 Alternative #2: Potassium Permanganate

Potassium permanganate is also regularly used as the oxidant for manganese dioxide-adsorption treatment processes and the System's operator has experience with it. Potassium permanganate powder is dissolved in water to form a solution which is injected into the process piping upstream of the filters via a chemical metering system. Potassium permanganate, when properly dosed, is effective at maintaining the oxidative state of the filter media.

Potassium permanganate is a strong oxidant; however, it is not used to provide a disinfectant residual. For this reason, potassium permanganate generally has lower potential for disinfection byproduct formation. If a disinfectant residual is required, a sodium hypochlorite solution is typically injected downstream of manganese dioxide-adsorption treatment.

Potassium permanganate dosing must be carefully monitored. If the dose is too high, the treated water will turn a pink or purple color. When this happens, manganese concentrations in the treated water may exceed the raw water concentration because additional manganese is being added to the water in the form of permanganate. If the dose is too low, the oxidative state of the media will not be maintained, and treatment performance may decrease. Getting the correct potassium permanganate dose can be challenging and typically requires more regular monitoring by the operator.

A summary of the pros and cons associated with potassium permanganate oxidation is provided in **Table 17**.

Table 17. Potassium Permanganate Oxidation Pros and Cons

Pros	Cons
1. Lower potential for disinfection byproduct formation.	1. No disinfectant residual. 2. Can turn water pink or purple if dose is too high. 3. Can increase manganese concentration if dose is too high. 4. Requires more regular operator monitoring.

7.2.3 Selected Oxidant

Sodium hypochlorite is the selected oxidant; primarily because it is easier to maintain optimal dosing levels and it provides a disinfectant residual in the system.

There is however some concern regarding the potential for taste and odor issues associated with chloramine formation given the ammonia levels in the raw water. However, with proper dosing to reach break point chlorination, this should not occur.

There is also concern regarding the potential for formation of disinfection byproducts given the DOC levels in the raw water. However, the EPA's disinfection byproduct rule does not apply to TNC water systems such as the System.

Space will be provided in the treatment building for future potassium permanganate oxidation if chloramine taste and odor issues become a problem. In that scenario, sodium hypochlorite could be moved downstream of the filters to maintain a disinfectant residual or chlorination could be removed from the System entirely. In the former case, there would still be potential for chloramine taste and odor issues.

7.3 Secondary Water Quality Effects

This section discusses possible secondary water quality effects of the selected treatment method and selected oxidant.

7.3.1 Ammonia

Ammonia is not a regulated drinking water contaminant; nevertheless, it can be responsible for taste and odor problems for systems employing chlorination, including in the form of sodium hypochlorite. When chlorine reacts with ammonia, ammonia is converted to chloramines. There are three types of chloramines: monochloramine, dichloramine, and trichloramine. Dichloramine and trichloramine carry a "swimming pool chlorine" taste and odor that many water system customers find objectionable, while monochloramine typically does not carry such taste and odor.

When chlorine reacts with ammonia, monochloramine is the first chloramine to form. As more chlorine is added, monochloramine is converted to dichloramine, which is in turn converted to trichloramine.

Finally, when more chlorine is added still, trichloramine is broken down into nitrogen gas, which escapes from the water and leaves the system. The point at which sufficient chlorine has been added to convert most trichloramine to nitrogen gas is called the chlorination breakpoint. Once the chlorination breakpoint is achieved, additional chlorine added to the system will form a free chlorine disinfectant residual.

Chloramines are collectively referred to as combined chlorine, because they consist of compounds of chlorine combined with ammonia. Total chlorine is the sum of free and combined chlorine. Breakpoint chlorination is typically defined as the point at which the free chlorine residual is 85% or higher of the total chlorine residual.

Chloramines are disinfectants, albeit weaker disinfectants than free chlorine, and some water systems will intentionally form monochloramine to provide a disinfectant residual in the system. This, however, is not recommended with manganese dioxide-adsorption treatment systems unless another oxidant is provided upstream of the filters because a continuous oxidant application is required to maintain the oxidative state of the filter media.

To ensure a free chlorine disinfectant residual is established, and to prevent the accumulation of taste and odor causing dichloramine and trichloramine, sufficient chlorine must be added to fully convert ammonia to chloramines and on to nitrogen gas. This process typically requires about ten parts chlorine to one part ammonia. As a result, the presence of ammonia can dramatically increase chlorine demand.

The System's raw water ammonia concentration was measured at 0.60 mg/L. Therefore, ammonia is expected to contribute approximately 6.0 mg/L of chlorine demand. This ammonia concentration and associated chlorine demand is considered moderately high. Achieving breakpoint chlorination with this ammonia concentration is feasible; however, it will require that the operator closely monitoring chlorine dosing, the free chlorine residual, and the total chlorine residual, particularly in the first few months of treatment operation.

7.3.2 Disinfection Byproduct Formation Potential Assessment

Disinfection byproducts form when disinfectants added to drinking water react with naturally occurring organic matter found in the water. Common disinfection byproducts associated with chlorine disinfection include total trihalomethanes (TTHMs) and five haloacetic acids (HAA5s). Both TTHMs and HAA5s are classified as primary drinking water contaminants, meaning they are regulated for their potential adverse effects on human health. The EPA has set primary maximum contaminant levels (MCLs) for both TTHMs and HAA5s.

Dissolved organic carbon (DOC) water quality testing is often used to quantify the amount of naturally occurring organic matter in water that could react with chlorine to form TTHMs and HAA5s. Waters with DOC less than 1.0 mg/L are unlikely to exceed the TTHM MCL, and waters with DOC less than 2.0 mg/L are unlikely to exceed the HAA5 MCL (DOH 2020). The System's raw water DOC concentration is 1.32 mg/L, suggesting that TTHM formation could be a concern.

The EPA's disinfection byproduct rule does not apply to TNC systems. As discussed in **Section 7.2.3**, potassium permanganate has a lower potential for disinfection byproduct formation and using it as the pre-filter oxidant may reduce disinfection byproduct levels in the system if desired in the future.

7.3.3 Corrosion Potential Assessment

Adding chlorination to a system can change the oxidation-reduction potential of the water and increase its corrosivity (DOH 2020). This can affect a system's ability to maintain compliance with the EPA's Lead and Copper Rule (LCR), depending on what materials were used in construction of the water system and premise plumbing (i.e., lead service lines, lead-based solder, copper plumbing, bronze and brass fittings, etc.). The LCR does not apply to TNC systems.

8. Full-Scale Treatment System Design

8.1 Full-Scale Treatment Pilot Test

The proposed treatment is not required by DOH and is being installed to address secondary contaminants. In addition, the same treatment process has been installed in a number of systems in Island County and functions well. Due to these considerations, a full-scale treatment system design has been provided using conservative loading rates. Once the system is installed, treatment removal efficiencies will be monitored and operating parameters will be adjusted to provide optimal performance. The "Full-scale pilot testing" will be performed after installation following the procedures discussed in **Section 10.7**.

8.2 Treatment System Overview

The proposed treatment system consists of a sodium hypochlorite chemical metering system that chlorinates the raw well water upstream of pressurized filter vessels. The filter vessels contain manganese dioxide-based media. The well pump will deliver water through the treatment system prior to filling the storage reservoir. Backwash water will also be supplied by the well pump and backwash waters will be directed to an infiltration area near the treatment building.

The proposed system will contain bypass piping to allow for the following modes of operation:

1. Normal operation (no treatment bypass)
2. Treatment bypass

A summary of major treatment system components is provided in **Table 18**.

Table 18. Major Treatment System Components Summary

Treatment System Components	Component Description
Filter Vessels	(4) 18" diameter x 60" sidewall height
Filter Media	Pyrolox advantage (manganese dioxide coated silica sand)
Filter Media Volume	42" depth (6.2 cf/filter)
Oxidant	Chlorine via sodium hypochlorite
Chlorine Dose (Initial Target)	8.2 mg/L
Free Chlorine Residual (Post Filter Target)	1.0 mg/L
Free Chlorine Residual (Post Filter Minimum)	0.5 mg/L
Backwash Supply Source	Treated Well Water

8.3 Design Criteria

Recommended design criteria are summarized in **Table 19**. These criteria were used to size the proposed treatment system. A conservative design target hydraulic loading rate of 5.0 gpm/sf was selected based on Facet's experience with similar treatment systems and similar water quality on Whidbey Island. Typically, hydraulic loading rates of as high as 9 gpm/sf see effective treatment. The backwash rate, duration, and frequency are based on information provided by the filter media and filter manufacturers and may need to be adjusted by the operator in the field during or after the full-scale treatment pilot test. Treatment design calculations are summarized in the following sections and provided in full in **Appendix G**.

Table 19. Treatment System Design Criteria

Design Criteria	Recommendation
Manufacturer	ATEC
Nominal Treatment Capacity	35 gpm
Hydraulic Loading Rate (all filters in service)	5.0 gpm/sf
Backwash Flow Rate	30 gpm/filter
Unit Backwash Flow Rate	17 gpm/sf
Backwash Duration	5 min/filter
Backwash Frequency	Once per 12 hours of filter run time
Filter Back Pressure During Backwash	40 psi

8.4 Flow Rate Available for Backwash

The proposed well pump will be used to backwash the filters. This pump has a design pumping rate of 120 gpm as described in **Section 4.3**. As discussed in **Section 9.1**, a flow control solenoid valve will limit the treatment influent flowrate to 35 gpm, so only 35 gpm is available for filter backwash.

8.5 Filter Size

If possible, it is preferred to limit filter cross-sectional surface area to ensure a sufficient flow rate for backwash can be provided by the well. Due to the flow control valve described in **Section 8.4**, 35 gpm is available for backwash. A filter diameter of 18 inches was selected because this results in a total backwash flow rate requirement of 30 gpm as shown in the following calculation.

$$Q_{BW} = n_{bw} A_F q_{bw}$$

Where:
Q_{BW} = total backwash flow rate required
n_{bw} = number of filters backwashed at a time
A_F = cross-sectional surface area of filter
q_{bw} = backwash flow rate per unit cross-sectional surface area of filter

$$Q_{BW} = (1\ filter)\left[\pi\left(\frac{9}{12}\ ft\right)^2 /filter\right](17\ gpm/sf) = 30\ gpm$$

8.6 Filter Quantity

The design target hydraulic loading rate is 5.0 gpm/sf with all filters in service. The minimum number of filters that can satisfy this requirement is four as shown in the following calculation.

$$q_f = \frac{Q_C}{nA_F}$$

Where:
q_f = filter loading rate
Q_C = nominal treatment capacity
n = number of filters in operation
A_F = cross-sectional surface area of filter

$$q_f = \frac{35\ gpm}{(4\ filters)\left[(\pi)\left(\frac{9}{12}\ ft\right)^2/filter\right]} \cong 5.0\ gpm/sf$$

With one filter out of service during backwash, the hydraulic loading rate will be 6.6 gpm/sf as shown in the following calculation. This is still well within the range of hydraulic loading rates seen for similar treatment systems and water qualities on Whidbey Island. It is estimated that only 100 gallons of water will be delivered to the reservoir during backwash operation. This is less than 1% of the treated water and will have a negligible impact of finished water quality.

$$q_f = \frac{40\ gpm}{(3\ filters)\left[(\pi)\left(\frac{9}{12}\ ft\right)^2/filter\right]} \cong 6.6\ gpm/sf$$

8.7 Backwash Operations

Water for backwash operations will be provided from the well via the filter inlet manifold. Each filter will be sequentially backwashed with treated water from the three other filters. Typically, 30 psi of back pressure in the filters is recommended to ensure treated water from the three filters is forced up through the filter being backwashed and out the backwash line.

Water flows from high to low head. If the head required to fill the storage reservoir is lower than the head required to flow up through the filter being backwashed, water will preferentially fill the storage reservoir and not backwash the filter. The elevation difference between the storage reservoir and treatment building results in a pressure of approximately 40 psi in the filters. This is more than the 30 psi recommended, so a pressure sustaining valve on the treatment outlet is not required to create more back pressure.

8.8 Backwash Frequency

The filters should be backwashed before filter breakthrough occurs; this is the point at which contaminant concentrations exceed their MCLs or SMCLs. To determine the theoretical volume of treated water before filter breakthrough, a filter media capacity based on a potassium permanganate demand of 10,000 mg/cf was selected. Additionally, the potassium permanganate demand equivalents and raw water quality listed in **Table 20** were used to establish the effective iron and manganese concentrations listed.

Table 20. Potassium Permanganate Demand Equivalents

Contaminant	Equivalence	Measured Concentration (mg/L)	Effective Concentration (mg/L)
Iron	1:1	1.21	1.21
Manganese	2:1	0.201	0.402
Total	N/A	N/A	1.61

The total binding capacity of the filter media was calculated as follows.

$$M_B = nV_F m_b = ndA_F m_b$$

Where:
M_B = total binding capacity of filter media expressed as mass of contaminant
n = number of filters
V_F = volume of filter media per filter
A_F = cross-sectional surface area of filter
d = depth of filter media in filter vessels
m_b = binding capacity of filter media per unit volume expressed as mass of contaminant

$$M_B = (4\ filters)\left(\frac{42}{12}\ ft\right)\left[(\pi)\left(\frac{9}{12}\ ft\right)^2/filter\right](10{,}000\ mg/ft^3) \cong 247{,}000\ mg\ of\ binding\ capacity$$

The theoretical volume of water treated before backwash is required, the theoretical filter run time before backwash is required, and the corresponding number of days between backwash cycles can be calculated from the total binding capacity, well production rate, and average system water usage as follows.

$$V_W = \frac{M_B}{C_E}$$

$$t = \frac{V_W}{Q_W}$$

$$Days = \frac{V_W}{ADD}$$

Where:

V_W = volume of treated water between backwash cycles
M_B = total binding capacity of filter media expressed as mass of contaminants
C_E = total effective concentration of iron and manganese
t = filter run time between backwash cycles
Q_W = well production rate
ADD = average day demand (gpd)

$$V_W = \frac{(247{,}000\ mg)}{(1.61\ mg/L)\left(\frac{3.79\ L}{gal}\right)} \cong 40{,}500\ gal$$

$$t = \frac{40{,}500\ gal}{(35\ gal/min)(60\ min/hour)} \cong 19\ hours$$

$$Days = \frac{40{,}500\ gal}{5{,}000\ gpd} \cong 8\ days$$

The above calculations suggest that the filters can run for approximately 19 hours before filter breakthrough occurs. This equates to approximately 8 days between backwash cycles for periods with average water usage. It is anticipated that a filter run time of 12 hours is very conservative estimate. The 12 hour of run time was assumed for design purposes.

During the full-scale treatment pilot test, filter run time will be extended to the filter breakthrough point or 63,000 gallons at a minimum. Based on the results of the validation test, the treatment system will be configured to backwash before breakthrough occurs.

The system operator should confirm that backwash occurs at minimum on a weekly basis to prevent channelization of the filter media, which can decrease treatment performance. If backwash has not occurred due to low water usage, the operator should manually initiate backwash.

8.9 Backwash Volume

Each filter will be backwashed at rate of 17 gpm/sf, equating to 30 gpm for the 18-inch diameter filters, for five minutes. This equates to a total backwash volume of 600 gallons for the four filters as shown below.

$$17\ \frac{gpm}{ft^2} \times (\pi)\left(\frac{9}{12}\ ft\right)^2 \cong 30\ gpm$$

$$30\ \frac{gal}{min} \times 5\ \frac{min}{filter} \times 4\ filters \cong 600\ gallons$$

Assuming backwash every 12 hours of production, the percentage of produced water used for backwashing is calculated as follows.

$$\frac{600\ gal}{25{,}200\ gal + 600\ gal} \cong 2.3\%\ of\ water\ used\ for\ backwash$$

This percentage may change based on the backwash frequency selected after the full-scale treatment pilot test.

8.10 Backwash Disposal

Backwash waste will be routed from the filters to an air gap and on to an infiltration area via gravity flow. The backwash infiltration area consists of a natural depression near the treatment building where backwash waste will be infiltrated into native soil. An outfall dispersal pad consisting of drainage rock will be provided at the daylight point of the drainpipe to minimize erosion of native soil.

8.11 Oxidative Demand

Chlorine, in the form of a liquid sodium hypochlorite solution, is the selected oxidant. Raw water quality data was used to estimate the oxidative demand of the water. The results of that estimate summarized in **Table 21**. Full oxidative demand calculations based on raw water quality data are included in **Appendix G**.

Approximately 80% of the chlorine demand is due to ammonia. The treatment system will target breakpoint chlorination.

Table 21. Estimated Oxidative Demand

Source of Oxidative Demand Estimate	Chlorine Demand (mg/L)
Raw Water Quality Data	7.2

8.12 Chemical Metering System

Characteristics of the proposed chemical metering system are summarized in **Table 22**. The design dosing rate was calculated based on the undiluted chlorine solution strength, dilution ratio, estimated oxidative demand of the raw water, and post-filter chlorine residual target. Calculations are provided in **Appendix G**. Metering pump product information is provided **Appendix E**.

Table 22. Proposed Chemical Metering System

Chemical Metering Pump Model	LMI PD061-A40HI
Chemical Metering Pump Capacity	1.75 gph
Chemical Storage Tank	50 gal, polyethylene
Solution Type	Sodium Hypochlorite
Undiluted Solution Strength	12.5%
Undiluted Solution Volume	1 gal
Dilution Water Volume	4 gal
Total Diluted Solution Volume	5 gal
Diluted Solution Concentration	25,000 ppm
Design Dose Rate (Initial Target)	8.2 ppm
Free Chlorine Residual (Target)	1.0 ppm
Free Chlorine Residual (Minimum)	0.5 ppm
Design Flow Rate	0.69 gph
Design Flow Rate Percent of Pump Capacity (Manual Speed Setting)	39%

As indicated in **Table 22**, the design dose rate listed is an initial target. It is based on the estimated oxidative demand of the source water. The actual oxidative demand in the field may vary from this estimate, possibly resulting in a required dosing rate different from the initial target listed in order to achieve the target chlorine residual. To account for this, the design flow rate was selected to be in the midrange of the chemical metering pump's capacity. This will give the operator room to adjust the dosing rate as needed in the field. Dilution factors may also be adjusted to support different chlorine demands.

The operator should maintain the target post-filter free chlorine residual of 1.0 mg/L in order to continuously regenerate the media and maintain its oxidative state. Post-filter free chlorine residuals should not drop below the minimum of 0.5 mg/L. The post-filter free chlorine residual should also be at least 85% of the post-filter total chlorine residual to ensure that breakpoint chlorination is obtained.

8.13 Future Chemical Metering Systems

Space in the treatment building is provided for a future potassium permanganate metering system. However, switching to potassium permanganate is not anticipated because the disinfection byproduct rule does not apply to TNC systems.

8.14 Pre-Filter Contact Time

No dedicated contact tank is provided for oxidation before the filters because contact time is not needed for the iron and manganese adsorption process.

8.15 Process Control and Monitoring

Process control and regular monitoring are essential for reliable treatment performance. The following methods of controlling and monitoring the treatment process are recommended for the proposed treatment system.

8.15.1 Chemical Dosing

The chemical metering pump dose rate is controlled via a manual speed setting. This speed setting may need to be adjusted by the operator to provide sufficient chlorine dosing to maintain the oxidative state of the filter media. The estimated manual speed setting required is listed in **Table 22**.

The metering pump will be powered by a dedicated electrical outlet that is only energized when the storage reservoir calls for the well pump to turn on. A flow switch will be installed in the treatment building on the raw water line from the well to cut power to this outlet when there is no flow in the pipe. This will minimize the chance of a chlorine overfeed event if the reservoir calls for water, but no water is flowing due to a closed valve, the well pump fails to start, or some other mechanical or electrical issue.

8.15.2 Water Quality Monitoring

The following water quality sampling locations will be provided to monitor treatment performance.

1. Raw water
2. Post chlorine injection point
3. Treated water
4. Distribution system entry point

The first three sampling locations will be in the treatment building and will be utilized to monitor treatment system performance. The distribution system entry point sampling location will be on the storage reservoir outlet adjacent to the tank and will be the point of compliance for DOH water quality monitoring.

The post-chlorine injection point sample tap will be used to monitor chlorine dosing. Regular monitoring of this sample tap will inform the operator if the expected amount of chlorine is being dosed. Additionally, comparison of the chlorine residual at this sample tap location with the treated water sample tap location will provide data on the oxidative demand of the water.

The treated water sample tap will be installed in the treatment building downstream of the filters. Regular monitoring of iron and manganese concentrations at this location will inform the operator if water quality targets are being met. Regular monitoring of the free and total chlorine residuals at this

location will inform the operator if breakpoint chlorination is being achieved as desired. The free chlorine residual should be at least 85% of the total chlorine residual for breakpoint chlorination.

In addition to the water quality monitoring requirements of the DOH, the System's operator should conduct the following water quality monitoring on a weekly basis at minimum. The well and treatment system should be running during sample collection and be allowed to run continuously for a minimum of fifteen minutes before sample collection. The free and total chlorine residual monitoring listed below should be performed with a DPD chlorine test kit.

1. Raw Water: iron and manganese
2. Post chlorine injection point: free and total chlorine
3. Treated water: iron, manganese, free chlorine, and total chlorine

If the target water quality targets or chlorine residuals are not being met, the operator may need to consider adjusting one of or a combination of the following:

1. Chlorine dosing
2. Backwash frequency
3. Backwash flow rate

8.15.3 Backwash Monitoring

The backwash flow rate is controlled by throttling a gate valve on the backwash line and will be set by an ATEC employee during treatment system startup. The target backwash rate is the highest flow rate that will not force filter media out of the filters during backwash. This is approximately 17 gpm/sf for the selected filter media, equating to 30 gpm for the 18-inch diameter filters. The actual backwash rate will be determined in the field by the ATEC employee.

The backwash air gap and the sight glass on the backwash line can be visually inspected for the presence of filter media to determine if the backwash rate is too high. A water meter on the backwash line will be used to monitor the backwash rate. If the backwash rate changes, or if filter media is being expelled from the filters during backwash, the operator may need to adjust the backwash gate valve.

Backwash operations are automatically initiated by the filter control panel after an adjustable, preset filter runtime. This filter runtime will be determined during the full-scale treatment pilot test. If regular water quality monitoring indicates filter breakthrough is occurring before backwash is initiated, the backwash flow rate and frequency may need to be revaluated by the System's engineer.

9. System Controls

9.1 Control Valves

Well pump on/off for potable water reservoir filling operations will be controlled by a pressure transducer on the reservoir fill line. When the potable reservoir level transmitter calls for water, a normally closed flow control solenoid valve on the potable reservoir fill line will open. This will allow

water to flow through the treatment system and up to the potable water reservoir. The flow control valve will limit the flow of water though the treatment system to 35 gpm to match the treatment system capacity. The VFD will maintain pressure upstream of the flow control valve to 50 psi, so when the valve opens, pressure in the reservoir fill line will drop and the VFD will turn on the well pump. Once the reservoir is full, the solenoid valve will shut, pressure in the reservoir fill line will rise, and the VFD will turn off the well pump.

When the irrigation reservoir level transmitter calls for water, a normally closed pressure sustaining solenoid valve on the irrigation reservoir fill line will open, causing pressure in that line to drop and the VFD to energize the well pump. The pressure sustaining valve will only open enough to maintain upstream pressure at 50 psi. This will ensure that the potable water reservoir will have priority on filling and only excess water will be delivered to the irrigation reservoir if both reservoirs are calling for water at the same time. If the potable water reservoir is full, the pressure sustaining valve will open more allowing the full capacity of the well pump to be delivered to the irrigation reservoir. Once the reservoir is full the pressure sustaining solenoid valve will shut and the VFD will turn off the well pump.

10. System Startup and Testing

10.1 Storage Reservoir Disinfection

The proposed reservoir will be disinfected before being brought into service in accordance with *AWWA C652 – Disinfection of Water Storage Facilities*. The contractor performing the work will be required to submit a detailed disinfection procedure description, including type of disinfectant to be used and calculations indicating the quantities of disinfectants required to produce the chlorine concentrations required in *AWWA C652*. The contractor shall furnish satisfactory bacteriological laboratory test results and chlorine residual test results showing the required chlorine concentration was achieved.

10.2 Storage Reservoir Leak Testing

Leak testing of the proposed reservoir shall follow the procedures outlined in this section.

Testing of the reservoir consists of filling the reservoir to check for water tightness no sooner than 28 days after all concrete pouring is completed and no later than 60 days after completed. The testing of the water can be done from this initial filling and if there are no obvious problems with the reservoir, it can be put online without emptying and refilling.

To test the reservoir, fill to full, close all valves and let sit for 24 hours. Note the height of the water. Check the water height after three consecutive 24-hour periods. Allowing for evaporation, the water level should not drop more than one tenth of one percent in any 24-hour period.

10.3 Watermain Disinfection

Watermains installed as a part of this project will be disinfected before being brought into service in accordance with the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction M 41-10, Section 7-09.3(24). The contractor performing the work will be required to submit a satisfactory bacteriological test result.

10.4 Watermain Pressure Testing

Watermains installed as a part of this project will be pressure testing before being brought into service in accordance with the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction M 41-10, Section 7-09.3(23).

10.5 Treatment Plant Disinfection

The proposed treatment system must be disinfected before being brought into service in accordance with *AWWA C653 – Disinfection of Water Treatment Plants*, including disinfection of plant piping downstream of the chlorine injection point. According to *AWWA C653*, the storage reservoir must also be disinfected before being brought back into service in accordance with *AWWA C652 – Disinfection of Water Storage Facilities*. Disinfection of the treatment plan, watermains, and storage reservoir should coincide.

The contractor performing the work will be required to submit a detailed disinfection procedure description, including type of disinfectant to be used and calculations indicating the quantities of disinfectants required to produce the chlorine concentrations required in AWWA C653. The contractor shall furnish satisfactory bacteriological laboratory test results and chlorine residual test results showing the required chlorine concentration was achieved.

10.6 Treatment Plant Startup

An ATEC representative, the contractor, system operator, and engineer should all be present for the treatment system startup. The following items should be evaluated during startup:

1. All ATEC system components are functioning properly and as intended
2. Backwash rate is properly set
3. Chemical metering system equipment is functioning properly and as intended
4. All system piping is functioning without leakage
5. The treatment system as a whole is functioning properly and as intended

10.7 Full-Scale Treatment Pilot Testing Procedures

After startup, a full-scale treatment pilot test will be performed. This test should be performed by the system operator under the supervision of the engineer. A pilot test worksheet and instructions are provided in **Appendix H**.

Typically, during pilot testing for manganese dioxide-adsorption treatment pilot testing, the potential for silica to bind to and foul the filter media is assessed. This is done by testing pre-filter and post-filter water samples for silica. If the pre-filter silica concentration is greater than the post-filter concentration, silica could be binding to the filter media. Over time this may foul the media and result in decreased treatment performance.

In cases where silica fouling of the filter media is a concern, the filter manufacturer recommends dosing a small amount of potassium permanganate upstream of the filters to minimize media fouling. Pre- and post-filter water quality testing will be performed for silica during the full-scale treatment pilot test to determine if pre-filter potassium permanganate addition is required to prevent silica fouling of the media.

The goals of the full-scale pilot test are as follows. Pilot testing may need to be repeated multiple times to achieve these goals.

1. Confirm finished water quality targets for iron and manganese are being met.
2. Confirm target post-filter free chlorine residual target is being met.
3. Confirm breakpoint chlorination is achieved.
4. Determine the chemical metering system equipment settings that will reliably achieve goals 1 through 3.
5. Determine the number of hours of filter run time at which filter breakthrough occurs.
6. Determine a backwash frequency that minimizes the percentage of system water used for backwashing yet occurs frequently enough to prevent filter breakthrough from occurring during normal operations.
7. Determine if a pre-filter potassium permanganate chemical metering system is required to prevent silica fouling of the filter media.

Filter to waste piping is provided in the treatment system design and should be used when establishing the initial chemical feed settings to prevent under or over chlorinated water from entering the System. Filter to waste water will be directed to the backwash infiltration area.

11. Operation and Maintenance Considerations

11.1 Operation and Maintenance Requirements

Operation and maintenance of the proposed treatment system will be the responsibility of the System's operator. A treatment system operation and maintenance manual will be provided by ATEC.

Operation of ATEC manganese dioxide-adsorption treatment systems generally do not place a heavy burden on the operator; however, there will be additional operation and maintenance requirements beyond what is already required for the System. A summary of these requirements is provided in **Table 23**.

Table 23. Treatment System Operation and Maintenance Requirements

Every time operator visits pumphouse
Check chlorine solution tank level, fill as needed.
Verify chlorine pump turns on/off with opening/closing of flow control solenoid valve.
Check pressure loss across filters while filters are running, inspect filter media if pressure loss exceeds 5 psi.
Weekly
Raw water quality field testing: iron and manganese.
Post chlorine injection point water quality field testing: free and total chlorine
Treated water quality field testing: iron, manganese, free chlorine, and total chlorine.
Monthly
Manually initiate backwash cycle, allow backwash cycle to complete. Observe backwash for each filter, confirm that target backwash rate and duration is achieved for each filter.
Inspect all piping and valve connections for tightness and leaks, correct deficiencies.
Inspect all hydraulic tubing for leaks and restrictions, replace if damaged.
Biannually
Check and record media level in all filters, add additional media as required to maintain recommended level. Record when additional media is added.
Annually
Fully open and close backwash throttling valve, reset valve to obtain required backwash flow rate.
Clean sight glass (annually or as needed).
Inspect filter vessels for rust and remove, touch up paint (annually or as needed)
Every Five Years
Rebuild or exchange backwash control valves (every 5 years or as needed).
Every 30 years
Replace filter media (every 30 years or as needed).

11.2 Operator Training and Certification Requirements

A Purification Plant Criteria Worksheet was completed for the proposed treatment system to determine the level of operator certification required. The treatment system was identified as a Class 1 water treatment plant, requiring a Water Treatment Plant Operator Level 1 (WTPO 1) certified operator in responsible charge. The completed Purification Plant Criteria Worksheet is included in **Appendix I**.

References

DOH (Washington State Department of Health). 2020. *Water System Design Manual*. DOH Publication 331-123. Olympia, WA: DOH Office of Drinking Water.

GLUMRB (Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers). 2018. *Recommended Standards for Water Works*. St. Paul, Mn: Minnesota's Bookstore Communications Media Division

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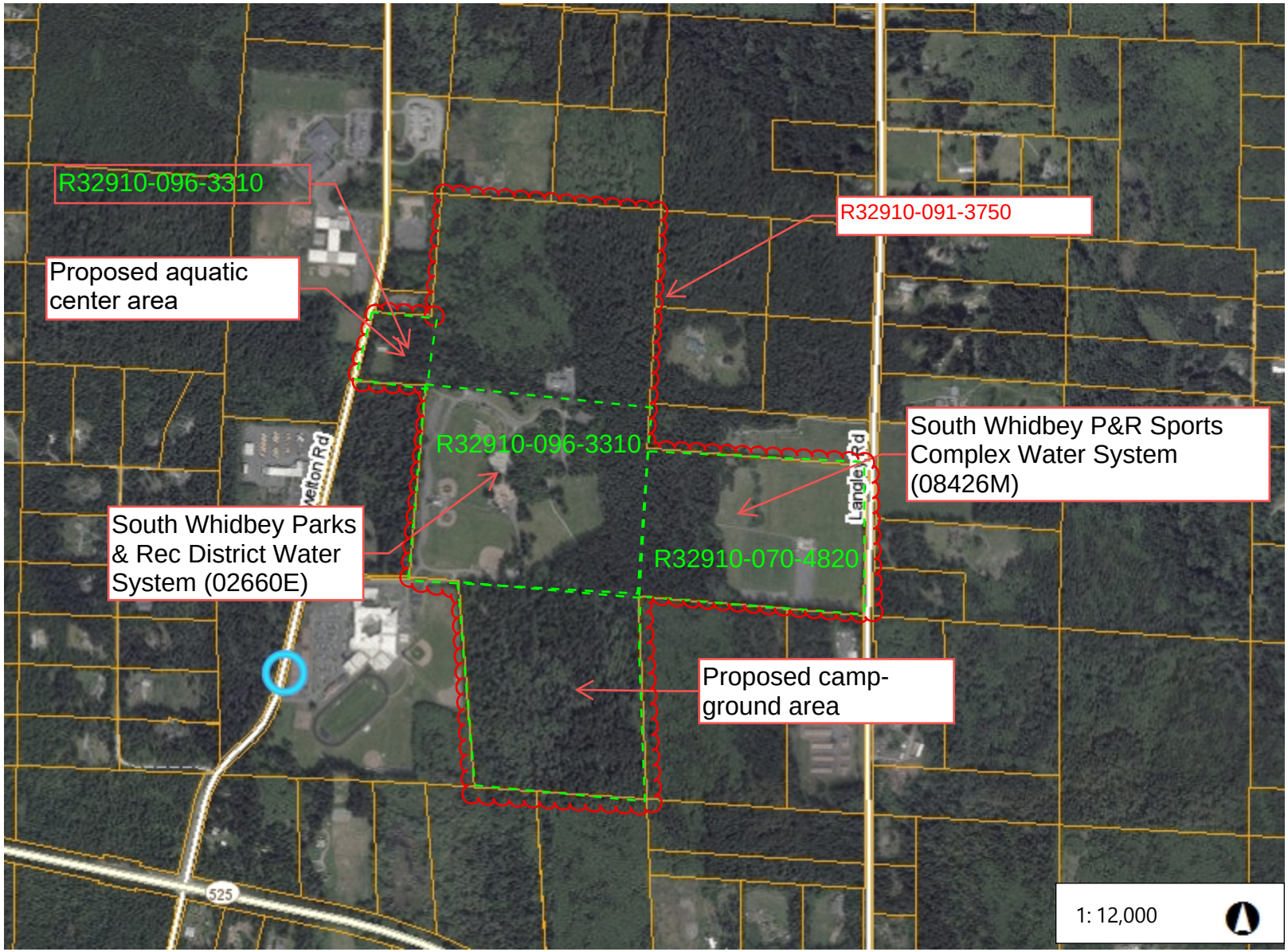
Appendix A. System & Well Information

Water System Parcels



Legend

- Parcels
- Roads
  - Highway
  - Collector and Arterial
  - Local
  - Private

Notes

Former Parcel

Current Parcel

2,000.0 0 1,000.00 2,000.0 Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere

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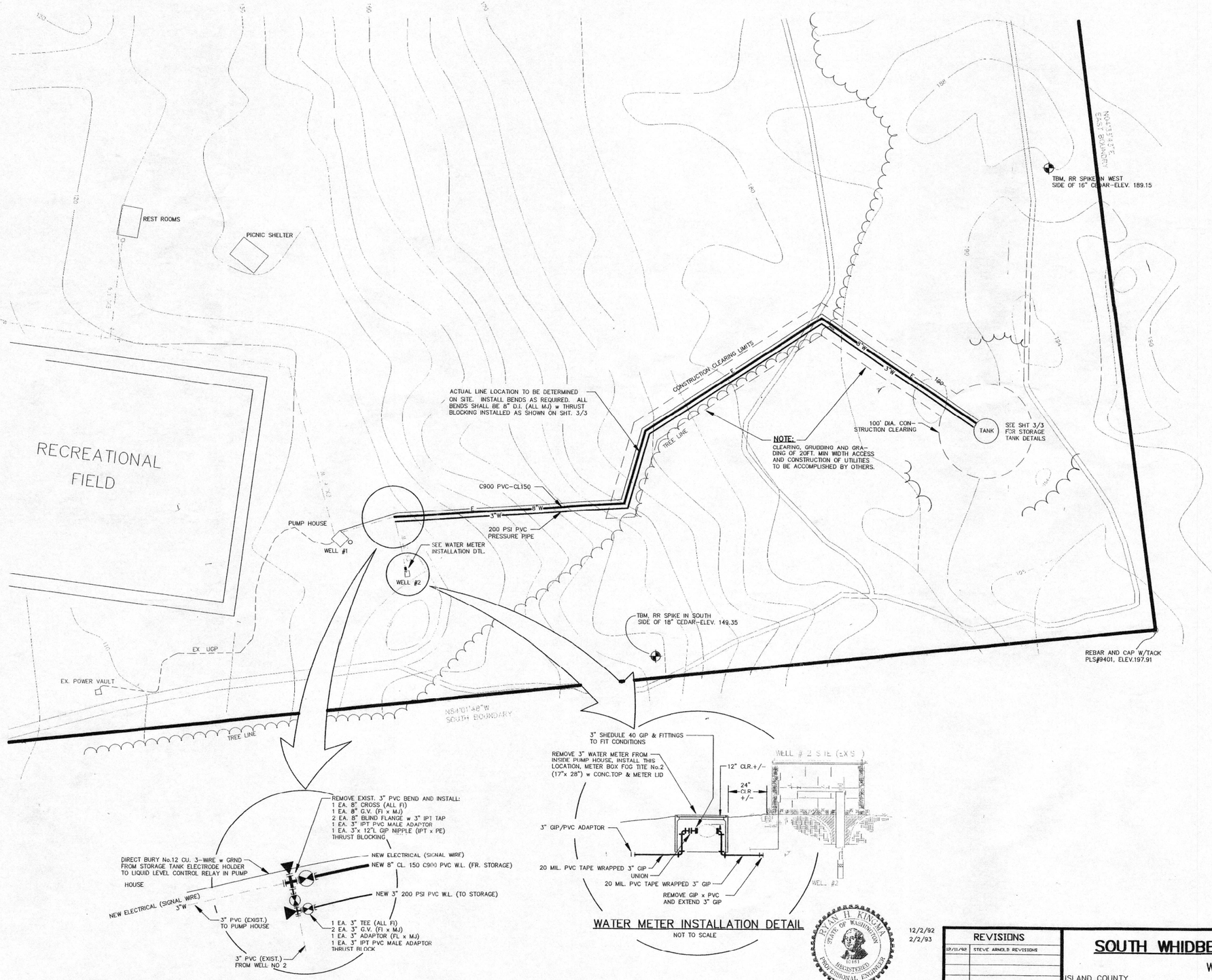
ORIGINAL,
RETAIN



WATER METER INSTALLATION DETAIL
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0 50 100 150
SCALE IN FEET

CONSTRUCTION NOTES:

1. MATERIAL AND INSTALLATION SHALL CONFORM TO THE STANDARDS AND REQUIREMENTS OF THE 1991 STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION OF THE STATE OF WASHINGTON, AND THE LATEST EDITION OF THE UNIFORM PLUMBING CODE.
2. EXISTING UTILITIES ARE SHOWN TO ASSIST THE CONTRACTOR IN THE PERFORMANCE OF HIS JOB. THE CONTRACTOR SHALL BE RESPONSIBLE TO PROTECT, IN PLACE, ALL UTILITIES OR STRUCTURES WHETHER SHOWN OR NOT ON THIS PLAN. DAMAGE DUE TO THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE. THE CONTRACTOR SHALL CALL PUGET SOUND UTILITY COORDINATING COUNCIL FOR UNDERGROUND LOCATES PRECEEDING EXCAVATIONS.
3. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE MEANS METHODS AND SEQUENCE OF CONSTRUCTION. SITE ADJUSTMENTS AND DIVERGENCE FROM THE PLANS ARE SUBJECT TO THE ENGINEER'S APPROVAL.
4. THE WATER LINE SHALL BE PRESSURE TESTED, DISINFECTED AND FLUSHED IN ACCORDANCE WITH SECTION 7-11 OF THE STANDARD SPECIFICATIONS. TEST PRESSURE SHALL BE 200 PSI.
5. PVC PIPE SHALL MEET MATERIALS REQUIRED OF ASTM D-2241 WITH MOLDED RUBBER RING IN EACH BELL JOINT. PIPE LENGTHS SHALL BE 20 FEET. PVC PIPE SHALL BE 200 PSI - SDR 21 OR AS SPECIFIED ON THE PLANS. PVC PIPE SHALL BEAR THE NSF SEAL.
6. UNLESS OTHERWISE SHOWN ON THE PLANS, 3" AND LARGER WATER DISTRIBUTION FITTINGS SHALL BE DUCTILE IRON WITH MECHANICAL JOINT CONNECTIONS.

RYAN D. KINGMA
STATE OF WASHINGTON
9401
REGISTERED PROFESSIONAL ENGINEER
EXP.DEC 03/20/

12/2/92
2/2/93

REVISIONS	
12/11/92	STEVE ARNOLD REVISIONS

E3294H2 3294WAT2.DWG PLOTTING SCALE: 1 = 50

SOUTH WHIDBEY PARKS AND RECREATON DISTRICT

WATER MAIN INSTALLATION PLAN

ISLAND COUNTY, WASHINGTON

DRAWN BY: HJV DATE: 11/20/92
APPROVED BY: DATE:

FAKKEMA & KINGMA, INC.
CONSULTING ENGINEERS & SURVEYORS
4086 400th Ave. West Oak Harbor, Wa. 98277 675-5973

SCALE: NOTED
DATE:
DWG. NO. 3294
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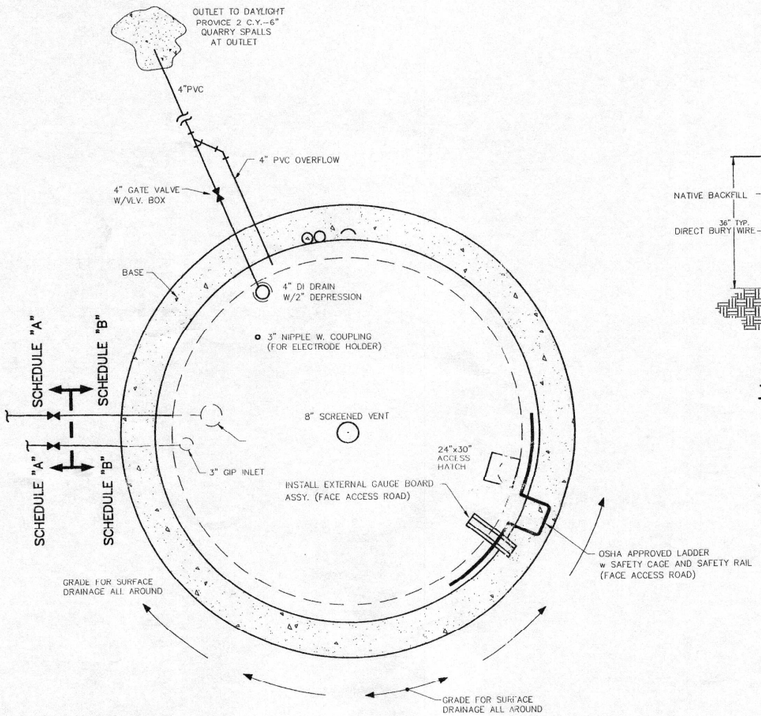

STORAGE TANK PLAN

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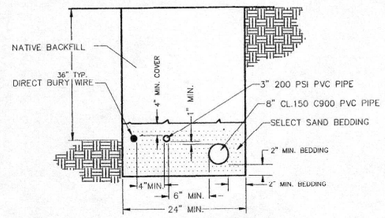

TRENCH DETAIL

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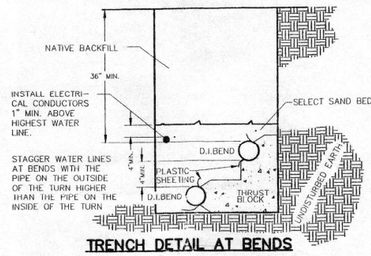

TRENCH DETAIL AT BENDS

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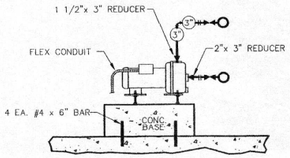
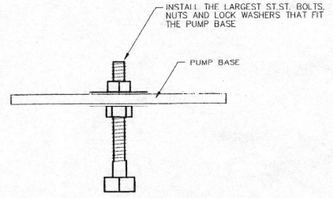


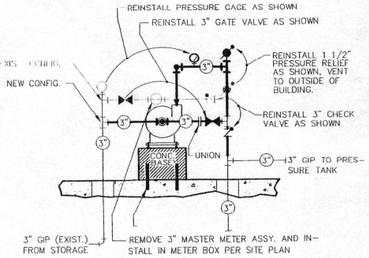
PUMP INSTALLATION SIDE VIEW

PLAN IS SCHEMATIC ONLY
NOT TO SCALE



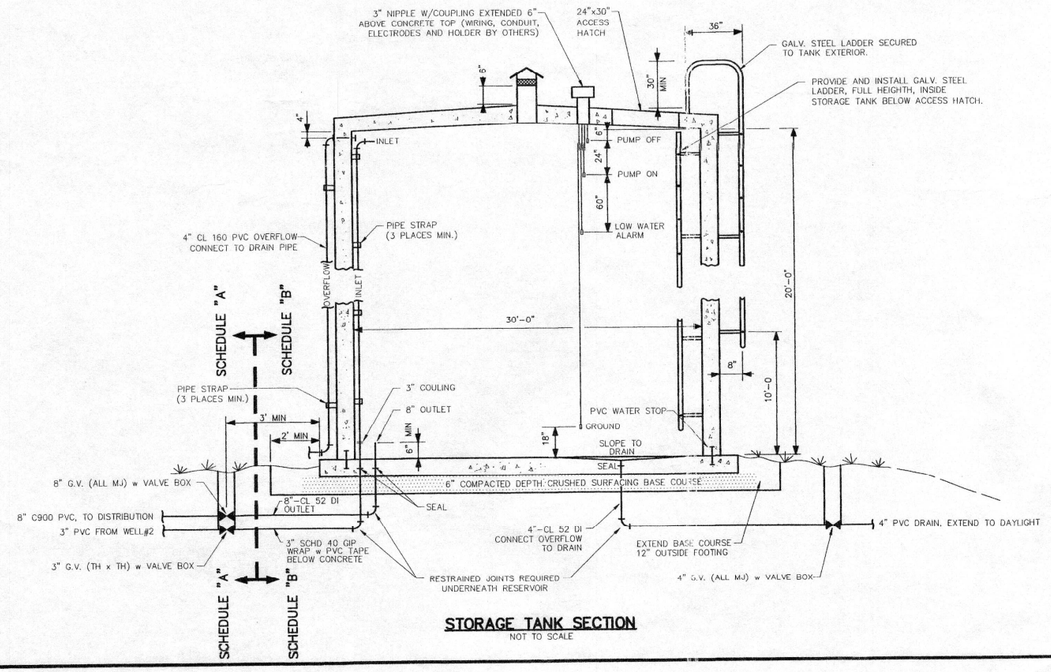
PUMP SUPPORT DTL

NOT TO SCALE



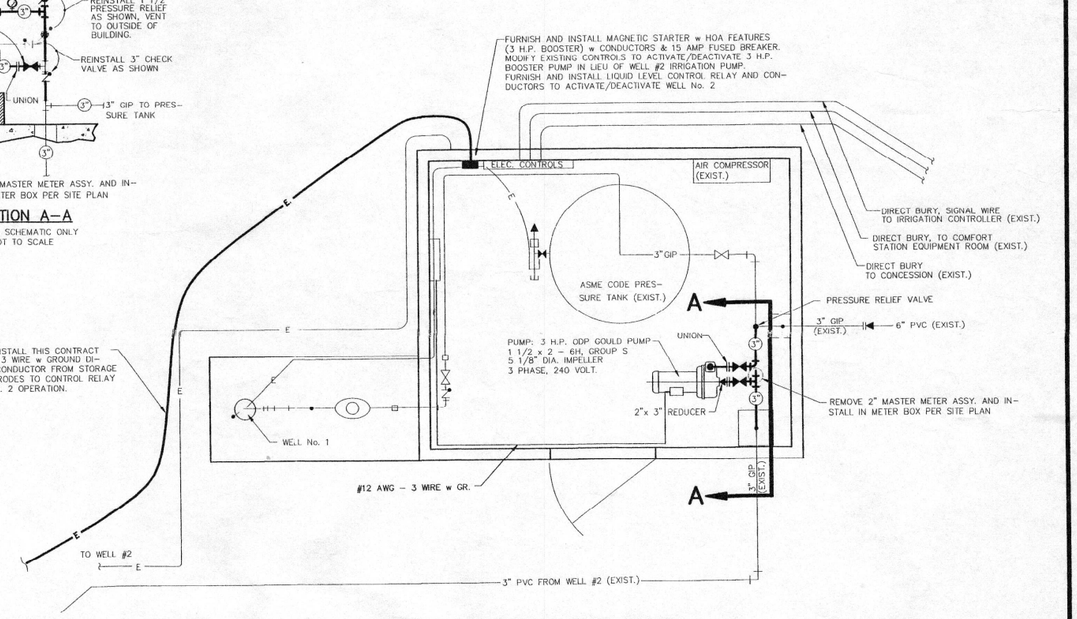
SECTION A-A

PLAN IS SCHEMATIC ONLY
NOT TO SCALE



STORAGE TANK SECTION

NOT TO SCALE



IRRIGATION PUMP INSTALLATION PLAN

SCALE: 1" = 2'

RYAN H. KINGMA — STATE OF WASHINGTON — 12162 — REGISTERED PROFESSIONAL ENGINEER
EXPIRES 03/20/

12/2/92

E:3294H2 3294WAT3.DWG PLOTTING SCALE: 1 = 20

REVISIONS	
12/11/92	STEVE ARNOLD REVIEW REVISIONS

SOUTH WHIDBEY PARKS AND RECREATON DISTRICT

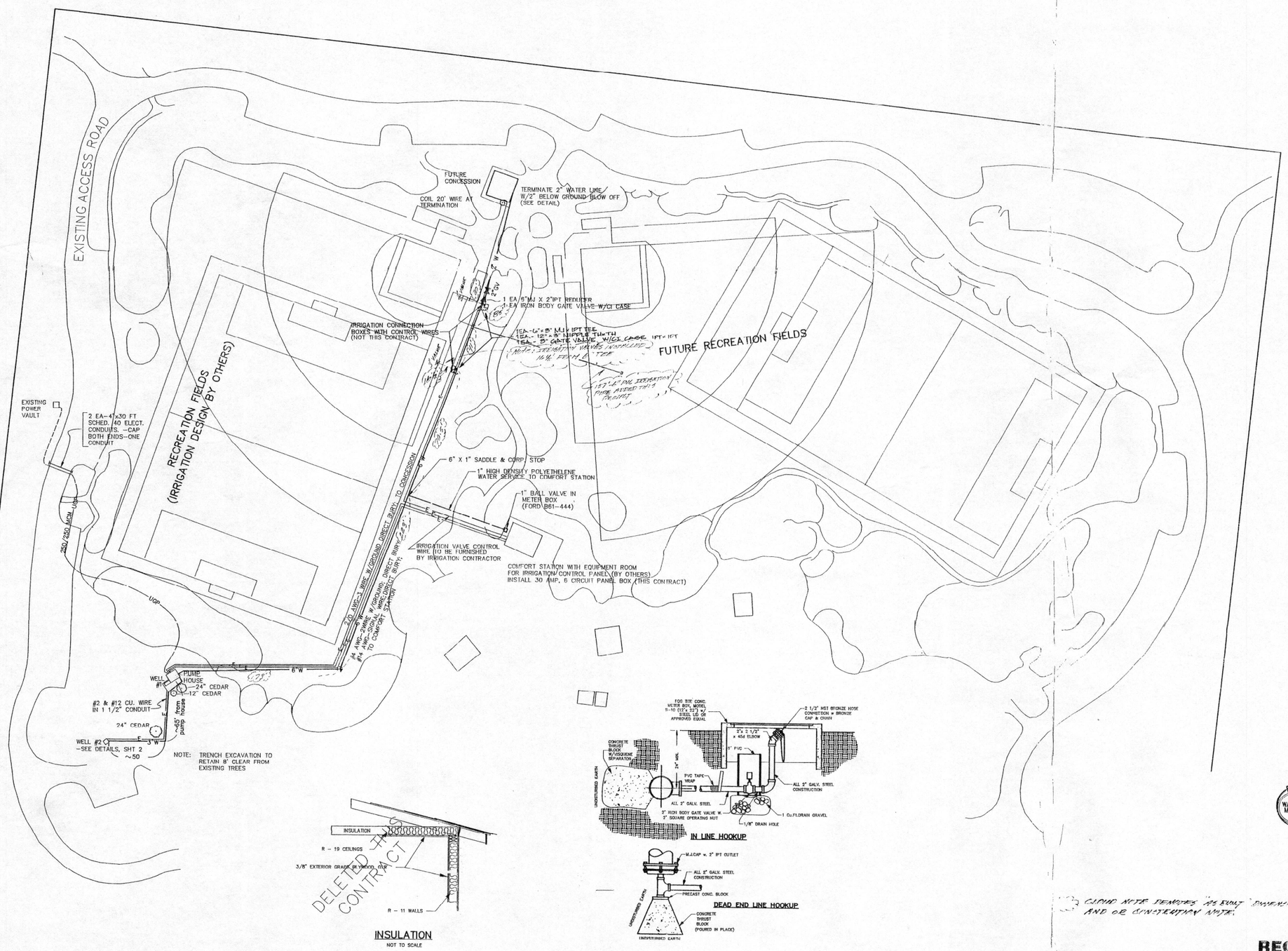
STORAGE TANK AND IRRIGATION PUMP INSTALLATION PLAN

ISLAND COUNTY, WASHINGTON

DRAWN BY: HJV DATE: 11/20/92
APPROVED BY: DATE:

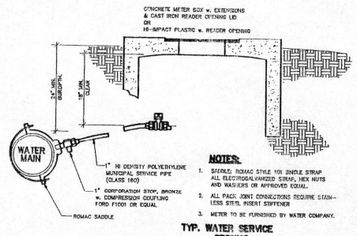
FAKKEMA & KINGMA, INC.
CONSULTING ENGINEERS & SURVEYORS
4086 400th Ave. West Oak Harbor, Wa. 98277 675-5973

SCALE: NOTED DWG. NO. 3294
DATE: SHEET NO. 3/3



INSULATION
NOT TO SCALE

2-INCH BLOWOFF DETAIL
NOT TO SCALE



NOTES:
1. SEAL: ROMAC STYLE 101 SINGLE STRAP ALL ELECTROGALVANIZED STRAP, HEX NUTS AND WASHERS OR APPROVED EQUAL.
2. ALL PACK JOINT CONNECTIONS REQUIRE STAINLESS STEEL INSERT STIFFENER
3. METER TO BE FURNISHED BY WATER COMPANY.

TYP. WATER SERVICE
DET#1/2
NOT TO SCALE

CLIPAP NOTE DENOTES "AS BUILT" DIMENSIONS AND OR CONSTRUCTION NOTE.

RECORD DRAWING

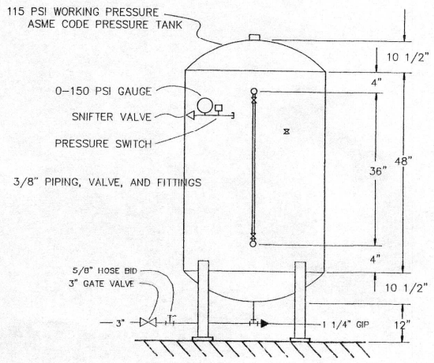
RYAN H. KINGMA STATE OF WASHINGTON REGISTERED PROFESSIONAL ENGINEER

REVISIONS	SOUTH WHIDBEY PARKS & RECREATION DISTRICT
ADDED AT SWS NOTES	IRRIGATION PIPING & ELECTRICAL PLAN
	ISLAND COUNTY, WASHINGTON

DRAWN BY: LJP
APPROVED BY:

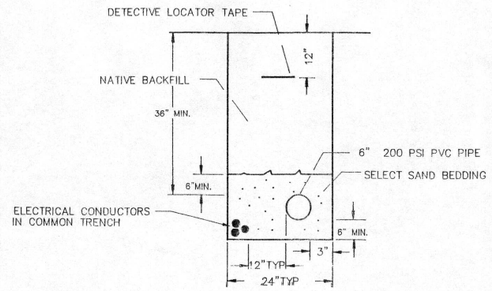
FAKKEMA & KINGMA, INC.
CONSULTING ENGINEERS & SURVEYORS
4086 400 Ave W., Oak Harbor, Wash. 98277 675-5923

SCALE: 1"=50'
DATE: 7/90
DWG. NO. 3294
SHEET NO. 1 OF 2



PRESSURE TANK DETAIL

NO SCALE



TRENCH DETAIL

NO SCALE

CONSTRUCTION NOTES:

1. MATERIAL AND INSTALLATION SHALL CONFORM TO THE STANDARDS AND REQUIREMENTS OF THE 1988 STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION OF THE STATE OF WASHINGTON, AND THE LATEST EDITION OF THE UNIFORM PLUMBING CODE.

2. EXISTING UTILITIES ARE SHOWN TO ASSIST THE CONTRACTOR IN THE PERFORMANCE OF HIS JOB. THE CONTRACTOR SHALL BE RESPONSIBLE TO PROTECT, IN PLACE, ALL UTILITIES OR STRUCTURES WHETHER SHOWN OR NOT ON THIS PLAN. DAMAGE DUE TO THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE. THE CONTRACTOR SHALL CALL PUGET SOUND UTILITY COORDINATING COUNCIL FOR UNDERGROUND LOCATES PRECEEDING EXCAVATIONS.

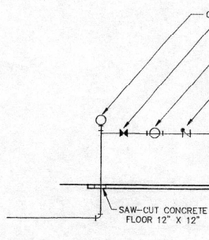
3. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE MEANS METHODS AND SEQUENCE OF CONSTRUCTION. SITE ADJUSTMENTS AND DIVERGENCE FROM THE PLANS ARE SUBJECT TO THE ENGINEER'S APPROVAL.

4. THE WATER LINE SHALL BE PRESSURE TESTED, DISINFECTED AND FLUSHED IN ACCORDANCE WITH SECTION 7-11 OF THE STANDARD SPECIFICATIONS.

5. PVC PIPE:
   PVC PIPE SHALL MEET MATERIALS REQUIRED OF ASTM D-2241, MOLDED RUBBER RING IN EACH BELL JOINT. PIPE LENGTHS SHALL BE 20 FEET. PVC PIPE SHALL BE 200 PSI - SDR 21. ALL PVC PIPE SHALL BEAR THE NSF SEAL. PIPE JOINTS SHALL BE MADE WITH A RUBBER RING AND THICKENED BELL.

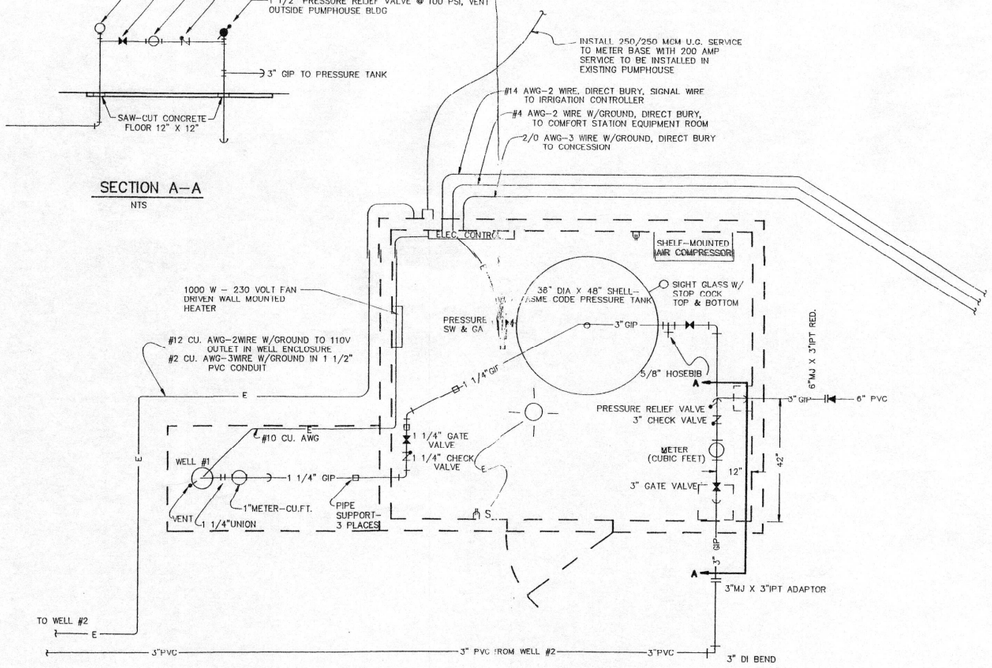
6. FITTINGS:
   3" AND LARGER WATER DISTRIBUTION (UNDERGROUND) FITTINGS SHALL BE DUCTILE IRON WITH MECHANICAL JOINT CONNECTIONS. PIPE FITTINGS ABOVE GROUND SHALL BE GALVINIZED STEEL WITH THREADED CONNECTIONS.

7. SUBMERSIBLE PUMP:
   GOULDS 10 HP,230 VOLT, 3 PHASE, 70L10632 OR AN APPROVED EQUIVALENT. RISER PIPE IS SCHED. 40 GALV. STEEL. DROP CABLE IS #8 CU., GROUNDED TO MEET STATE ELECTRICAL CODE. PUMP INSTALLATION SHALL INCLUDE COUNTY CODE REQUIREMENT FOR 1/2" PVC SOUNDING TUBE EXTENDED FROM WELL CASING TOP TO TOP OF SUBMERSIBLE PUMP (APPROX. 250').



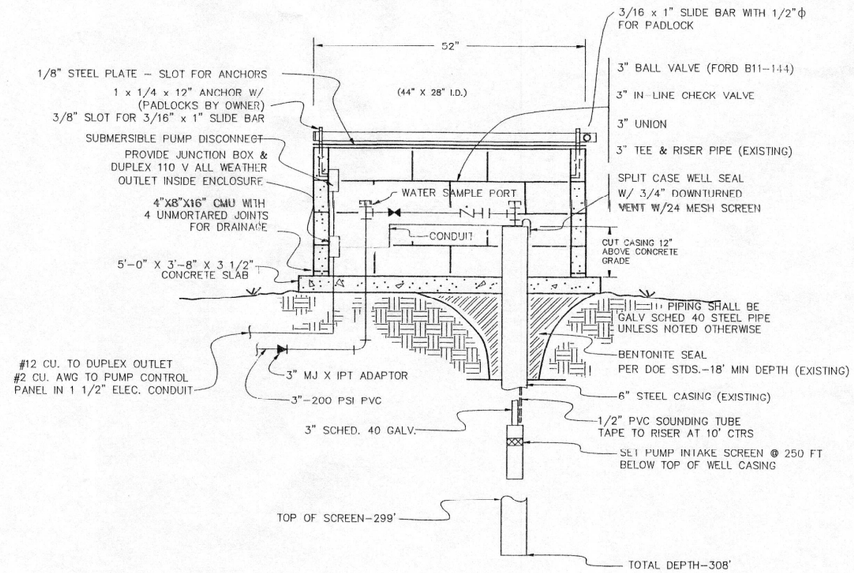
SECTION A-A

NTS



EXISTING PUMP HOUSE DETAIL

1" = 2'-0"



WELL #2 DETAIL

NO SCALE

RECORD DRAWING

REVISIONS

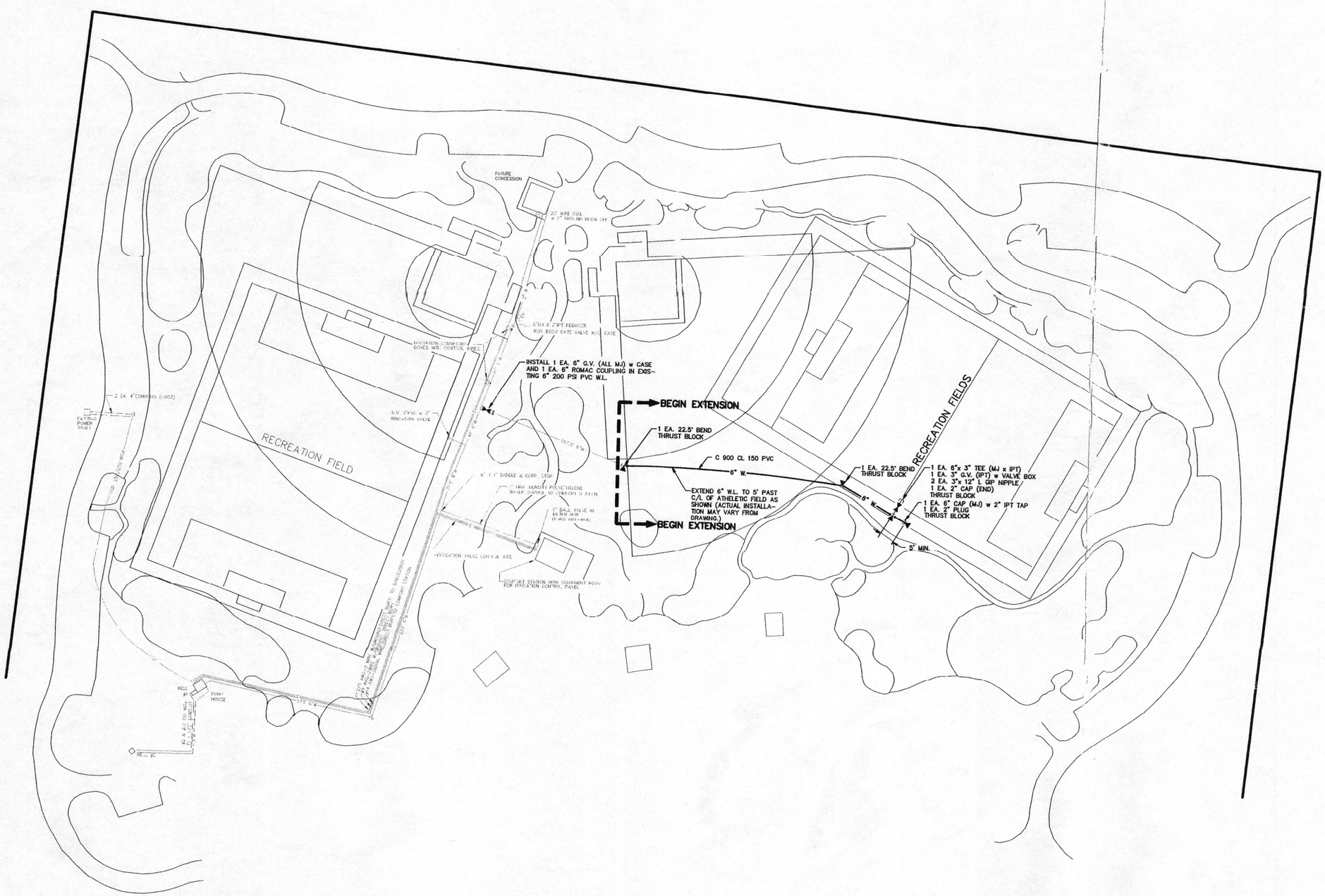
SOUTH WHIDBEY PARKS AND RECREATON DISTRICT
IRRIGATION WELL AND PUMP SYSTEM

ISLAND COUNTY, WASHINGTON

DRAWN BY: LJP	FAKKEMA & KINGMA, INC. CONSULTING ENGINEERS & SURVEYORS 4086 400 Ave W., Oak Harbor, Wash. 98277 675-5973	SCALE: AS NOTED	DWG. NO. 3294
APPROVED BY:		DATE: 7/90	SHEET NO. 2 OF 2

RYAN H. KINGMA STATE OF WASHINGTON REGISTERED PROFESSIONAL ENGINEER

ORIGINAL,
IF BLUE



0 50 100 150

SCALE IN FEET

CONSTRUCTION NOTES:

1. MATERIAL AND INSTALLATION SHALL CONFORM TO THE STANDARDS AND REQUIREMENTS OF THE 1991 STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION OF THE STATE OF WASHINGTON, AND THE LATEST EDITION OF THE UNIFORM PLUMBING CODE.
2. EXISTING UTILITIES ARE SHOWN TO ASSIST THE CONTRACTOR IN THE PERFORMANCE OF HIS JOB. THE CONTRACTOR SHALL BE RESPONSIBLE TO PROTECT, IN PLACE, ALL UTILITIES OR STRUCTURES WHETHER SHOWN OR NOT ON THIS PLAN. DAMAGE DUE TO THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE. THE CONTRACTOR SHALL CALL PUGET SOUND UTILITY COORDINATING COUNCIL FOR UNDERGROUND LOCATES PRECEEDING EXCAVATIONS.
3. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE MEANS METHODS AND SEQUENCE OF CONSTRUCTION. SITE ADJUSTMENTS AND DIVERGENCE FROM THE PLANS ARE SUBJECT TO THE ENGINEER'S APPROVAL.
4. THE WATER LINE SHALL BE PRESSURE TESTED, DISINFECTED AND FLUSHED IN ACCORDANCE WITH SECTION 7-11 OF THE STANDARD SPECIFICATIONS. TEST PRESSURE SHALL BE 200 PSI.
5. PVC PIPE SHALL MEET MATERIALS REQUIRED OF ASTM D-2241 WITH MOLDED RUBBER RING IN EACH BELL JOINT. PIPE LENGTHS SHALL BE 20 FEET. PVC PIPE SHALL BE 200 PSI - SDR 21 OR AS SPECIFIED ON THE PLANS. PVC PIPE SHALL BEAR THE NSF SEAL.
6. UNLESS OTHERWISE SHOWN ON THE PLANS, 3" AND LARGER WATER DISTRIBUTION FITTINGS SHALL BE DUCTILE IRON WITH MECHANICAL JOINT CONNECTIONS.

PRELIMINARY PRINT
NOT FOR CONSTRUCTION

EVAN H. KINGMA
STATE OF WASHINGTON
REGISTERED
PROFESSIONAL ENGINEER

EXPIRES 03/20/

12/2/92
2/2/93

REVISIONS

E3294H2 3294WAT1.DWG PLOTTING SCALE: 1 = 50

SOUTH WHIDBEY PARKS AND RECREATON DISTRICT

6" IRRIGATION LINE EXTENSION PLAN

ISLAND COUNTY, WASHINGTON

DRAWN BY: HJV	DATE: 11/20/92	FAKKEMA & KINGMA, INC. CONSULTING ENGINEERS & SURVEYORS	SCALE: 1"= 50'
APPROVED BY:	DATE:		DWG. NO. 3294

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. [redacted]

Water Right Permit No. _____

(1) **OWNER:** Name South Whidbey Community Center Address Box 136 Langley, WA. 98260

(2) **LOCATION OF WELL:** County Island SW ¼ SE ¼ Sec 10 T. 29 N., R. 3 W.M.

(2a) **STREET ADDDRESS OF WELL** (or nearest address) Above High School, Langley, WA.

(3) **PROPOSED USE:** ☐ Domestic ☐ Industrial ☐ Municipal ☐ ☐ Irrigation ☐ Test Well ☐ Other ☒ ☐ DeWater

(4) **TYPE OF WORK:** Owner's number of well (if more than one) _____
Abandoned ☐ New well ☒ Method: Dug ☐ Bored ☐ Deepened ☐ Cable ☐ Driven ☐ Reconditioned ☐ Rotary ☒ Jetted ☐

(5) **DIMENSIONS:** Diameter of well 6" inches.
Drilled 308 feet. Depth of completed well 308 ft.

(6) **CONSTRUCTION DETAILS:**
Casing Installed: 6 " Diam. from 0 ft. to 299 ft.
Welded ☐ Liner installed ☐ Threaded ☐ _____ " Diam. from _____ ft. to _____ ft.
_____ " Diam. from _____ ft. to _____ ft.

Perforations: Yes ☐ No ☒
Type of perforator used _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson
Type Stainless Steel Model No. _____
Diam. 5 7/8 Slot size #30 from 299 ft. to 308 ft.
Diam. _____ Slot size _____ from _____ ft. to _____ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) **PUMP:** Manufacturer's Name _____
Type: _____ H.P. _____

(8) **WATER LEVELS:** Land-surface elevation above mean sea level _____ ft.
Static level 192' ft. below top of well Date 4-5-90
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.)

(9) **WELL TESTS:** Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? A. P. Arvik
Yield: 50 gal./min. with 9'6½" ft. drawdown after 24 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level
30 Sec.	194'2"	12 Min.	192'11½	30 Min.	192'6"
1 Min.	193'4"	15 Min.	192'11		
2 Min.	193'3"	20 Min.	192'10"		

Date of test _____
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest 60+ gal./min. with stem set at _____ ft. for _____ hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes ☒ No ☐

(10) **WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION**

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Brown Sandy Clay	0	55
Blue Sand & Water	55	72
Blue Clay	72	205
Fine Sand & Water	205	222
Blue Clay	222	292
Coarse Sand & Water	292	308

RECEIVED
APR 23 1990
DEPT. OF ECOLOGY

Work started 4-2-90, 19. Completed 4-5-90, 19

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME DAHLMAN PUMP & WELL DRILLING, INC. (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address Box 422 Burlington, WA. 98233

(Signed) Leo Rieckers (WELL DRILLER) License No. 0623

Contractor's Registration No. DAHLMPW123LC Date 4-5-90, 19

(USE ADDITIONAL SHEETS IF NECESSARY)

1-20 (10/87) 1329 3 by Architect -

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Well Tagging Form

Unique Well Tag No: AGA524 SOK Well #C

RECORD VERIFICATION (check ✓ one)

- [x] Well Report available *(please attach this form to the well report and submit it to the Ecology Regional Office near you)*
- [ ] Verification inconclusive
- [ ] Well Report not available

WELL OWNERSHIP IF DIFFERENT FROM WELL REPORT

First Name: S. WHID. PARKS & REC 02660-E Last Name:

Street Address: James

City: State:

LOCATION OF WELL, IF DIFFERENT FROM WELL REPORT

Well Address: IN THE BACK OF SAGE MEADOWS DRIVE

City: Stanwood County:

T. N. R. W.M. Sec. 1/4 of the

FOR AGENCY USE ONLY

Latitude N48° 00.438' " Longitude W122° 24.287' "

- [x] GPS
- [ ] Topographic Map
- [ ] Survey
- [ ] Computer generated

Elevation at land surface feet/meters *(circle one)*

- [ ] Digital Altimeter
- [ ] Topographic Map
- [ ] Other

Additional information, if available:

- [ ] Location marked on topographic map *(please attach)*
- [ ] Location marked on air photo *(please attach)*

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

FOR AGENCY USE ONLY

WELL CHARACTERISTICS

Physical Description of well (size of casing, type of well, housing, etc.)

10" WELL CASING, TNC WELL, CINDER BLOCK HOUSING (~4' HIGH) WITH METAL PLATE WHICH IS LOCKED. SAMPLE PORT CLOSE TO HEAD

Location of Well identification Tag:

ON WELL CASING

Was supplemental tag needed for ease of identifying well? ☐ Yes ☑ No

If yes, where was tag placed?

D	C	B	A
E	F	G	H
M	L	K	J
N	P	Q	R

Scale 1:24,000 (1"=2,000')

Indicate the location of the well within the Section by drawing a dot at that pc

SECTION 10

COMMENTS: ACCESS WELL THROUGH WELL ADDRESS - NEEDS TO BE UNLOCKED

FOR ECOLOGY WATER RESOURCES PROGRAM ONLY

Water Right # _____ Date Issued _____

Circle One: Application Permit Certificate Claim Exempt

Water Right Self-Assessment Form for Small Water System Management Programs and Project Reports

System Name: So. Whidbey Parks & Rec District	System ID#: 02660E	Type of System: TNC	Proposed Type of System: N/A

Water Right Permit, Certificate, Claim # or Exempt *If water right is interruptible, identify limitation in yellow section below	Name on Water Right	FOR NON-MUNICIPAL SUPPLIERS ONLY: Does water right identify a number of connections? If yes, how many?	WFI Source # If a source has multiple water rights, list each water right on separate line	Existing Water Rights Qi = Instantaneous Flow Rate Allowed (GPM or CFS) Qa = Annual Volume Allowed (Acre Feet/Year)			
				Primary Qi Maximum Rate Allowed	Non-Additive Qi Maximum Rate Allowed	Primary Qa Annual Volume Allowed	Non-Additive Qa Annual Volume Allowed
1 G1-25547C	South Whidbey Parks and Rec District	N/A	S01 & S02	60		25.5	
2 G1-28084P	South Whidbey Parks and Rec District	N/A	S01 & S02	60		40.2	
			TOTALS =	120		65.7	
			Column Identifiers for Calculations:	A		B	

Current Source Production – Most Recent Calendar Year Qi=Maximum Instantaneous Withdrawal from Source. (GPM or CFS) Qa=Maximum Annual Volume Withdrawn (Acre Feet/Year) This includes wholesale water provided to other systems				Forecasted Source Production at Full System Build Out Projected maximum withdrawal from source at full build out. This includes wholesale water provided to other systems			
Total Qi Instantaneous Flow Rate	Excess or (Deficiency) Qi	Total Qa Annual Volume	Excess or (Deficiency) Qa	Total Qi Instantaneous Flow Rate	Excess or (Deficiency) Qi	Total Qa Annual Volume	Excess or (Deficiency) Qa
120	0	34	31.7	120	0	45	20.7
0	0	0		0	0		0
120	0	34	31.7	120	0	45	20.7
C	=A-C	D	=B-D	E	=A-E	F	=B-F

Interruptible Water Rights Identify limitations on any water rights listed above that are interruptible	
Permit or certificate #	Time Period of Interruption

INTERTIES: Systems receiving wholesale water complete this section. Wholesaling systems must include water sold through interties in the source production columns above.

Name of Wholesaling System Providing Water	Quantities Allowed In Contract		Currently Purchased Quantity currently purchased through intertie				Forecasted Purchase at Full System Build Out Forecasted quantity purchased through intertie			
	Maximum Qi	Maximum Qa	Maximum Qi Instantaneous Flow Rate	Excess or (Deficiency) Qi	Maximum Qa Annual Volume	Excess or (Deficiency) Qa	Maximum Qi Instantaneous Flow Rate	Excess or (Deficiency) Qi	Maximum Qa Annual Volume	Excess or (Deficiency) Qa
TOTALS =										
	A	B	C	=A-C	D	=B-D	E	=A-E	F	=B-F

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

PERMIT
TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
August 4, 2000	G1-28084	G1-28084P	

NAME
South Whidbey Parks & Recreation District % Suzette Hart

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
P.O. Box 136	Langley	WA	98260

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Well

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE FEET PER YEAR
	60*	40.2**

QUANTITY, TYPE OF USE, PERIOD OF USE
Municipal, Continuous
*The combined instantaneous quantity of G1-28084 and G1-25547 shall not exceed 120 gpm.
**The combined annual quantity of G1-28084 and G1-25547 shall not exceed 65.7 acre-feet per year.

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION--WITHDRAWAL
1900 feet east and 115 feet north of the southwest corner of Section 10, Township 29 North, Range 03 East, W.M.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW¼ of the SE¼	10	29	03 E	6	Island

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

The Southeast quarter of the Southeast quarter of Section 10; Township 29N, Range 3E of the Willamette Meridian. EXCEPT the north 10 acres thereof.

ALSO the Northwest quarter of the Southeast quarter and the Southwest quarter of the Southeast quarter of Section 10, Township 29N, Range 3E of the Willamette Meridian.

ALSO Lot 1 of Island County Short Plat SHP247-95, as described in Volume 3 of Short Plats on page 127, records of Island County, Washington.

Situate in Island County, Washington.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
Started	December 31, 2023	December 31, 2028

PROVISIONS

PROVISIONS

Well Construction: All water wells constructed within the State shall meet the minimum standards for well construction and maintenance as provided under chapter 18.104 RCW, Washington Water Well Construction Act of 1971, and Chapter 173-160 WAC, Minimum Standards for Construction and Maintenance of Wells.

Water Level Monitoring: In order to protect the ground water resource, static water level in the well shall be measured at least once each month. Ecology shall be notified if water levels drop below normal seasonal declines. The water level data shall be maintained and made available to Ecology upon request.

Water Use: An approved measuring device shall be installed and maintained for each diversion/withdrawal of the sources identified by this water right in accordance with the rule "Requirements for Measuring and Reporting Water Use," Chapter 173-173 WAC.

Water use data shall be recorded weekly. Data shall be maintained by the property owner and promptly submitted to Ecology upon request. Recording and retention of data by the water right holder are required to inform the water users about how much water is used, when the water is used and to assist users in efficient water management.

Chapter 173-173 WAC describes the requirements for data accuracy, device installation and operation, and information reporting. It also allows a water user to petition Ecology for modifications to some of the requirements. Installation, operation and maintenance requirements are contained in the document entitled "Water Measurement Device Installation and Operation Requirements."

Department of Ecology personnel, upon presentation of proper credentials, shall have access at reasonable times, to the records of water use that are kept to meet the above conditions, and to inspect at reasonable times any measuring device used to meet the above conditions.

Sea Water Intrusion: Permittee or certificate holder and its successor(s) shall provide data on chloride concentrations for the well authorized by this permit or certificate with analysis performed by a state accredited laboratory. Accreditation information may be obtained from Ecology's Quality Assurance Program at (360) 895-4649. Sampling shall occur in April and August of each year, with a copy of the laboratory results for both sampling events submitted by October 15 of the same year, to the Department of Ecology, Northwest Regional Office, Bellevue, Washington.

If pumping from any well authorized by this water right causes chloride concentrations to show an increasing trend, immediate action shall be required to prevent pumping concentrations from increasing, as is consistent with the water quality anti-degradation policy WAC 173-200-030. These actions include, but are not limited to reducing the instantaneous withdrawal rate (gpm) of the well, lowering the annual quantity removed from the well, drilling additional wells, installing more storage capacity, or revising the pumping schedule. If chloride concentrations continue to increase, even after corrective measures are taken, the permit holder shall relinquish the option to perfect additional allocated quantities regardless of the stage of development.

Conservation and Water Use Efficiency: Issuance of this water right may be subject to implementation of the minimum requirements established in the Conservation Planning Requirements, Guidelines and Requirements for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology, and Conservation Programs, March 1994, and as revised.

Under RCW 90.03.005 and 90.54.020(6), conservation and improved water use efficiency must be emphasized in the management of the State's water resources, and must be considered as a potential new source of water. Accordingly, as part of the terms of this water right, the applicant may be required to prepare and implement a water conservation plan approved by Department of Health. The standards for such a plan may be obtained from either the Department of Health or the Department of Ecology.

Water System Plan: Department of Health approval of a water system plan is required prior to the issuance of a certificate.

Decommissioning of Well #1: Well #1 shall either be properly decommissioned or maintained in accordance with chapter 18.104 RCW, Washington Water Well Construction Act of 1971, and Chapter 173-160 WAC, Minimum Standards for Construction and Maintenance of Wells.

Water Allocation: The applicant is advised that the certificate will issue for only that quantity of water that has been withdrawn and applied to actual beneficial use. Such quantity applied to actual beneficial use shall not exceed the quantity specified in this report of exam and will be calculated on the basis of the best information available to Ecology, including metering data and/or water duty analysis. The applicant is advised that the quantity of water allocated by this permit may be reduced at the time of final certification to reflect system capacity and actual usage.

A water right certificate shall not be issued until a final investigation has been made.

This permit shall be subject to cancellation should the permittee fail to comply with the above development schedule and/or fail to give notice to the Department of Ecology on forms provided by that Department documenting such compliance.

Given under my hand and the seal of this office at Bellevue, Washington, this 27th *day of* January, *2004.*

Department of Ecology

By Daniel L. Swenson

Daniel L. Swenson, Section Supervisor, Water Resources

ENGINEERING DATA
OK

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

PERMIT

TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
November 15, 1989	G1-25547	G1-25547 P	

NAME
South Whidbey Parks & Recreation District

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
P.O. Box 136	Langley	Washington	98260

The applicant is, pursuant to the Report of Examination which has been accepted by the applicant, hereby granted a permit to appropriate the following described public waters of the State of Washington, subject to existing rights and to the limitations and provisions set out herein.

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Well

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	60	25.5

QUANTITY, TYPE OF USE, PERIOD OF USE

Group domestic supply - continuously
Irrigation - during irrigation season

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION/WITHDRAWAL

1,900 feet east and 115 feet north from the southwest corner of Section 10

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SW¼ SE¼	10	29	3E	6	Island

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

SW¼ SE¼ Section 10, Township 29 north, Range 3 east W.M., Island County, Washington.

DESCRIPTION OF PROPOSED WORKS

Well and delivery system to irrigate 20 acres and supply water to concession stand and restrooms. 100,000 gallon holding tank.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
Started	February 26, 1994	February 26, 1995

PROVISIONS

Installation and maintenance of an access port as described in Ground Water Bulletin No. 1 is required. An air line and gauge may be installed in addition to the access port.

In order to monitor the resource, static water level (SWL) shall be measured **at least** twice each year, in April and August. Measurements shall be taken after the pump has been shut off a reasonable time to allow water level to return to normal. Ecology's Water Resources Section (Northwest Regional Office) shall be notified if a below normal seasonal drop is measured in SWL, otherwise this data shall be maintained and be made available to Ecology upon request. The Department has made available to the public a measuring device (E-Tape) through Island County Health Department.

An approved measuring device shall be installed and maintained in accordance with RCW 90.03.360, WAC 508-64-020 through WAC 508-64-040. Meter readings shall be recorded monthly and this data shall be maintained and be made available to the Department of Ecology upon request.

A certificate of water right will not be issued until a final investigation is made.

This permit shall be subject to cancellation should the permittee fail to comply with the above development schedule and/or fail to give notice to the Department of Ecology on forms provided by that Department documenting such compliance.

Given under my hand and the seal of this office at Bellevue, Washington,

this 26th day of February, 1993.

Department of Ecology

ENGINEERING DATA
OK RJF

by Stephen J. Hirschey
Stephen J. Hirschey, Section Supervisor, Water Resources

WATER FACILITIES INVENTORY (WFI) FORM

Washington State Department of Health
Division of Environmental Health
Office of Drinking Water

ONE FORM PER SYSTEM

Quarter: 3
Updated: 12/18/2024
Printed: 1/21/2025
WFI Printed For: On-Demand
Submission Reason: Source Update

RETURN TO: Central Services - WFI, PO Box 47822, Olympia, WA, 98504-7822 or email wfi@doh.wa.gov

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
02660 E	SOUTH WHIDBEY PARKS & REC DISTRICT	ISLAND	A	TNC

6. PRIMARY CONTACT NAME & MAILING ADDRESS

JEFFREY J. OLSON
PO BOX 699
NEWBERG, OR 97132

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN
ADDRESS
CITY STATE ZIP

7. OWNER NAME & MAILING ADDRESS

SOUTH WHIDBEY PARKS & REC DIST DIRECTOR
BRIAN TOMISSER
5475 MAXWELTON RD
LANGLEY, WA 98260-0136

STREET ADDRESS IF DIFFERENT FROM ABOVE

ATTN
ADDRESS
CITY STATE ZIP

9. 24 HOUR PRIMARY CONTACT INFORMATION		10. OWNER CONTACT INFORMATION	
Primary Contact Daytime Phone: (503) 554-8333		Owner Daytime Phone: (360) 221-5484	
Primary Contact Mobile/Cell Phone: (541) 279-3178		Owner Mobile/Cell Phone:	
Primary Contact Evening Phone: (xxx)-xxx-xxxx		Owner Evening Phone: (xxx)-xxx-xxxx	
Fax:	E-mail: jxxxxn@nwnaturalwaterservi	Fax: (360) 221-7323	E-mail: dxxxxxxr@whidbey.com

11. SATELLITE MANAGEMENT AGENCY - SMA (check only one)

- ☐ Not applicable (Skip to #12)
- ☐ Owned and Managed
- ☒ Managed Only
- ☐ Owned Only

SMA NAME: KING WATER COMPANY SMA Number: 128

12. WATER SYSTEM CHARACTERISTICS (mark all that apply)

- ☐ Agricultural
- ☐ Commercial / Business
- ☐ Day Care
- ☐ Food Service/Food Permit
- ☐ 1,000 or more person event for 2 or more days per year
- ☐ Hospital/Clinic
- ☐ Industrial
- ☐ Licensed Residential Facility
- ☐ Lodging
- ☒ Recreational / RV Park
- ☐ Residential
- ☐ School
- ☐ Temporary Farm Worker
- ☐ Other (church, fire station, etc.):

13. WATER SYSTEM OWNERSHIP (mark only one)

- ☐ Association
- ☐ City / Town
- ☐ County
- ☐ Federal
- ☐ Investor
- ☐ Private
- ☒ Special District
- ☐ State

14. STORAGE CAPACITY (gallons)

100,000

15	16	17	18									19			20	21						22	23	24			
	SOURCE NAME	INTERTIE	SOURCE CATEGORY									USE				TREATMENT						DEPTH		SOURCE LOCATION			
Source Number	LIST UTILITY'S NAME FOR SOURCE AND WELL TAG ID NUMBER. Example: WELL #1 XYZ456 IF SOURCE IS PURCHASED OR INTERTIED, LIST SELLER'S NAME Example: SEATTLE	INTERTIE SYSTEM ID NUMBER	WELL	WELL FIELD	WELL IN A WELL FIELD	SPRING	SPRING FIELD	SPRING IN SPRINGFIELD	SEA WATER	SURFACE WATER	RANNEY / INF. GALLERY	OTHER	PERMANENT	SEASONAL	EMERGENCY	SOURCE METERED	NONE	CHLORINATION	FILTRATION	FLUORIDATION	IRRADIATION (UV)	OTHER	DEPTH TO FIRST OPEN TERVAL IN FEET	CAPACITY (GALLONS PER MINUTE)	1/4, 1/4 SECTION	SECTION NUMBER	TOWNSHIP	RANGE
S01	AGA524 WELL 2		X									X			Y	X						299	120	SW SE	10	29N	03E
S02	WELL #1 AGA525		X											X	Y	X						200	50	SW SE	10	29N	03E
S03	InAct 11/08/2024 Unapproved WELL 3		X											X	N	X							0	NE SW	10	29N	03E

WATER FACILITIES INVENTORY (WFI) FORM - Continued

1. SYSTEM ID NO.	2. SYSTEM NAME	3. COUNTY	4. GROUP	5. TYPE
02660 E	SOUTH WHIDBEY PARKS & REC DISTRICT	ISLAND	A	TNC

	ACTIVE SERVICE CONNECTIONS	DOH USE ONLY! CALCULATED ACTIVE CONNECTIONS	DOH USE ONLY! APPROVED CONNECTIONS
25. SINGLE FAMILY RESIDENCES (How many of the following do you have?)		0	0
A. Full Time Single Family Residences (Occupied 180 days or more per year)	0		
B. Part Time Single Family Residences (Occupied less than 180 days per year)	0		
26. MULTI-FAMILY RESIDENTIAL BUILDINGS (How many of the following do you have?)			
A. Apartment Buildings, condos, duplexes, barracks, dorms	0		
B. Full Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied more than 180 days/year	0		
C. Part Time Residential Units in the Apartments, Condos, Duplexes, Dorms that are occupied less than 180 days/year	0		
27. NON-RESIDENTIAL CONNECTIONS (How many of the following do you have?)			
A. Recreational Services and/or Transient Accommodations (Campsites, RV sites, hotel/motel/overnight units)	2	2	2
B. Institutional, Commercial/Business, School, Day Care, Industrial Services, etc.	2	2	2
28. TOTAL SERVICE CONNECTIONS		4	4

29. FULL-TIME RESIDENTIAL POPULATION

A. How many residents are served by this system 180 or more days per year? 0

30. PART-TIME RESIDENTIAL POPULATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many part-time residents are present each month?												
B. How many days per month are they present?												

31. TEMPORARY & TRANSIENT USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. How many total visitors, attendees, travelers, campers, patients or customers have access to the water system each month?	250	400	800	5000	5000	5000	5000	5000	5000	2500	2500	300
B. How many days per month is water accessible to the public?	31	28	31	30	31	30	31	31	30	31	30	31

32. REGULAR NON-RESIDENTIAL USERS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
A. If you have schools, daycares, or businesses connected to your water system, how many students, daycare children and/or employees are present each month that are NOT already included in the residential population?	6	6	7	7	7	11	11	11	7	7	6	6
B. How many days per month are they present?	22	20	22	21	22	21	22	22	21	22	21	22

33. ROUTINE COLIFORM SCHEDULE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	0	1	1	1	1	1	1	1	1	1	1	0

34. NITRATE SCHEDULE	QUARTERLY	ANNUALLY	ONCE EVERY 3 YEARS
(One Sample per source by time period)		S01	

35. Reason for Submitting WFI:

☐ Update - Change ☐ Update - No Change ☐ Inactivate ☐ Re-Activate ☐ Name Change ☐ New System ☐ Other _____

36. I certify that the information stated on this WFI form is correct to the best of my knowledge.

SIGNATURE: _____ **DATE:** _____

PRINT NAME: _____ **TITLE:** _____

Appendix B. Capacity Analysis Calculations

WATER SYSTEM INFORMATION

System:	South Whidbey Parks and Rec District
PWS ID:	02660 E
Location:	Langley, WA
Owner:	South Whidbey Parks and Rec District
Operator:	

Operating Permit	
Issue Date	12/1/2024
Color	Green

Water Facilities Inventory (WFI) Form	
Date Printed	1/21/2025
Active Residential Connections	0
Active Residential Population	0
Active Non-Residential Connections	4
Average Non-Residential Population	8
Approved Connections	4

CONNECTIONS BASED ON WATER USE DATA

System: South Whidbey Parks and Rec District
PWS ID: 02660 E
Location: Langley, WA

Year	Active Connections	Active Metered	Active Unmetered	Ready to Serve	Committed Connections
2020	4	4	0		4
2021	4	4	0		4
2022	4	4	0		4
2023	4	4	0		4
2024	4	4	0		4
			0		

Proposed Connections	1	Aquatic Center

EXISTING FACILITY: RAW WATER USAGE DATA AND DEMAND

System: South Whidbey Parks and Rec District
PWS ID: 02660 E
Location: Langley, WA

Date	Meter Reading (100 ft^3)	Water Usage (gal)	Gallons per day
1/4/11	41,369	0	
2/7/11	41,493	92,528	2,721
3/7/11	41,507	10,173	363
4/5/11	41,517	7,929	273
5/9/11	41,536	13,614	400
6/3/11	41,561	19,149	766
7/5/11	42,393	622,560	19,455
8/9/11	46,716	3,233,080	92,374
9/12/11	48,299	1,184,458	34,837
10/10/11	48,923	466,677	16,667
11/14/11	48,986	47,348	1,353
12/12/11	49,004	13,015	465
1/9/12	49,004	0	0
2/14/12	49,171	124,841	3,468
3/12/12	49,171	0	0
4/9/12	49,760	441,021	15,751
5/7/12	50,191	322,238	11,509
6/12/12	50,532	254,619	7,073
7/9/12	51,796	945,936	35,035
8/13/12	54,167	1,773,717	50,678
9/13/12	56,369	1,646,498	53,113
10/9/12	56,982	458,748	17,644
11/13/12	57,003	16,082	459
12/11/12	57,003	0	0
1/8/13	57,003	0	0
2/12/13	57,269	198,744	5,678
3/12/13	57,269	0	0
4/15/13	58,071	599,746	17,640
5/14/13	59,137	797,069	27,485
6/11/13	59,917	583,964	20,856
7/9/13	60,836	687,337	24,548
8/13/13	62,140	975,168	27,862
9/10/13	64,815	2,000,825	71,458
10/8/13	66,931	1,583,067	56,538
11/12/13	68,220	964,172	27,548
12/10/13	68,220	0	0

EXISTING FACILITY: RAW WATER USAGE DATA AND DEMAND

System: South Whidbey Parks and Rec District
PWS ID: 02660 E
Location: Langley, WA

Date	Meter Reading (ft^3)	Water Usage (gal)	Gallons per day
1/14/14	68,222	1,197	34
2/11/2014	68,222	0	0
3/14/2014	68,891	500,636	16,150
4/10/2014	69,316	318,124	11,782
5/13/14	70,006	515,970	15,635
6/10/14	70,019	9,948	355
7/8/14	72,012	1,490,091	53,218
8/12/14	73,391	1,032,165	29,490
9/9/14	74,362	725,859	25,924
10/14/2014	76,644	1,706,861	48,767
11/11/14	76,986	256,115	9,147
12/9/14	76,986	0	0
1/7/2015	76,986	0	0
2/10/15	76,986	0	0
3/10/15	77,013	20,121	719
4/14/15	77,019	4,488	128
5/12/15	77,393	279,827	9,994
6/9/15	77,462	51,313	1,833
7/14/15	80,863	2,544,322	72,695
8/11/15	84,080	2,406,017	85,929
9/8/15	88,191	3,075,477	109,838
10/13/15	90,367	1,627,124	46,489
11/10/15	91,573	902,387	32,228
12/8/15	91,998	317,825	11,351
1/8/2016	91,998	0	0
2/10/2016	91,998	0	0

EXISTING FACILITY: RAW WATER USAGE DATA AND DEMAND

System: South Whidbey Parks and Rec District
PWS ID: 02660 E
Location: Langley, WA

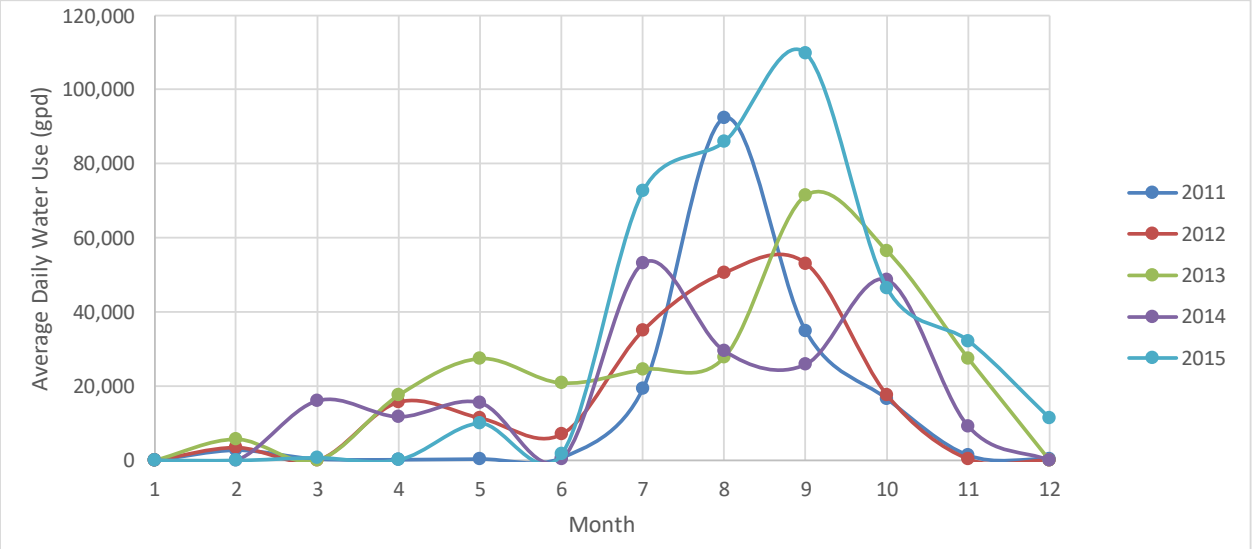
	Average Daily Water Usage (gpd)				
	2011	**2012**	**2013**	**2014**	**2015**
Jan	0	0	0	34	0
Feb	2,721	3,468	5,678	0	0
Mar	363	0	0	16,150	719
Apr	273	15,751	17,640	11,782	128
May	400	11,509	27,485	15,635	9,994
Jun	766	7,073	20,856	355	1,833
Jul	19,455	35,035	24,548	53,218	72,695
Aug	92,374	50,678	27,862	29,490	85,929
Sep	34,837	53,113	71,458	25,924	109,838
Oct	16,667	17,644	56,538	48,767	46,489
Nov	1,353	459	27,548	9,147	32,228
Dec	465	0	0	0	11,351
Summer ADD	48,889	46,275	41,289	36,211	89,488
Non-Irrigation ADD	793	4,782	12,401	6,638	7,032
Summer Irrigation ADD	48,096	41,493	28,888	29,573	82,456
Irrigation % of Total	98%	90%	70%	82%	92%

	Monthly Water Usage (gallon)				
	2011	**2012**	**2013**	**2014**	**2015**
Jan	0	0	0	1,197	0
Feb	92,528	124,841	198,744	0	0
Mar	10,173	0	0	500,636	20,121
Apr	7,929	441,021	599,746	318,124	4,488
May	13,614	322,238	797,069	515,970	279,827
Jun	19,149	254,619	583,964	9,948	51,313
Jul	622,560	945,936	687,337	1,490,091	2,544,322
Aug	3,233,080	1,773,717	975,168	1,032,165	2,406,017
Sep	1,184,458	1,646,498	2,000,825	725,859	3,075,477
Oct	466,677	458,748	1,583,067	1,706,861	1,627,124
Nov	47,348	16,082	964,172	256,115	902,387
Dec	13,015	0	0	0	317,825
July-Sep Total Usage	5,040,000	4,370,000	3,660,000	3,250,000	8,030,000
Max Month Usage	3,233,080	1,773,717	2,000,825	1,706,861	3,075,477
MMADD	92,374	53,113	71,458	53,218	109,838
MMADD Irrigation	90,876	47,624	49,996	43,462	101,208
MMADD Other	1,498	5,489	21,462	9,756	8,631
MDD=($MMADD^{O}$*1.65+$MMADD^{irr}$*7/5)	129,698	75,730	105,407	76,943	155,931
Annual Total Usage	5,700,000	6,000,000	8,400,000	6,600,000	11,200,000
ADD	15,616	16,438	23,014	18,082	30,685

MDD was based on 1.65 peaking factor for the non-irrigation portion of water usage and a 7/5 peaking factor for the irrigation demand. This would correspond to only irrigating 5 days of week. The standard peaking factor calculation estimates water usage above the physical capacity of the well, which is impossible.

EXISTING FACILITY: RAW WATER USAGE DATA AND DEMAND

System: South Whidbey Parks and Rec District
PWS ID: 02660 E
Location: Langley, WA



	EXISTING	
ADD	31,000	gpd
Summer ADD	90,000	gpd
Non-Irrigation ADD	7,000	gpd
MDD	156,000	gpd
Well Capacity	173,000	gpd
Max Annual Use	34	ac-ft

WATER RIGHTS SUMMARY

System: South Whidbey Parks and Rec District
PWS ID: 02660 E
Location: Langley, WA

Certificate #	Name	Priority Date	Source Name	Primary or Supplemental	Q_i (gpm)	Q_a (acre-ft)
G1-25547 C	South Whidbey Parks and Recreation District	11/15/89	Well	Primary	60.0	25.5
G1-28084 P	South Whidbey Parks and Recreation District	08/04/00	Well	Supplemental	60.0	40.2
				Total	**120**	**65.7**
				max flow per day (gal)	172,800	2,860,000
						21,400,000
						58,600

Total
annual water rights (CF/yr)
annual water rights (gal/yr)
avg available daily water rig

Q_i = Maximum Instantaneous Flow Rate
Q_a = Maximum Annual Withdrawal

Conversion Factors	
square feet per acre	43,560
gallons per CF	7.48
days per year	365
hours per day	24

Pump	
pump cycles per hour	6
pump run per hour (min)	60
pump run per day (min)	1440

EXISTING AND PROPOSED: DEMAND CALCULATIONS

System: South Whidbey Parks and Rec District
PWS ID: 02660 E
Location: Langley, WA

Function	Size (Sq. Feet)	Users	Daily Demand (gpd)	Total MDD (gpd)	Total ADD (gpd)[1]
Existing Facility Demand Requirements					
Irrigation Demand				*141,691*	*83,000*
Non-Irrigation Demand (Domestic)				9,800	7,000
Yearly Demand				*151,491*	*31,000*
Aquatic Center Demand Requirements					
Total Facility Users[3]	N/A	1,000	10	10,000	4,000
Staff	N/A	10	15	150	150
Swimming Pool[4]	3,501	N/A	10	350	350
Activity Pool	2,269	N/A	10	227	227
Hydrotherapy Spa	100	N/A	10	10	10
Subtotal	*5,870*	*1,010*		*11,000*	*5,000*
Existing + Proposed Aquatic Center				*162,491*	*95,000*
Summer Total After Build Out (Worst Case)				162,000	95,000

[1]-Used daily average users value of 40%

[2]-Inclusive of both existing and proposed demands.

[3]- Values from Water System Design Manual 06/2020, WSDOH, Table 3-2; Pool (swimmer); gpd/person

[4]- Values from Water System Design Manual 06/2020, WSDOH, Table 3-2; Pool Maintenance; gpd/100 sq. ft

		DESIGN	
ADD	System (Summer)	95,000	gpd
	System (Annual)	36,000	gpd
	Domestic	12,000	gpd
MDD	System[2]	162,000	gpd
	Design (limited by Water Right)	156,000	gpd
	Domestic	20,800	
	Anticipated Annual Usage	41	ac-ft

SOURCE-BASED PHYSICAL CAPACITY

System: South Whidbey Parks and Rec District
PWS ID: 02660 E
Location: Langley, WA

WATER RIGHT CALCULATIONS

Based on Annual Volume & Average Day Demand (Eqn 6-3):

$Q_a > (365 * ADD)$

Where:

Q_a *= Annual Volume of Water Available from All Sources, as limited by Water Right (gallons/year)*
ADD = Average Daily Demand (gpd)

	Q_a (gal/year)	ADD (gpd)	365*ADD (gal/year)	Governs:
Potential Connections	21,400,000	36,000	13,140,000	Demand

Based on Instantaneous Flow & Maximum Day Demand (Eqn 6-4):

$V_d = (Q_i * t_d)$
$V_d > MDD$

Where:

V_d *= Total Volume of Water Available for Maximum Day's Demand (gpd)*
MDD = Maximum Daily Demand (gpd)
Q_i *= Instantaneous Maximum Water Right Flow Rate (gpm)*
t_d *= Time that source operates per day (minutes/day)*

	Q_i (gpm)	Minutes Pumped/Hr	t_d (min/day)	V_d (gpd)	MDD (gpd)	Governs
Potential Connections	120	60	1440	172,800	162,000	Demand

SOURCE-BASED PHYSICAL CAPACITY

System: South Whidbey Parks and Rec District
PWS ID: 02660 E
Location: Langley, WA

SOURCE CALCULATIONS

Total Source Capacity (Eqn 4-2):

$V_T=sum(Q_j*T_j)$

Where:

V_T = Total volume of water available to the system over a specified period of time (gal/specified time period)
Q_j = Delivery rate of source (gal/unit time)
t_j = Time that flow (Q_j) was delivered from source "j"

Source ID	1	2	0	0	0
Q_j Delivery Rate (gpm)	0	120			
Max Pump Time (min/day)		1200			
Max Days Pumped (days/yr)		365			
V_j Source Capacity (gal/yr)	0	52,560,000	0	0	0

Q_s = 120 gpm

V_T = 52,560,000 gal/yr

Based on Source Production & Maximum Day Demand (Eqn 4-3):

$N=V_{t/MDD}$
V_d>MDD

Where:

V_t = Total Volume of Water Available for all non-emergency souces in 24 hour period
MDD = Max Daily Demand (gpd)
Q_s = Total Well Production Flow rate (gpm)
t_d = Time that source operates per day (minutes/day)

	Q_s (gpm)	Minutes Pumped/Hr	t_d (min/day)	V_t (gpd)	MDD (gpd)	Governs
Potential Connections	120	60	1,440	172,800	162,000	Demand

SOURCE-BASED PHYSICAL CAPACITY

System: South Whidbey Parks and Rec District
PWS ID: 02660 E
Location: Langley, WA

TREATMENT CALCULATIONS

Based on Treatment Max Design Flow & Maximum Day Demand (Eqn 6-4):

$N = V_d/MDD = (Q_t * t_d)/MDD)$

Where:

N = Number of Service Connections, ERUs
V_d = Total Volume of Water Available for Maximum Day's Demand (gallons/day)
MDD = Maximum Daily Demand (gpd)
Q_t = Treatment System Maximum Design Flow Rate (gpm)

	Q_t (gpm)	Percent Backwash Waste	V_d, Avg. Daily Treatment Capacity (gal)	Domestic MDD (gpd)	Governs
Potential Connections	35	2.5%	40,950	20,800	Demand

SUMMARY

Condition	Capacity (gpd)	Limiting Factors	Governed by
Water Right	13,140,000	Q_a & ADD	Demand
Water Right	162,000	Q_i & MDD	Demand
Source	162,000	Q_s & MDD	Demand
Treatment Capacity	20,800	Q_t & Domestic MDD	Demand

(only applies to Domestic water demand)

System is limited by: Source Capacity and Water Right

System's most-limiting Capacity: Source Capacity

System will need to limit daily irrigation on summer days to meet source capacity and water right limitations

PEAK HOUR DEMAND (PHD) CALCULATION

System: South Whidbey Parks and Rec District
PWS ID: 02660 E
Location: Langley, WA

Description: The demand calculations are based on the AWWA M22 2004 edition Chapter 4 "Estimating Demands Using Fixture Values" per the sample calculation on Page 37.

		Buildings/Units						
		Existing					Proposed	
Fixture or Appliance	Suggested Fixture Value (gpm)	Concession Stand	Old Maintenance Bldg	Maintenance Bldg	Castle Park Restroom	Total Existing Fixtures	Aquatic Center	Total Future Fixtures
Toilet (tank)	4	3	1	1	4	9		9
Toilet (flush valve)	35					0	9	9
Urinal (wall or stall)	16	1			2	3	2	5
Urinal (flush valve)	35					0		0
Bidet	2					0		0
Shower (single head)	2.5		1			1	20	21
Faucet (lavatory)	1.5	2	1	1	4	8	8	16
Faucet (sink)	2.2	1		1		2	2	4
Faucet (utility sink)	4					0	1	1
Dishwasher	2					0		0
Bathtub	8					0		0
Clothes washer	6					0	1	1
Hose connection - 1/2 in.	5		1	1		2		2
Hose connection - 5/8 in.	9					0	6	6
Hose connection - 3/4	12					0		0
Misc. - Bedpan washer	10					0		0
Misc. - Drinking fountains	2	1			1	2	2	4
Misc. - Dental units	2					0		0
Total Fixture Value:		35.2	13	12.7	56	**117**	**481**	**598**
% of overall future system flow		5.9%	2.2%	2.1%	9.4%	**19.5%**	**80.5%**	**100.0%**

Total Domestic Peak Hour Demand (from Fig 4-2) **90** **gpm**

STORAGE CAPACITY CALCULATIONS

System: South Whidbey Parks and Rec District
ID No.: 02660 E
Location: Langley, WA

Demands		
N (ERUs)	0	
ADD (gpd/ERU)	0	
MDD (gpd/ERU)	13,200	*Estimated MDD + 20%*
PHD Domestic (gpm)	90	*Existing facilities plus aquatic center*

Sources		
Source ID	**Delivery Rate (gpm)**	
Well #2	35	*as limited by treatment system*
Q_S =	35	
Q_S =	120	*water right limited*
Q_L =	35	*largest source*

Reservoirs						
Reservoir ID	**Diameter (ft)**	**Area (ft^2)**	**Height (ft)**	**Base Elevation (ft)**	**Volume (gal)**	**VF (gal/ft)**
Proposed Reservoir	26	530.9	25	265	99,284	3,971
					0	0
				Total	99,284	3,971

Top Dead Storage (TDS)	
Depth (ft)	**Volume (gal)**
1.00	3,971

Operational Storage (OS)	
Depth (ft)	**Volume (gal)**
1.0	3,971

Required Equalizing Storage (ES)			
PHD (gpm)	**Q_S (gpm)**	**Volume (gal)**	**Depth (ft)**
90	35	8,250	2.1

*ES = (PHD-Q_S)*150 or Zero*

Standby Storage (SB)*						
	N (ERU)	**Sbi (gal/day/ERU)**	**Q_S (gpm)**	**Q_L (gpm)**	**SB Volume (gallons)**	**Depth (ft)**
Recommended **	1	13,200	n/a	n/a	13,200	3.3
				Recommended SB	**13,200**	**3.3**

*** (Section 4.4.3.2) Sbi=ERU $_{MDD}$ and T_d =1 day*

STORAGE CAPACITY CALCULATIONS

System: South Whidbey Parks and Rec District
ID No.: 02660 E
Location: Langley, WA

Available Standby Storage (SB)			
Volume (gallons)	**Depth (ft)**	**N (ERUs)**	**SB_i (gal/ERU)**
81,105	20.4	0	n/a

SB = Total Storage Volume -TDS-OS -ES-BDS

Fire Suppression Storage (FSS)		
Fire Flow (gpm)	**t_m (min)**	**Volume (gal)**
1,200	60	72,000

FSS = FFt_m*

Where: FF = Required fire flow rate (gpm)
t_m = Duration of FF rate (minutes)

Bottom Dead Storage (BDS)	
Depth (ft)	**Volume (gal)**
0.5	1,986

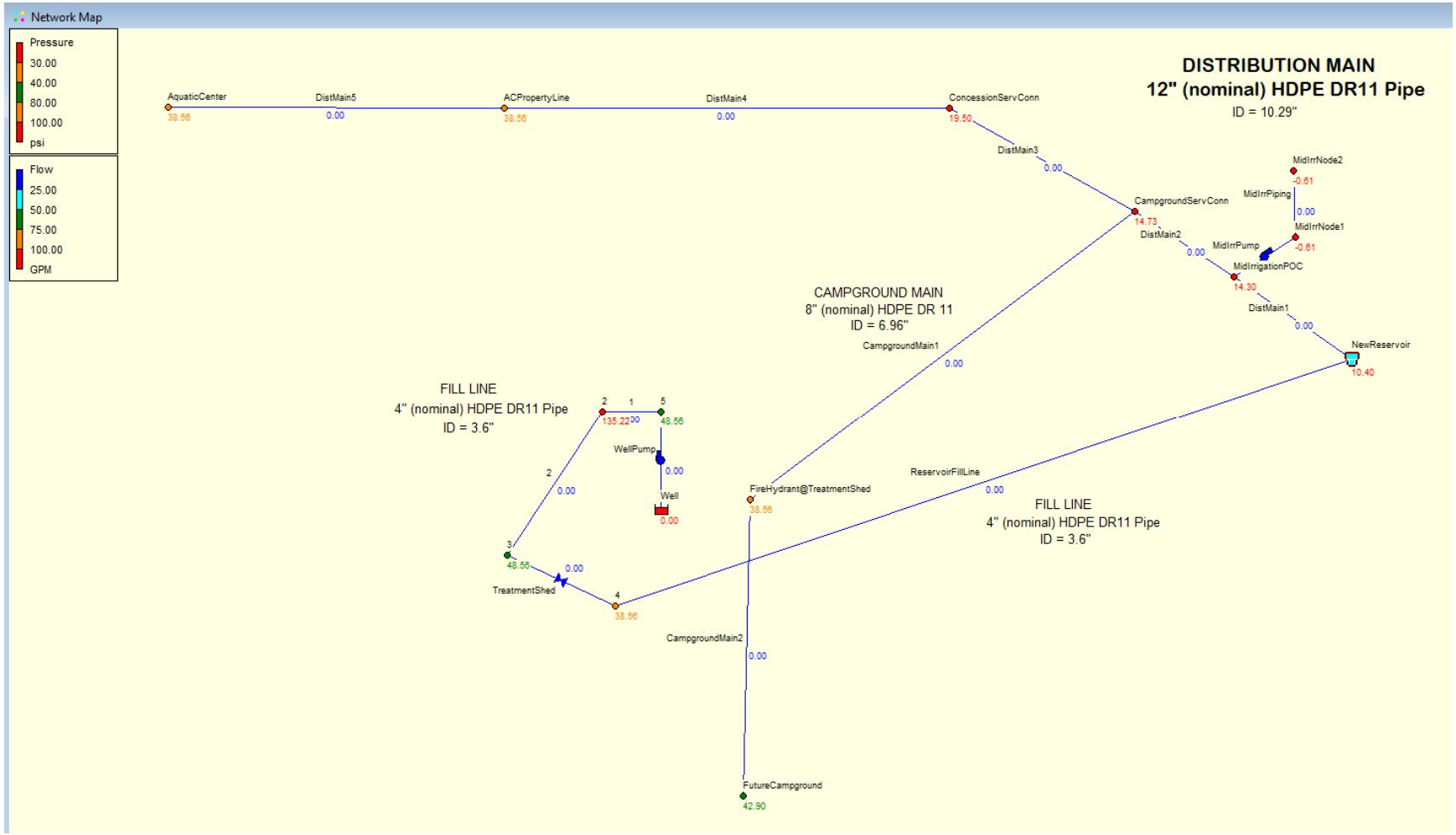
Available Storage Summary		
Component	**Volume (gal)**	**Depth of Storage Component (ft)**
TDS	3,971	1.0
OS	3,971	1.0
ES	8,250	2.1
SB/FSS	81,105	20.4
BDS	1,986	0.5
Total	99,284	25.0

Is the available SB/FSS…	
greater than recommended SB?	greater than required FSS?
yes	yes

25.000

Appendix C. Hydraulic Modeling Results

Static Model - Layout



Static Model – Node Results

Network Table - Nodes

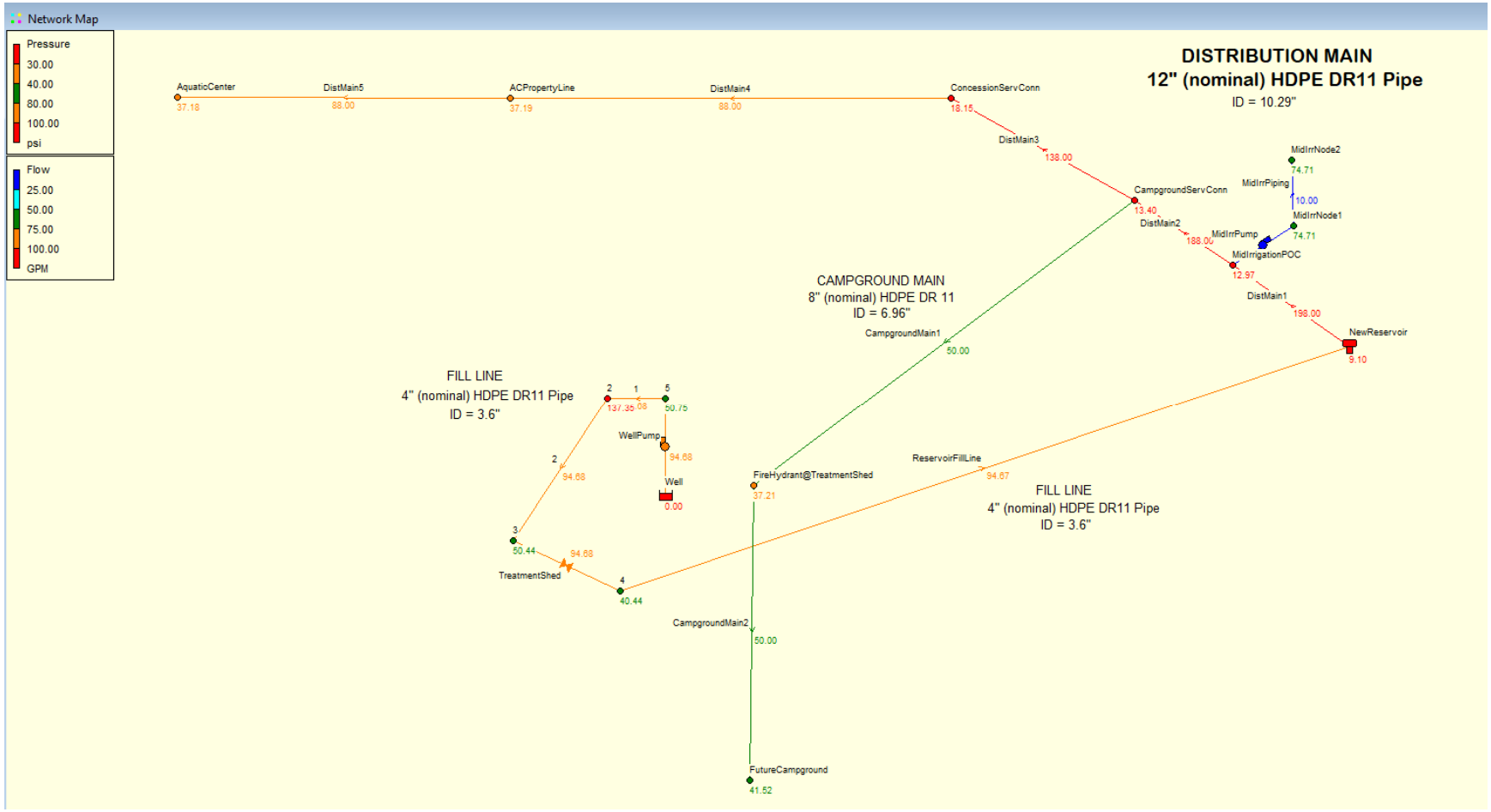
Node ID	Elevation ft	Base Demand GPM	Demand GPM	Head ft	Pressure psi
Junc 2	0	0	0.00	312.08	135.22
Junc 3	200	0	0.00	312.08	48.56
Junc 4	200	0	0.00	289.00	38.56
Junc 5	200	0	0.00	312.08	48.56
Junc ACPropertyLine	200	0	0.00	289.00	38.56
Junc MidIrrigationPOC	256	0	0.00	289.00	14.30
Junc ConcessionServConn	244	0	0.00	289.00	19.50
Junc FutureCampground	190	0	0.00	289.00	42.90
Junc CampgroundServConn	255	0	0.00	289.00	14.73
Junc FireHydrant@TreatmentShed	200	0	0.00	289.00	38.56
Junc AquaticCenter	200	0	0.00	289.00	38.56
Junc MidIrrNode1	260	0	0.00	258.59	-0.61
Junc MidIrrNode2	260	0	0.00	258.59	-0.61
Resvr Well	-15	#N/A	0.00	-15.00	0.00
Tank NewReservoir	265	#N/A	0.00	289.00	10.40
Tank 7	0	#N/A	0.00	10.00	4.33

Static Model – Link Results

Network Table - Links

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
Pipe 1	12	4	100	0.00	0.00	0.00	Open
Pipe 2	60	3.6	140	0.00	0.00	0.00	Open
Pipe ReservoirFillLine	740	3.6	140	0.00	0.00	0.00	Open
Pipe DistMain1	280	10.29	140	0.00	0.00	0.00	Open
Pipe DistMain2	40	10.29	140	0.00	0.00	0.00	Open
Pipe CampgroundMain1	380	7	140	0.00	0.00	0.00	Open
Pipe CampgroundMain2	450	7	140	0.00	0.00	0.00	Open
Pipe DistMain3	233	10.29	140	0.00	0.00	0.00	Open
Pipe DistMain4	1344	10.29	140	0.00	0.00	0.00	Open
Pipe DistMain5	575	10.29	140	0.00	0.00	0.00	Open
Pipe MidIrrPiping	100	6	140	0.00	0.00	0.00	Open
Pump WellPump	#N/A	#N/A	#N/A	0.00	0.00	0.00	Closed
Pump MidIrrPump	#N/A	#N/A	#N/A	0.00	0.00	0.00	Closed
Valve TreatmentShed	#N/A	3.6	#N/A	0.00	0.00	23.08	Active

PHD – Layout


Network Map
Pressure
30.00
40.00
80.00
100.00
psi
Flow
25.00
50.00
75.00
100.00
GPM
DISTRIBUTION MAIN
12" (nominal) HDPE DR11 Pipe
ID = 10.29"
AquaticCenter
37.18
DistMain5
88.00
ACPropertyLine
37.19
DistMain4
88.00
ConcessionServConn
18.15
DistMain3
138.00
MidIrrNode2
74.71
MidIrrPiping
10.00
MidIrrNode1
74.71
CampgroundServConn
13.40
DistMain2
188.0
MidIrrPump
MidIrrigationPOC
12.97
DistMain1
198.00
NewReservoir
9.10
CAMPGROUND MAIN
8" (nominal) HDPE DR 11
ID = 6.96"
CampgroundMain1
50.00
FILL LINE
4" (nominal) HDPE DR11 Pipe
ID = 3.6"
2
1
5
137.35
50.75
WellPump
94.68
Well
0.00
2
94.68
3
50.44
94.68
TreatmentShed
4
40.44
FireHydrant@TreatmentShed
37.21
ReservoirFillLine
94.67
FILL LINE
4" (nominal) HDPE DR11 Pipe
ID = 3.6"
CampgroundMain2
50.00
FutureCampground
41.52

PHD – Node Results

Network Table - Nodes

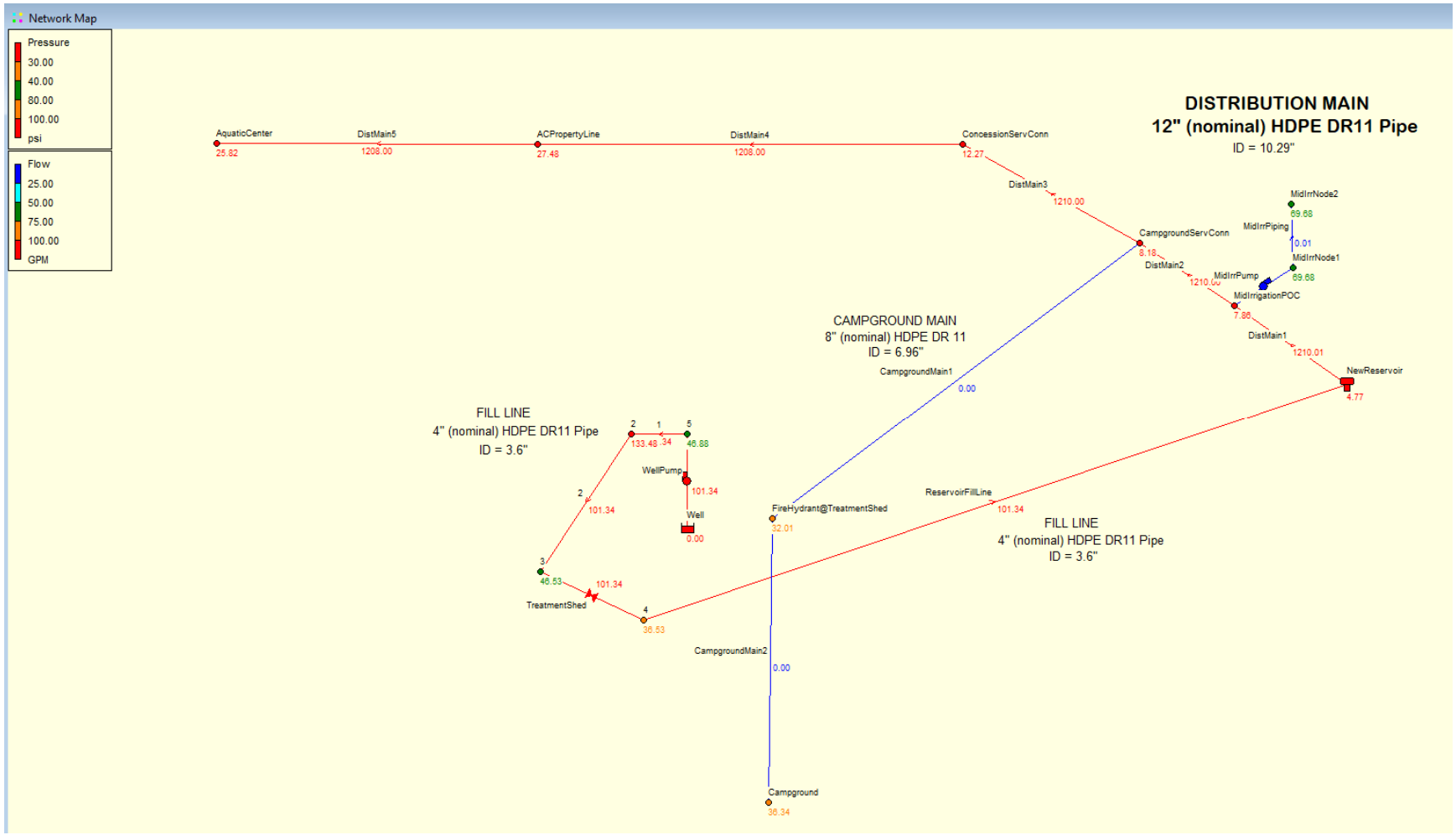
Node ID	Elevation ft	Base Demand GPM	Demand GPM	Head ft	Pressure psi
Junc 2	0	0	0.00	316.99	137.35
Junc 3	200	0	0.00	316.40	50.44
Junc 4	200	0	0.00	293.32	40.44
Junc 5	200	0	0.00	317.12	50.75
Junc ACPropertyLine	200	0	0.00	285.83	37.19
Junc MidIrrigationPOC	256	0	0.00	285.93	12.97
Junc ConcessionServConn	244	50	50.00	285.90	18.15
Junc FutureCampground	190	50	50.00	285.83	41.52
Junc CampgroundServConn	255	0	0.00	285.93	13.40
Junc FireHydrant@TreatmentShed	200	0	0.00	285.88	37.21
Junc AquaticCenter	200	88	88.00	285.80	37.18
Junc MidIrrNode1	260	0	0.00	432.42	74.71
Junc MidIrrNode2	260	10	10.00	432.41	74.71
Resvr Well	-15	#N/A	-94.68	-15.00	0.00
Tank NewReservoir	265	#N/A	-103.33	286.00	9.10
Tank 7	0	#N/A	0.00	10.00	4.33

PHD – Link Results

Network Table - Links

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Friction Factor	Status
Pipe 1	12	4	100	94.68	2.42	11.04	0.041	Open
Pipe 2	60	3.6	140	94.68	2.98	9.89	0.021	Open
Pipe ReservoirFillLine	740	3.6	140	94.67	2.98	9.89	0.021	Open
Pipe DistMain1	280	10.29	140	198.00	0.76	0.23	0.022	Open
Pipe DistMain2	40	10.29	140	188.00	0.73	0.21	0.022	Open
Pipe CampgroundMain1	380	7	140	50.00	0.42	0.12	0.026	Open
Pipe CampgroundMain2	450	7	140	50.00	0.42	0.12	0.026	Open
Pipe DistMain3	233	10.29	140	138.00	0.53	0.12	0.023	Open
Pipe DistMain4	1344	10.29	140	88.00	0.34	0.05	0.025	Open
Pipe DistMain5	575	10.29	140	88.00	0.34	0.05	0.025	Open
Pipe MidIrrPiping	100	6	140	10.00	0.11	0.01	0.032	Open
Pump WellPump	#N/A	#N/A	#N/A	94.68	0.00	-332.12	0.000	Open
Pump MidIrrPump	#N/A	#N/A	#N/A	10.00	0.00	-146.48	0.000	Open
Valve TreatmentShed	#N/A	3.6	#N/A	94.68	2.98	23.08	0.000	Active

Fire Flow + MDD - Layout



Fire Flow + MDD – Node Results

Network Table - Nodes

Node ID	Elevation ft	Base Demand GPM	Demand GPM	Head ft	Pressure psi	Quality
Junc 2	0	0	0.00	308.05	133.48	0.00
Junc 3	200	0	0.00	307.38	46.53	0.00
Junc 4	200	0	0.00	284.30	36.53	0.00
Junc 5	200	0	0.00	308.20	46.88	0.00
Junc ACPropertyLine	200	0	0.00	263.41	27.48	0.00
Junc MidIrrigationPOC	256	0	0.00	274.14	7.86	0.00
Junc ConcessionServConn	244	2	2.00	272.32	12.27	0.00
Junc Campground	190	0	0.00	273.87	36.34	0.00
Junc CampgroundServConn	255	0	0.00	273.87	8.18	0.00
Junc FireHydrant@TreatmentShed	200	0	0.00	273.87	32.01	0.00
Junc AquaticCenter	200	1208	1208.00	259.60	25.82	0.00
Junc MidIrrNode1	260	0	0.00	420.81	69.68	0.00
Junc MidIrrNode2	260	.01	0.01	420.81	69.68	0.00
Resvr Well	-15	#N/A	-101.34	-15.00	0.00	0.00
Tank NewReservoir	265	#N/A	-1108.67	276.00	4.77	0.00
Tank 7	0	#N/A	0.00	10.00	4.33	0.00

Fire Flow + MDD – LinkResults

Network Table - Links

Link ID	Length ft	Diameter in	Roughness	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Friction Factor	Quality	Status
Pipe 1	12	4	100	101.34	2.59	12.52	0.040	0.00	Open
Pipe 2	60	3.6	140	101.34	3.19	11.22	0.021	0.00	Open
Pipe ReservoirFillLine	740	3.6	140	101.34	3.19	11.22	0.021	0.00	Open
Pipe DistMain1	280	10.29	140	1210.01	4.67	6.65	0.017	0.00	Open
Pipe DistMain2	40	10.29	140	1210.00	4.67	6.65	0.017	0.00	Open
Pipe CampgroundMain1	380	7	140	0.00	0.00	0.00	0.000	0.00	Open
Pipe CampgroundMain2	450	7	140	0.00	0.00	0.00	0.000	0.00	Open
Pipe DistMain3	233	10.29	140	1210.00	4.67	6.65	0.017	0.00	Open
Pipe DistMain4	1344	10.29	140	1208.00	4.66	6.63	0.017	0.00	Open
Pipe DistMain5	575	10.29	140	1208.00	4.66	6.63	0.017	0.00	Open
Pipe MidIrrPiping	100	6	140	0.01	0.00	0.00	0.000	0.00	Open
Pump WellPump	#N/A	#N/A	#N/A	101.34	0.00	-323.20	0.000	0.00	Open
Pump MidIrrPump	#N/A	#N/A	#N/A	0.01	0.00	-146.67	0.000	0.00	Open
Valve TreatmentShed	#N/A	3.6	#N/A	101.34	3.19	23.08	0.000	0.00	Active

Appendix D. Construction Plans

PLANS SUBMITTED AS
SEPARATE DOCUMENT

Appendix E. Product Information

SP

Submersible pumps, motors, and accessories
North America, 60 Hz

GRUNDFOS

Identification

Type key, SP pumps

Example: 475S500-5-AB

Example	475	S	500 -	5 -	A	B
Pos.	1	2	3	4	5	6

Pos.	Description		
1	Rated flow rate in gpm		
2	Type range Stainless steel parts of material		
	S	=	AISI 304 (EN 1.4301) SS
	N	=	AISI 316 (EN 1.4401) SS
	R	=	AISI 904L (EN 1.4539) SS
3	Hp of motor		
4	Number of impellers		
5	First reduced-diameter impeller (A, B or C)		
6	Second reduced-diameter impeller (A, B or C)		

Type key, MS402 motors

Example: MS402

Example	MS	4	02	
Pos.	1	2	3	4

Pos.	Description		
1	Motor submersible		
2	Minimum well casing diameter in inches		
3	Generation		
4	Material type		
	-	=	AISI 304 (EN 1.4301) stainless steel

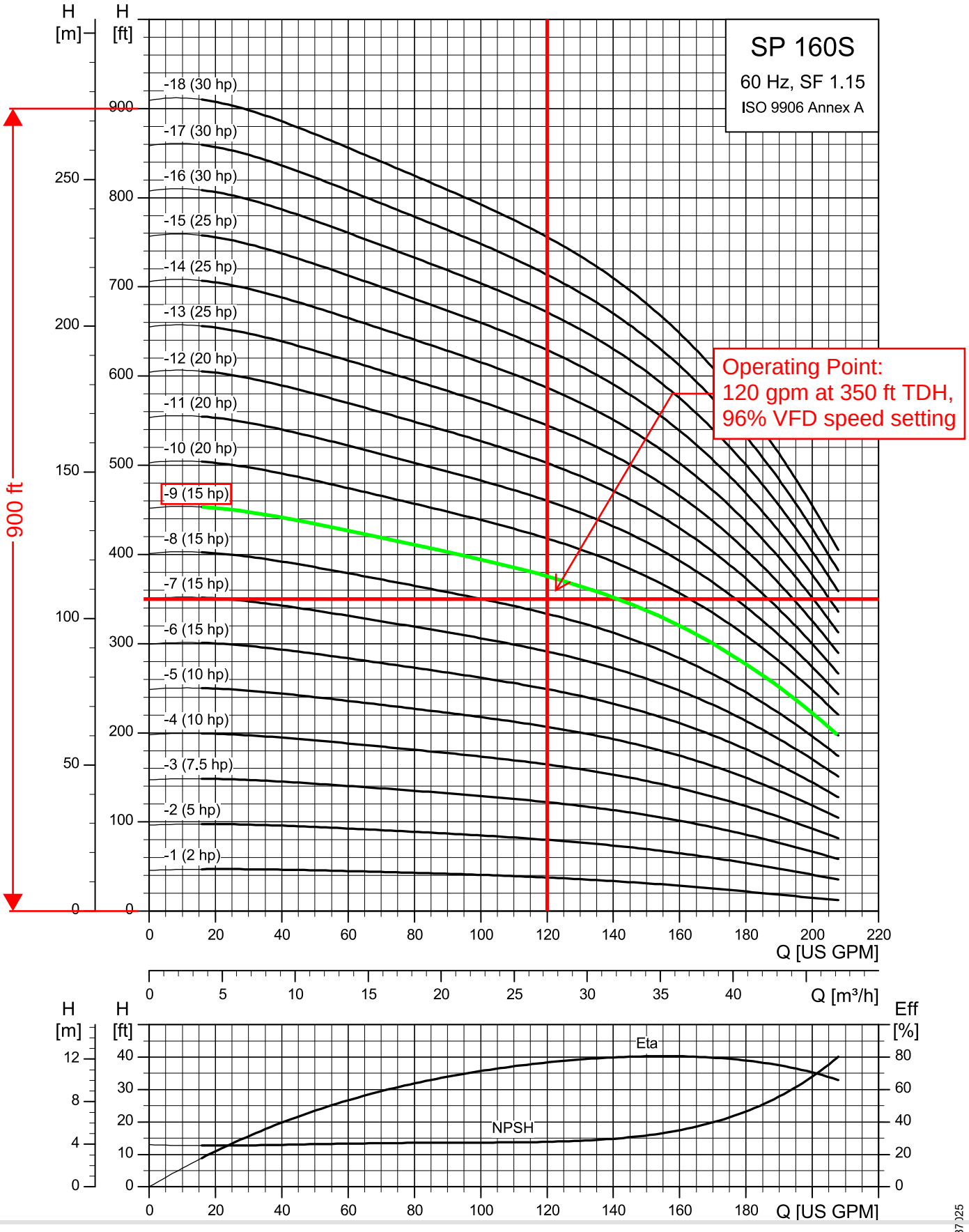
Type key, MS4000C motors

Example: MS4000RESWDMXT4 3 x 380-415/60 10 Hp

Example	MS4000 A	R	E	S	W	D	M	X	T4	3 x 380-415/50	7.5 kW
Pos.	1	2	3	4	5	6	7	8	9	10	11

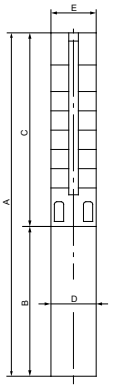
Pos.	Description		
1	Motor type		
	MS4000A	=	MS4000 asynchronous motor
2	Material version		
	Z	=	EN 1.4301
	R	=	EN 1.4539
3	Elastomers		
	B	=	NBR
	E	=	FKM
4	Shaft seal		
	C	=	Hard metal / Ceramic
	S	=	SiC/SiC
	Bearing system		
5	W	=	Ceramic

SP 160S (160 gpm)



SP 160S (160 gpm) pump with 4", 6" motor

Pump model	Nom. head [ft]	Motor					Dimensions [in (mm)]					Net weight (complete) [lb]	160S
		Ph	Volts [V]	[Hp]		[rpm]	A	B	C	D	E		
160S - Motor diameter 4-inch, 3-wire motor, 60 Hz, rated flow rate 160 gpm (3" NPT)													
160S20-1	39	1	230	2	●	3477	33.67 (855)	19.57 (497)	14.10 (358)	3.75 (95)	5.28 (134)	52.0	
	39	3	230	2	■	3474	27.83 (707)	13.74 (3349)	14.10 (358)	3.75 (95)	5.28 (134)	37.0	
	39	3	460	2	■	3474	28.83 (707)	13.74 (349)	14.10 (358)	3.75 (95)	5.28 (134)	37.0	
160S50-2	78	1	230	5	●	3502	44.53 (1131)	26.66 (677)	17.88 (454)	3.75 (95)	5.28 (134)	76.2	
	79	3	230	5	●	3517	40.59 (1031)	22.71 (577)	17.88 (454)	3.75 (95)	5.28 (134)	42.3	
	79	3	460	5	●	3516	40.59 (1031)	22.71 (577)	17.88 (454)	3.75 (95)	5.28 (134)	65.1	
160S75-3	118	3	230	7.5	●	3508	48.30 (1227)	26.65 (677)	21.66 (550)	3.75 (95)	5.28 (134)	80.4	
	118	3	460	7.5	●	3508	48.30 (1227)	26.65 (677)	21.66 (550)	3.75 (95)	5.28 (134)	80.4	
160S100-4	154	3	230	10	●	3473	52.08 (1323)	26.65 (677)	25.44 (646)	3.75 (95)	5.28 (134)	84.7	
	154	3	460	10	●	3473	52.08 (1323)	26.65 (677)	25.44 (646)	3.75 (95)	5.28 (134)	84.7	
160S100-5	195	3	460	10	●	3481	59.0 (1519)	30.59 (777)	29.22 (742)	3.75 (95)	5.28 (134)	97.8	
160S - Motor diameter 6 inch, 60 Hz, rated flow rate 160 gpm (3" NPT)													
160S100-4	155	3	230	10	▲	3482	49.69 (1262)	23.51 (597)	26.19 (665)	5.49 (139.5)	5.59 (142)	109.9	
	156	3	460	10	▲	3493	49.69 (1262)	23.51 (597)	26.19 (665)	5.49 (139.5)	5.59 (142)	109.9	
160S100-5	195	3	230	10	▲	3482	54.65 (1388)	24.69 (627)	29.97 (761)	5.49 (139.5)	5.59 (142)	120.8	
	196	3	460	10	▲	3493	54.65 (1388)	24.69 (627)	29.97 (761)	5.49 (139.5)	5.59 (142)	120.8	
160S150-6	238	3	230	15	▲	3508	60.79 (1544)	27.05 (687)	33.75 (857)	5.49 (139.5)	5.59 (142)	144.9	
	239	3	460	15	▲	3511	60.79 (1544)	27.05 (687)	33.75 (857)	5.49 (139.5)	5.59 (142)	144.9	
160S150-7	276	3	230	15	▲	3492	64.57 (1640)	27.05 (687)	37.52 (953)	5.49 (139.5)	5.59 (142)	149.2	
	277	3	460	15	▲	3496	64.57 (1640)	27.05 (687)	37.52 (953)	5.49 (139.5)	5.59 (142)	149.2	
160S150-8	313	3	230	15	▲	3474	68.35 (1736)	27.05 (687)	41.30 (1049)	5.49 (139.5)	5.59 (142)	153.5	
	314	3	460	15	▲	3480	68.35 (1736)	27.05 (687)	41.30 (1049)	5.49 (139.5)	5.59 (142)	153.5	
160S150-9	357	3	230	15	▲	3496	72.16 (1832)	27.05 (687)	45.08 (1145)	5.49 (139.5)	5.59 (142)	157.8	
	359	3	460	15	▲	3506	72.16 (1832)	27.05 (687)	45.08 (1145)	5.49 (139.5)	5.59 (142)	157.8	
160S200-10	395	3	230	20	▲	3484	78.47 (1993)	29.61 (752)	48.86 (1241)	5.49 (139.5)	5.59 (142)	177.5	
	397	3	460	20	▲	3495	78.47 (1993)	29.61 (752)	48.86 (1241)	5.49 (139.5)	5.59 (142)	177.5	
160S200-11	431	3	230	20	▲	3471	82.25 (2089)	29.61 (752)	52.64 (1337)	5.49 (139.5)	5.59 (142)	181.7	
	435	3	460	20	▲	3483	82.25 (2089)	29.61 (752)	52.64 (1337)	5.49 (139.5)	5.59 (142)	181.7	
160S200-12	477	3	230	20	▲	3490	88.19 (2185)	29.61 (752)	56.42 (1433)	5.49 (139.5)	5.59 (142)	186.0	
	479	3	460	20	▲	3500	88.19 (2185)	29.61 (752)	56.42 (1433)	5.49 (139.5)	5.59 (142)	186.0	
160S250-13	514	3	230	25	▲	3480	91.97 (2336)	31.78 (807)	60.20 (1529)	5.49 (139.5)	5.59 (142)	200.2	
	517	3	460	25	▲	3492	91.97 (2336)	31.78 (807)	60.20 (1529)	5.49 (139.5)	5.59 (142)	200.2	
160S250-14	550	3	230	25	▲	3470	95.75 (2432)	31.78 (807)	63.98 (1625)	5.49 (139.5)	5.59 (142)	204.5	
	554	3	460	25	▲	3482	95.75 (2432)	31.78 (807)	63.98 (1625)	5.49 (139.5)	5.59 (142)	204.5	



E = Maximum diameter of pump including cable guard and motor

Notes:

Control box is required for 3-wire, single-phase applications. Data does not include control box.

Performance conforms to ISO 9906. 1999 (E) Annex A. Minimum submergence is 5 ft (1.5 m).

■	MS402 motor
●	MS4000C motor
▲	MS6000C motor

PD Series

DATA SHEET

Chemical Metering Pump

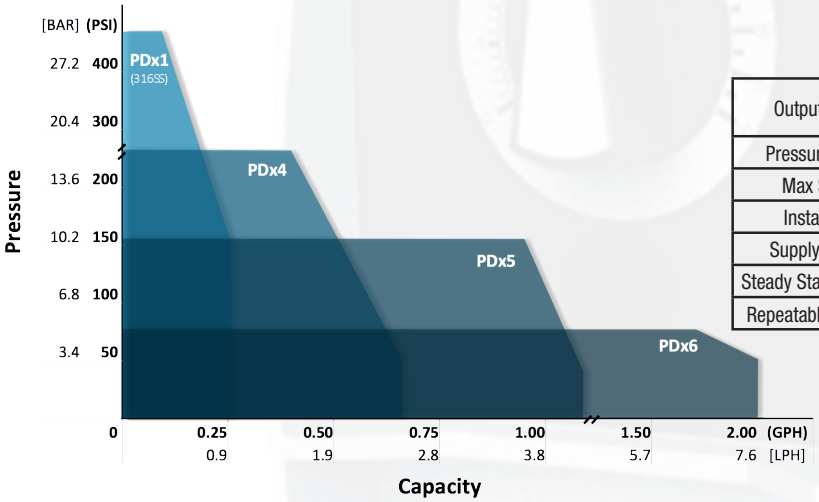
Designed to Last

Introducing the PD Series chemical metering pump, the new standard in water treatment. This upgrade to LMI's most popular pump series includes an improved drive design, all new electronics, and proven FASTPRIME™ liquid ends. Available in Manual or Enhanced control models, the PD Series pump fits seamlessly into your process control application. The Manual model offers straightforward control without the need for tedious calculations. Its split-scale dial ensures precision, even at lower flow rates. The Enhanced model offers external control and a large graphical display to provide intuitive access to advanced features such as calibration assist, system and user totalizers, the new STAYPRIME™ degassing technology, and more.

Trusted by water treatment professionals for more than a generation, the PD Series chemical metering pump will continue to earn your trust for years to come.

Manual Model Enhanced Model

Performance Specifications



Output Range	.002 – 2.0 GPH (.008 – 7.6 LPH)
Pressure Range	50-450 PSI (3.4-30.6 BAR)
Max Stroke	160 SPM
Installation	Indoor/Outdoor
Supply Voltage	115-230V / 50-60Hz
Steady State Accuracy	+/- 3%
Repeatable Accuracy	+/- 3%

FastPrime™ Liquid Ends*

	PSI	GPH	BAR	LPH
PDx1	450	0.10	30.6	0.38
	300	0.20	20.4	0.76
	150	0.25	10.2	0.95
PDx4	250	0.35	17.0	1.32
	150	0.52	10.2	1.97
	50	0.68	3.4	2.57
PDx5	150	0.80	10.2	3.03
	110	1.00	7.5	3.79
	30	1.10	2.0	4.20
PDx6	70	1.70	4.8	6.44
	60	1.85	4.1	7.00
	50	2.00	3.4	7.57

*Standard on PD0 and PD7 models

Features and Benefits

- Shared drive platform with universal 115-230V, 50/60 Hz power supply
- Flows from 2 GPH (7.57 LPH) up to 450 PSI (30.6 BAR)
- Simplified capacity control with constant stroke length to maintain calibration across the adjustable range
- Advanced electronics with dynamic compensation for temperature and voltage conditions
- FastPrime™ liquid ends (standard) that allow fast and easy priming with integrated bleed valve
- AutoPrime™ liquid ends (optional), designed specifically for off-gassing liquids (See page 4 for performance specifications)
- Rugged construction with NEMA 4X/IP 65 housing for the harshest environments and outdoor use
- Compact footprint for efficient use of space in process applications or OEM configuration
- Agency certifications - NSF 61 and 50 (pending), ETL, CE
- Built on decades of experience and fully backed by LMI's two-year warranty

Enhanced Functionality (PD7)

- **2.4" Color LCD** - Intuitive navigation allows you to configure and operate with ease – view status and alerts from a distance to confirm safe operation
- **External Control Inputs** - Automate your process with pulse pacing, remote start/stop, and tank level indication – ideal for proportional dosing
- **Calibration Assist** - Simply draw from a column and adjust the estimated value on-screen to the measured actual – calibration is that easy
- **System & User Totalizers** - An odometer for your pump that logs pump strokes, estimated volume, and power cycles – confirm pump operation between visits
- **StayPrime™ Degassing Technology** - Automates the priming cycle after a period of idle pump time to ensure prime

LMI®
an Accudyne Industries brand

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OUTPUT CODE 1 — 0.25 GPH (0.95 LPH); 450 psi (30.6 bar)

Drive End								
Control								
PD01	Manual Control	-						
PD71	Enhanced Control with Pulse Input, Remote Stop/Start, and Tank Level Input							
	Power Code							
	X	See Power Code Table						
		Liquid End	**Head**	**Fittings**	**Balls**	**Seat / O-Rings**	**Connections**	**RPM Kit**
		Machined FastPrime™						
		907NP	316SS	316SS	316SS	316SS / PTFE	1/4” NPT	RPM-907

PD01	1	-907	N	P

OUTPUT CODE 4 — 0.68 GPH (2.6 LPH); 250 psi (17.0 bar)

Drive End							
Control							
PD04	Manual Control	-					
PD74	Enhanced Control with Pulse Input, Remote Stop/Start, and Tank Level Input						
	Power Code						
	X	See Power Code Table					
	Liquid End	**Head**	**Fittings**	**Balls**	**Seat / O-Rings**	**RPM Kit**	
	Molded FastPrime™						
	822	PVDF	PVDF	Ceramic	PTFE / Polyprel®	RPM-822	
	823	PVDF	PVDF	Ceramic	PTFE / Polyprel®	RPM-823	
	828	PVC	PVC	Ceramic	PTFE /Polyprel®	RPM-822	
	Machined FastPrime™						
	925	PP	PP	Ceramic	PTFE / Polyprel®	RPM-823	
	927	316SS	316SS	316SS	316SS / PTFE	RPM-927	
	928	PVC	PVC	Ceramic	PTFE / Polyprel®	RPM-822	
	929	Acrylic	PVDF	PTFE	Polyprel®	RPM-929	
	920	Acrylic	PVC	Ceramic	PTFE / Polyprel®	RPM-822	
	AutoPrime™						
	A28	PVC	PVC	Ceramic	PTFE / Polyprel®	RPM-A20A	
	A20	Acrylic	PVC	Ceramic	PTFE / Polyprel®	RPM-A20A	

	FastPrime Valve Code		**AutoPrime Valve Code**
	S	with 4 Function Valve	H	with 4 Function Valve
	N	-	A	-

	Connection Code		**Also sold as**
	I	Imperial	2
	M	Metric	3
	P	Pipe (1/4” NPT, 316SS only)	0

PD04	1	- 822	S	I

POWER CODE TABLE

Power Code	Voltage	Frequency	Plug
1	115/230V	50-60 Hz	110-120V US Plug, UL
2	115/230V	50-60 Hz	220-240V US Plug, UL
3	115/230V	50-60 Hz	220-240V DIN Plug, CE
5	115/230V	50-60 Hz	220-240V UK Plug, CE
6	115/230V	50-60 Hz	220-240V Aust/NZ Plug

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OUTPUT CODE 5 — 1.1 GPH (4.2 LPH); 150 psi (10.2 bar)

Drive End

Control

PD05	Manual Control	-
PD75	Enhanced Control with Pulse Input, Remote Stop/Start, and Tank Level Input	

Power Code

X	See Power Code Table

Liquid End	Head	Fittings	Balls	Seat / O-Rings	RPM Kit
Molded FastPrime™					
832	PVDF	PVDF	Ceramic	Polyprel®	RPM-832
833	PVDF	PVDF	Ceramic	PTFE	RPM-833
838	PVC	PVC	Ceramic	Polyprel®	RPM-832
Machined FastPrime™					
935	PP	PP	Ceramic	PTFE	RPM-833
937	316SS	316SS	316SS	316SS / PTFE	RPM-937
938	PVC	PVC	Ceramic	Polyprel®	RPM-832
939	Acrylic	PVDF	PTFE	Polyprel®	RPM-939
930	Acrylic	PVC	Ceramic	Polyprel®	RPM-832
AutoPrime™					
A38	PVC	PVC	Ceramic	PTFE / Polyprel®	RPM-A30A
A30	Acrylic	PVC	Ceramic	PTFE / Polyprel®	RPM-A30A

FastPrime Valve Code		AutoPrime Valve Code	
S	with 4 Function Valve	H	with 4 Function Valve
N	-	A	-

Connection Code		Also sold as
I	Imperial	2
M	Metric	3
P	Pipe (1/4” NPT, 316SS only)	0

PD05	1	- 832	S	I

OUTPUT CODE 6 — 2.0 GPH (7.6 LPH); 70 psi (4.8 bar)

Drive End

Control

PD06	Manual Control	-
PD76	Enhanced Control with Pulse Input, Remote Stop/Start, and Tank Level Input	

Power Code

X	See Power Code Table

1

Liquid End	Head	Fittings	Balls	Seat / O-Rings	RPM Kit
Molded FastPrime™					
842	PVDF	PVDF	Ceramic	Polyprel®	RPM-842
843	PVDF	PVDF	Ceramic	PTFE	RPM-843
848	PVC	PVC	Ceramic	Polyprel®	RPM-842
Machined FastPrime™					
945	PP	PP	Ceramic	PTFE	RPM-843
947	316SS	316SS	316SS	316SS / PTFE	RPM-947
948	PVC	PVC	Ceramic	Polyprel®	RPM-842
949	Acrylic	PVDF	PTFE	Polyprel®	RPM-949
940	Acrylic	PVC	Ceramic	Polyprel®	RPM-842
AutoPrime™					
A48	PVC	PVC	Ceramic	PTFE / Polyprel®	RPM-A40A
A40	Acrylic	PVC	Ceramic	PTFE / Polyprel®	RPM-A40A

FastPrime Valve Code		AutoPrime Valve Code	
S	with 4 Function Valve	H	with 4 Function Valve
N	-	A	-

Connection Code		Also sold as
I	Imperial	2
M	Metric	3
P	Pipe (1/4” NPT, 316SS only)	0

PD06	1	- 842	S	I

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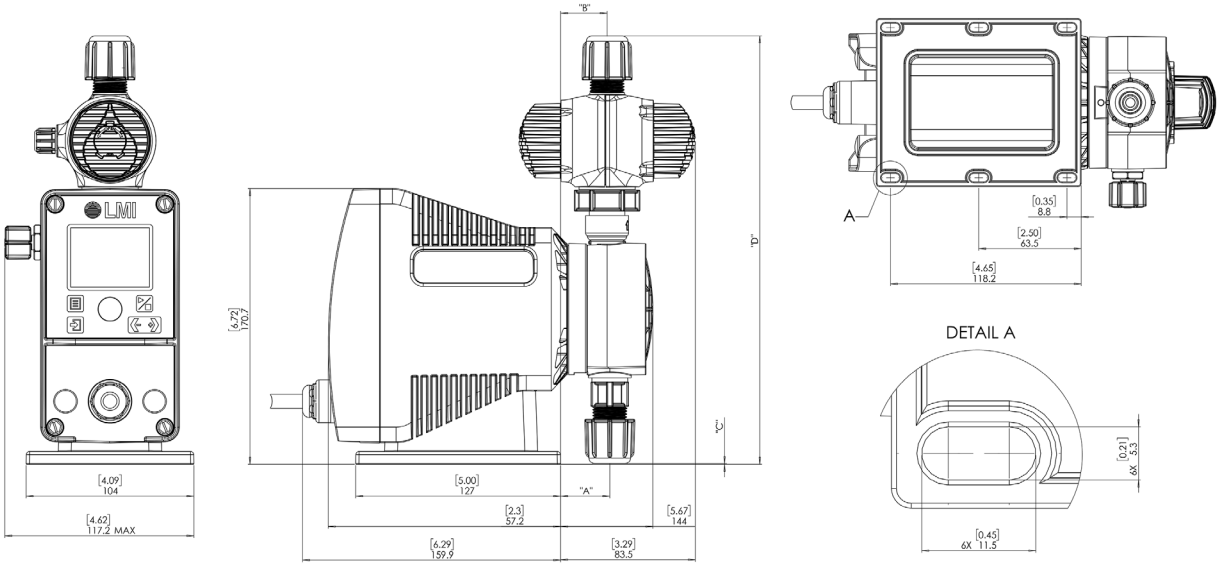
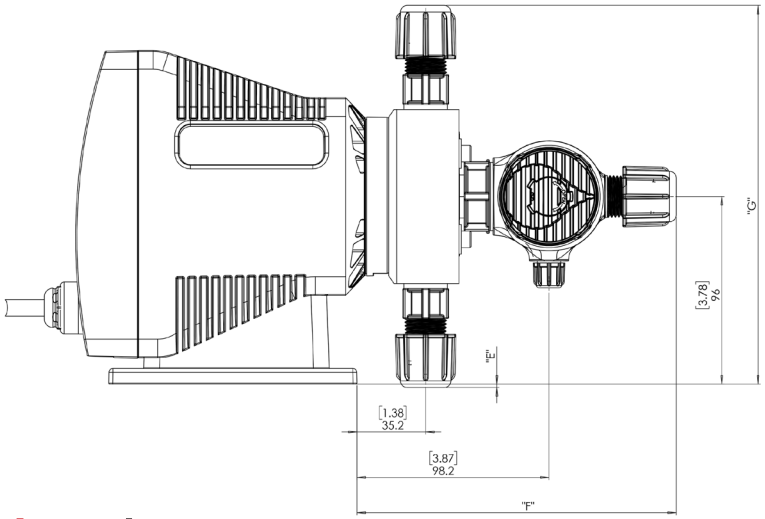
Dimensions



LIQUID END MODEL	"A"		"B"		"C"		"D"	
	INCH	MM	INCH	MM	INCH	MM	INCH	MM
LE-7XXNX	1.20	30.5	1.13	28.8	0.34	8.6	7.84	199.2
LE-7XXNX	1.20	30.5	1.13	28.8	0.34	8.6	10.45	265.4
LE-8XXNX	1.20	30.5	1.13	28.8	0.01	0.3	8.17	207.5
LE-8XXSX	1.20	30.5	1.13	28.8	0.01	0.3	10.45	265.4
LE-90XNX, LE-92XNX, LE-93XNX	1.39	35.2	1.39	35.2	0.10	2.5	7.47	189.7
LE-90XSX, LE-92XSX, LE-93XSX	1.39	35.2	1.39	35.2	0.10	2.5	9.75	247.6
LE-94XNX	1.39	35.2	1.39	35.2	-0.07	-1.8	7.64	194
LE-94XSX	1.39	35.2	1.39	35.2	-0.07	-1.8	9.92	251.9

AUTOPRIME™ LIQUID END



LIQUID END MODEL	"E"		"F"		"G"	
	INCH	MM	INCH	MM	INCH	MM
LE-A1XNX, LE-A2XNX, LE-A3XNX	-0.10	-2.5	4.15	105.4	7.46	189.6
LE-A1XSX, LE-A2XSX, LE-A3XSX	-0.10	-2.5	6.43	163.3	7.46	189.6
LE-A4XNX	0.07	1.8	4.15	105.4	7.63	193.8
LE-A4XSX	0.07	1.8	6.43	163.3	7.63	193.8

Performance Specifications

AutoPrime™ Degassing Liquid Ends

	PSI	GPH	BAR	LPH
PDx4	250	0.20	17.0	0.76
	150	0.30	10.2	1.14
PDx5	110	0.75	7.5	2.84
	50	0.85	3.4	3.22
PDx6	50	1.75	3.4	6.62
	30	1.85	2.0	7.00

Accudyne INDUSTRIES

We are a proud member of Accudyne Industries, a leading global provider of precision-engineered, process-critical and technologically advanced flow control systems and industrial compressors. Delivering consistently high levels of performance, we enable customers in the most important industries and harshest environments around the world to accomplish their missions.

FastPrime is a trademark of Milton Roy, LLC
AutoPrime is a trademark of Milton Roy, LLC
StayPrime is a trademark of Milton Roy, LLC
Polyprel is a registered trademark of Milton Roy, LLC

Contact your local representative to find out more about Series PD Chemical Metering Pumps

www.lmipumps.com
www.relyonLMI.com

LMI® an Accudyne Industries brand

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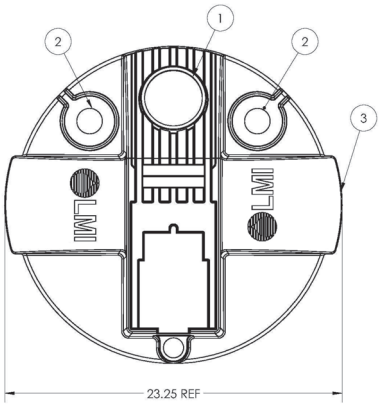
Information Sheet

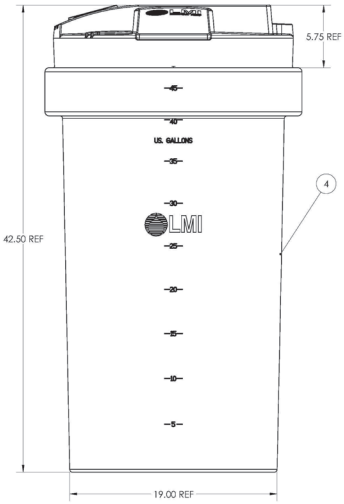
Polyethylene Tank and Cover Assembly and Accessories

MODEL NO. 26350
50 GALLON TANK ASSEMBLY

- Ultraviolet resistant, molded yellow polyethylene tank.
- High rigidity black polyethylene cover with molded recess for mounting of pump, agitator* and liquid level switch.
- 5 gallon (20 liter) graduations
- Self supporting, tapered sides.
- Suitable for most corrosive and noncorrosive solutions.
- Can be nested up to four (4) per carton for shipping economy.
- Certified to NSF/ANSI Standard 61 and 372.

Model No. 26350





COMPONENT PARTS

Ref No.	Part No.	Description	Qty
1	25985	Caplug Assembly Black Polyethylene	1
2	10346	Caplug Assembly Black Polyethylene	2
3*	26637	Cover, Black Polyethylene	1
4	25688	Tank, 50 Gallon Yellow Polyethylene	1

Shipping wt. 25 lbs (11.4 kg)

NOTES:

1. Full, flat bottom support required.
2. Maximum solution/ambient temperature 110° F (43° C)
3. Minimum solution/ambient temperature 0° F (-18°C)
4. Maximum weight limit for cover 50 lbs (23 kg)
5. Not suitable for use with concentrated organic solvents, oils and related materials.

NSF
Certified to NSF/ANSI 61 & 372

Cover must be drilled at factory for agitator mounting. Please indicate your desire for this option when ordering.

LMI

201 Ivyland Road
Ivyland, PA 18974 USA
TEL: (215) 293-0401
FAX: (215) 293-0445
http://www.lmipumps.com

Griffco Valve Inc.
188 Creekside Dr
Amherst, NY 14228 USA
Phone: +1 716 835-0891
Fax: +1 716 835-0893
sales@griffcovalve.com
www.griffcovalve.com

CORPORATION STOPS

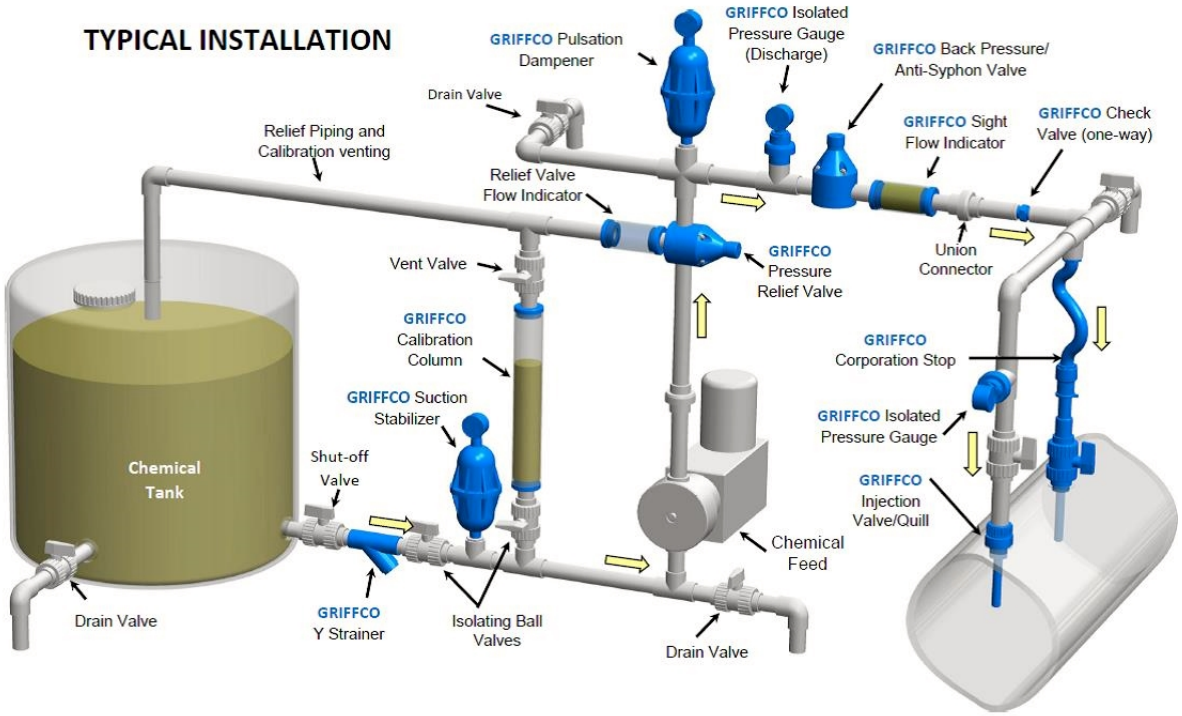
Features:

- **High Reliability / Low Cost**
- **Lead Free Brass Corp stops**
- **Union connections (Threads optional)**
- **Integral ball check valve w/spring**
- **Poppet tip option**
- **Dual lock capability**
- **316SS locking chain**
- **Variable & custom injector lengths**
- **Ball Valves with PTFE seals**
- **Wide range of materials for quills and ball valves**

Griffco corporation stops are designed to ensure chemical feed systems inject into the center of a process stream for better mixing and to prevent corrosion along the process pipe. In addition, they allow for quill servicing without having to turn off or shut down the process or main line. The check valve prevents the process fluid from going back up the chemical line. Robust construction ensures reliability in the rigorous service of municipal and industrial applications. Materials of construction include PVC, CPVC, PVDF, 316 SS, Alloy 20 and Hastelloy C. They are available in sizes 1/2", 3/4", and 1".

Operation:

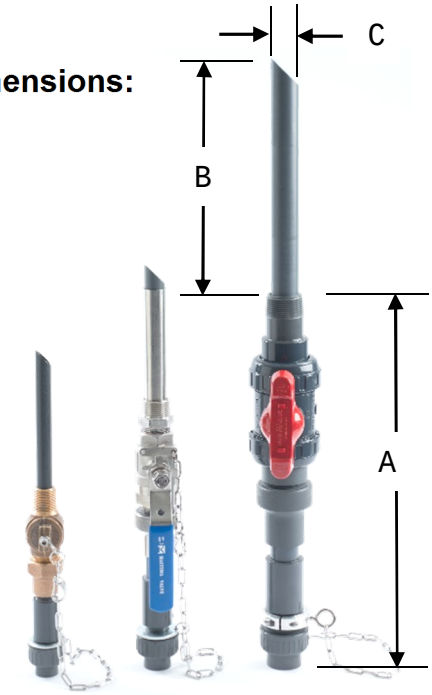
Griffco corporation stops are threaded into a process pipe or tank to deliver chemical to a desired application point. The ball valve allows for separation of the process fluid and chemical being injected for servicing or isolations purposes. The integrated quill keeps the chemical off the wall of the tank or pipe and will ensure better mixing of the chemical with the process fluid. The ball check in the valve functions as a positive shut-off to ensure the process fluid does not go back up the chemical line. The union facilitates an easy connection between the valve and the chemical line. An optional flexible line is available to allow for removing or retracting the quill from the process or main.



Technical Data:

Sizes: Model CS	**1/2", 3/4", and 1"**
Quill Connections:	**Plastic: Union Threaded Connection** **Metal: Male Threads**
Ball Connections	**Threaded: 3/4", 1", 1.25" (NPT, AWWA [Brass only])**
Maximum Temperature: (°F)	**Plastic: 140° ; Metal: 300°**
Maximum Operating Pressure:	**150 psi**
Materials of Construction:	
Ball Valve:	**316SS, Brass(Lead-Free), PVC, PVDF, CPVC, Brass (AWWA threads)**
Optional Check Valve Ball / Spring: **Check Valve Body Matches Quill Material**	**Plastic: PTFE Ball / Hastelloy C Spring** **Metals: 316SS Ball and 316SS Spring (matches body) ,** **A20 – A20 Ball - No Spring**
O Ring:	**Standard: Viton Optional: EPDM**
Union Nut:	**Standard: Plastic: Matches Quill Material** **Metal valve: N/A for threads only. Optional: Others on Request**
Injection Quill:	**PVC, CPVC, PVDF, 316 SS, A 20, Hast. C, Others on Request**
Locking Chain:	**316SS**

Dimensions:

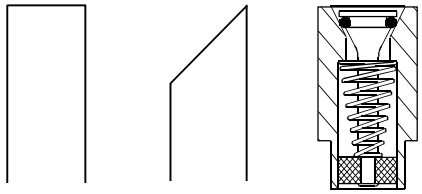


Connection Size	Ball Valve	"A" Length	"B" Quill Length (* std)	"C" Tip OD
½"	¾"	9"	6" *	.75"
¾"	1"	13"	6" *	1"
1"	1.25"	17"	6" *	1.2"

Quill Length	In.	mm
1	1	25
2	2	50
3	3	75
4	4	100
5	5	125
6	6	150
7	7	175
8	8	200
9	9	225
10	10	250
11	11	275
12	12	300
13	13	325
14	14	350
15	15	375
16	16	400
17	17	425
18	18	450
19	19	475
20	20	500
21	21	525
22	22	550
23	23	575
24	24	600

Tip Configurations:

Flat (std) Beveled Poppet



Note: standard configuration is:

- **6" Quill length**
- **Flat tip**
- **Viton O-rings (union only)**
- **Male NPT threads**

Product Codes for Ordering:

CS □ □ □□□ □ □ □

1 2 3 4 5 6

1 = Ball Valve Material

S – 316SS
B – Brass
P – PVC
K – PVDF
CP - CPVC
BW – Brass (AWWA threads)

2 = Check Valve

Blank – No Check
C – w/check valve

3 = Size

050 – 1/2"
075 – 3/4"
100 – 1"

4 = Quill Material

S - 316 SS
A - Alloy 20
C - Hastelloy C
P - PVC
K - PVDF
CP-CPVC

5 = Quill Length

Blank - 6" (Standard)

(Others by request)

6 = Options

Blank – Viton O-ring & flat tip
E – EPDM Union O-ring
B – BSPT threads
S – Socket Conn. (Plastic only)
SD – Metric Socket
X2 – Dual chain lock
TC – PTFE Coated Hast. C Spring
L – Beveled/angled
D – Poppet Tip

Web Site: www.griffcovalve.com **E-mail: sales@griffcovalve.com**

FLOW SWITCH

MODEL Q-10N Q-10VCR

FLEXIBLE DESIGN:

Model Q-10 is provided with three factory adjustable parameters which provide performance flexibility to meet a multitude of applications:

- Paddle Area
- Paddle Length
- Paddle Stiffness

Responds to fluid flow only, independent of line pressure and temperature.

Maximum flow rate should be no more than five times the close point.

Positive stop eliminates fatigue effects of turbulence, vibration and flow surge on flow detecting element.

Small size and low profile provides easy mounting in crowded installations.

Very low pressure drop - typically less than 1.0 psig at normal flow rate.

Quick response.

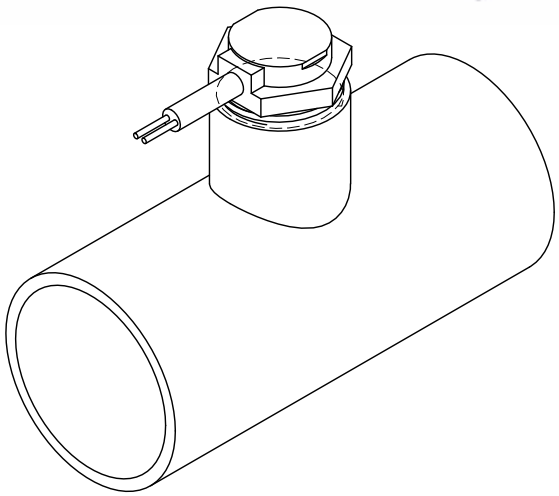
Available with NO, NC or SPDT Reed Switch

Switches 5VDC to 240VAC.

Switches resistive and light inductive loads.

Switch employs magnetic coupling.

Send us your special requirements. We will quote a special unit to meet those requirements.



KEY FEATURES

Flow Range	**0.7–1,025 GPM (2.6–3,880 L/m)**
Working Temp	**200°F (93°C) Maximum**
Working Pressure	**250 psig (1724 kPa)**
Process Connection	**1" NPT**
Electrical (Reed) Switch	**SPNO 0.5A**
Enclosure	**NEMA 4X / IP 66**

TYPICAL USES

Monitoring flow of coolant supplied to:

Brakes and Clutches	Emergency Wash-Down Showers
Computer Systems	Marine and Stationary Engines
Diodes, SCRs, Triacs, etc.	RF and Radar Transmitters
Electromagnets	Spot welders
Fire Sprinkler Flow Alarms	Transformers
Lasers	Vacuum Systems

In Chemical Processing:

Fluid Blending Systems	Liquid Transfer
Heat Transfer Fluids	Monitor Filter Clogging
Liquid Scrubbers	Starting back-up pumps

Monitoring pump output, valve position, systems flow status

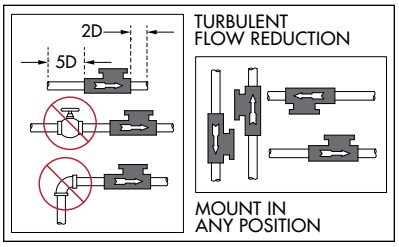
In Water Treatment:

Irrigation Systems	Municipal Water Supply Systems

≋ TYPICAL WORKING FLUIDS

For use in concentrated acids, bases, ketones, esters, alcohols, phenols, etc.

Mild Acids	Hydrocarbons
Mild Bases	Ketones
Plating Solutions	Lubricating Oils
Gasoline	Cooling Tower Water
Glycol Solutions	Water (saltwater, pure, tap, etc.)
JP-4	



HARWIL
541 Kinetic Drive
Oxnard, CA 93030
www.harwil.com
v8.01

Phone: (805) 988-6800
Fax: (805) 988-6804
Email: harwil@harwil.com

MODEL Q-10N Q-10VCR

MODEL SELECTION CHART			
Flow Range (Water calibrated at 70°F / 21°C) Accuracy ±10%			
PIPE SIZE	NOMINAL ON/OFF SWITCH POINT RANGE (GPM)		PADDLE NUMBER
	ON	OFF	
1"	1.3	0.9	1
	4	2	2
1½"	3	2	10691A
	8	4	3
	17	14	4
2"	5	4	10691A
	10	7	5
	16	11	6
3"	12	8	10691A
	22	15	7
	36	25	8
4"	21	14	10691A
	39	27	9
	64	45	10
5"	33	25	10691A
	61	43	11
	100	70	12
6"	48	35	10691A
	88	62	13
	144	101	14
Call our customer support for a wider range of pipe sizes. (805) 988-6800			

SAMPLE PART NUMBER Q-10N/6/NO

Q-10N	/ 13	/ NO	/ 4'
BASE MODEL			
	PADDLE #		
		SWITCH OPERATION (NO, NC, OR SPDT)	
			POWER CORD LENGTH

TECHNICAL SPECIFICATIONS

ELECTRICAL (REED) SWITCH CHARACTERISTICS

SPNO
Contact Ratings:
- AC Voltage (max. switching) 300VAC
- DC Voltage (max. switching) 350VDC
- Current (max. switching) 0.5A
- Current (max. carrying) 2.5A
- Power (max) (VA, W) 50 watts
- Contact resistance (max. initial) 0.15 ohms
- Insulation resistance 1010 ohms
- Operating temperature -40°F–240°F (-40°C–115°C)

OPTIONAL: SPNC or SPDT, 3 watt, 100VAC/VDC.

Q-10N (NORYL®)

WORKING PRESSURE: 200 psig max. @ 70°F
WORKING TEMPERATURE: 180°F @ ambient pressure
WETTED MATERIALS: Body: Noryl® (PPO) (10% glass fibers); Paddle: 316 stainless steel

Q-10VCR (FORTRON®)

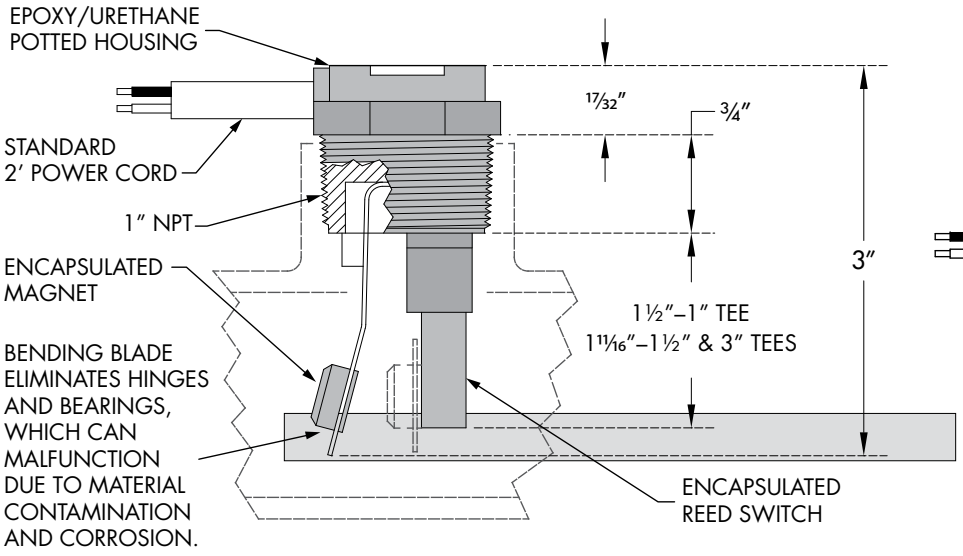
WORKING PRESSURE: 250 psig max. @ 70°F
WORKING TEMPERATURE: 200°F @ ambient pressure
WETTED MATERIALS: Body: Fortron® (PPS) (40% glass fibers); Paddle: HASTELLOY® C

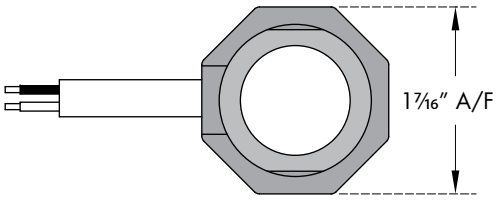
INDUCTIVE LOADS

Switch contacts have been tested with small relays and 30A J-C relay inductive driving coils at 120/240VAC to 500,000 operations without failure.

NOTE: Model Q-10N employs magnetic coupling between bending blade and switch body. Magnetic particles can accumulate on and around magnetic housing which may affect proper operation. Please conduct appropriate fluid magnetic particle evaluation and operational tests prior to and during installation and use.

INSTALLATION DIMENSIONS





- Installation drawing and a numbered parts list is supplied with each unit.
- Special one-day delivery is available.

Pressure Relief/Sustaining Valve

Model 730

- Prioritizing pressure zones
- Ensuring controlled pipeline fill-up
- Preventing pipeline emptying
- Pump overload & cavitation protection
- Safeguarding pump minimum flow
- Excessive line pressure protection

The Model 730 Pressure Relief/Sustaining Valve is a hydraulically operated, diaphragm actuated control valve that can fulfill either of two separate functions. When installed in-line, it sustains minimum pre-set, upstream (back) pressure regardless of fluctuating flow or varying downstream pressure.
When installed as a circulation valve, it relieves excessive line pressure when above maximum pre-set.

Features and Benefits

- **Line pressure driven –** Independent operation
- **Balanced seal disk –** High relief flow capacity
- **In-line serviceable –** Easy maintenance
- **Double chamber design**
  - Moderated valve reaction
  - Protected diaphragm
- **Flexible design –** Easy addition of features
- **Variety of accessories –** Perfect mission matching
- **"Y" or angle, wide body –** Minimized pressure loss
- **Semi-straight flow –** Non-turbulent flow
- **Stainless Steel raised seat –** Cavitation damage resistant
- **Obstacle free, full bore –** Uncompromising reliability
- **V-Port Throttling Plug –** Low flow stability

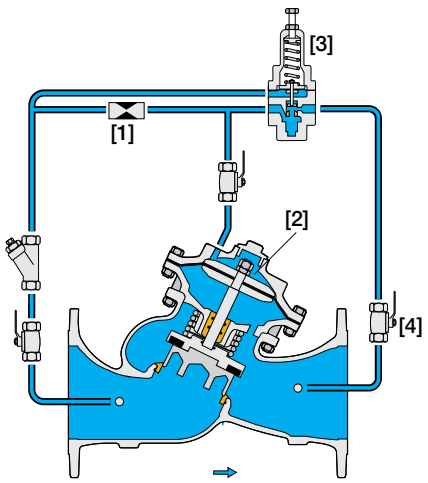
Major Additional Features

- UL Listed and FM Approved for fire protection – **FP-730-UL/FM**
- Solenoid control – **730-55**
- Quick pressure relief valve – **73Q**
- Pressure sustaining & reducing valve – **723**
- Check feature – **730-20**
- High sensitivity pilot – **730-12**
- Level control & pressure sustaining valve – **753**
- Pump control & pressure sustaining valve – **743**
- Pump circulation & pressure sustaining valve – **748**
- Electrically selected multi-level settings – **730-45**
- High sensitivity hydraulic positioning – **730-85**
- Electronic pressure sustaining valve – **738-03**

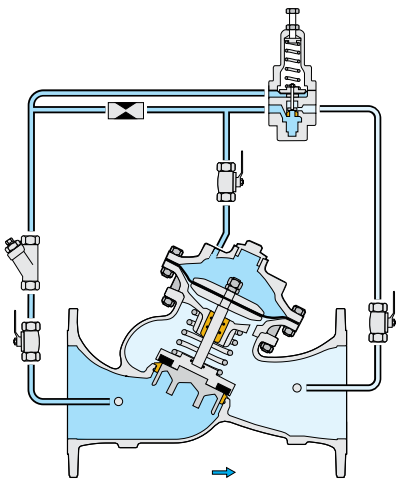
See relevant BERMAD publications.

Operation - Pressure Sustaining (In-Line)

The Model 730 is a pilot controlled valve equipped with an adjustable, 2-Way pressure sustaining pilot.
The restriction **[1]** continuously allows flow from the main valve inlet into the upper control chamber **[2]**. The pilot **[3]** senses upstream pressure and should be set to minimum system pressure allowed.
Should upstream pressure tend to fall below pilot setting, the pilot throttles, enabling pressure to accumulate in the upper control chamber, causing the main valve to throttle, sustaining upstream (back) pressure at pilot setting.
Should upstream pressure be below pilot setting, the pilot closes, causing the main valve to close drip tight. Should upstream pressure tend to rise above pilot setting, the pilot releases accumulated pressure causing the main valve to modulate open.
The downstream cock valve **[4]** enables manual closing.



Valve Regulates

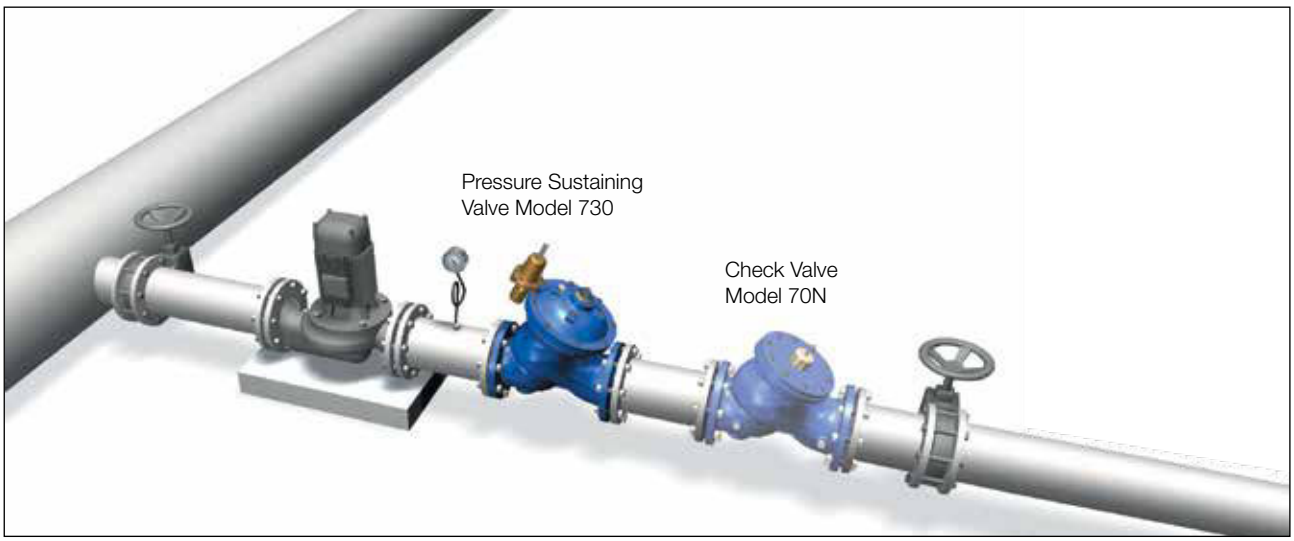


Valve Closed
(Upstream pressure below pilot setting)

Typical Applications

Pump Overload and Cavitation Protection

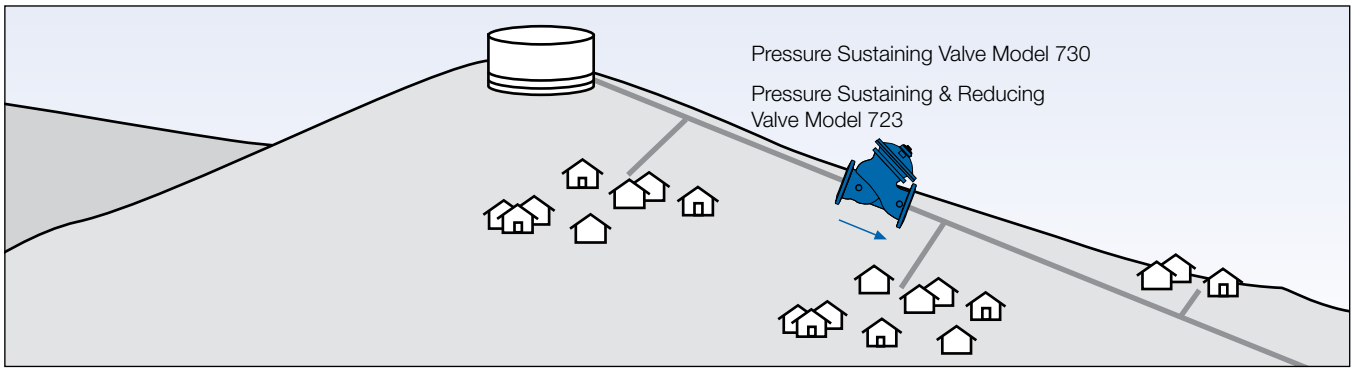
The Model 730 sustains pump discharge pressure, preventing pump overload and cavitation damage caused by excessive demand.
By connecting the pilot sensing line to pump suction, the Model 730 becomes Model 730R which sustains pump suction pressure.
Where suction pressure regimes vary, the Model 736 is needed to limit pump flow by sustaining pump differential pressure.



Prioritizing One Zone over Another

This application is usually found in gravity fed systems. The **Model 730** enables prioritizing the higher elevation zone over downhill consumers when they create excessive total demand.

By adding a pressure reducing feature to the primary pressure sustaining function, the Model 730 becomes a **Model 723** that also protects downhill consumers from over pressure during low demand.



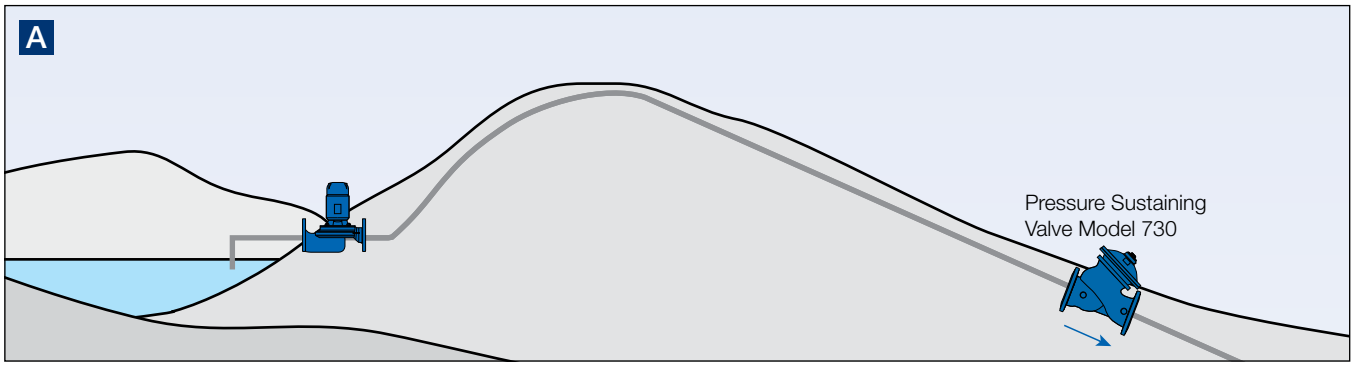
Preventing Line Emptying

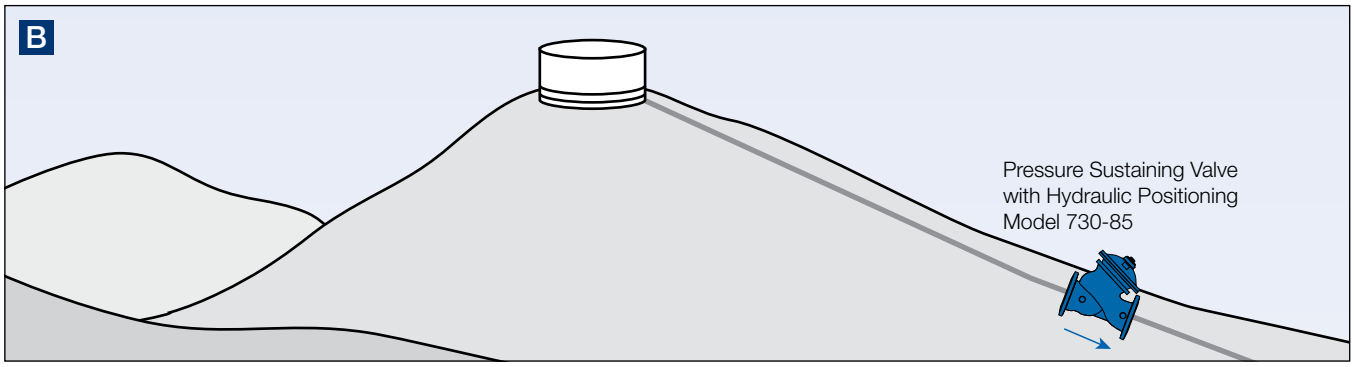
Line emptying presents a serious problem in water distribution networks. Preventing it in downhill networks requires setting the pilot slightly above the elevation differential between the highest point of the line and the valve.

Where a **pump** provides pressure A , the relatively high pressure causes the **Model 730** to open wide. When the pump stops, pressure drops below pilot setting and the valve closes drip-tight preventing line emptying.

Where a **reservoir** provides pressure B , there is only a small potential for variation in pressure (the difference in high and low reservoir levels). The problem is made worse by having a significant part of that potential pressure lost on line friction. The standard Model 730 might not be enough. The solution is to install a valve with very low head loss, super sensitivity, accuracy and repeatability.

Install the **Model 730-85** pressure sustaining with high sensitivity hydraulic positioning.





Pilot System Specifications

Standard Materials:

Pilot:

Body: Stainless Steel 316 or Bronze

Elastomers: Synthetic Rubber

Spring: Galvanized Steel or Stainless Steel

Tubing & Fittings:

Stainless Steel 316 or Copper & Brass

Accessories:

Stainless Steel 316, Brass and Synthetic Rubber Elastomers

Pilot Adjustment Range:

0.5 to 3.0 bar ; 7 to 40 psi

0.8 to 6.5 bar ; 11 to 95 psi

1 to 16 bar ; 15 to 230 psi

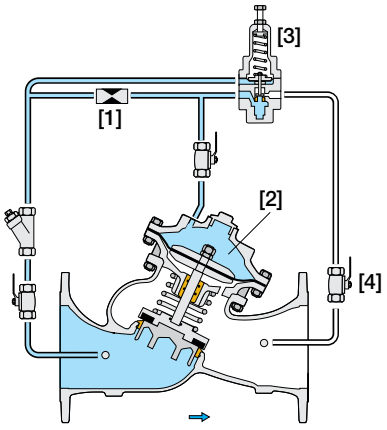
5 to 25 bar ; 70 to 360 psi

Notes:

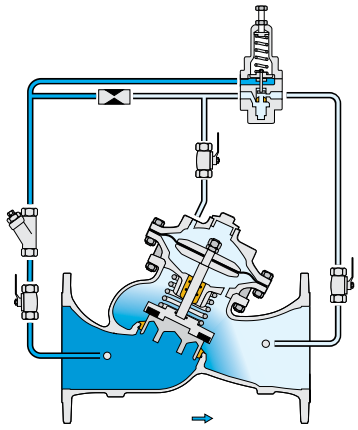
- Inlet pressure, outlet pressure and flow rate are required for optimal sizing and cavitation analysis
- Recommended continuous flow velocity: 0.3-6.0 m/sec ; 1-20 ft/sec
- Minimum operating pressure: 0.7 bar ; 10 psi. For lower pressure requirements consult factory.

Operation - Pressure Relief (Circulation)

The Model 730 is a pilot controlled valve equipped with an adjustable, 2-Way pressure sustaining pilot.
The restriction **[1]** continuously allows flow from the main valve inlet into the upper control chamber **[2]**. The pilot **[3]** senses upstream pressure and should be set slightly above system working pressure.
Should upstream pressure rise above pilot setting, the pilot releases pressure from the upper control chamber, causing the main valve to modulate open, relieving excessive upstream pressure. Should upstream pressure fall, the pilot throttles, enabling pressure to accumulate in the upper control chamber, causing the main valve to throttle closed, sustaining upstream (back) pressure at the pilot setting. Should upstream pressure be below pilot setting, the pilot closes, causing the main valve to close drip tight.
The downstream cock valve **[4]** enables manual closing.



Valve Closed
(Upstream pressure below pilot setting)

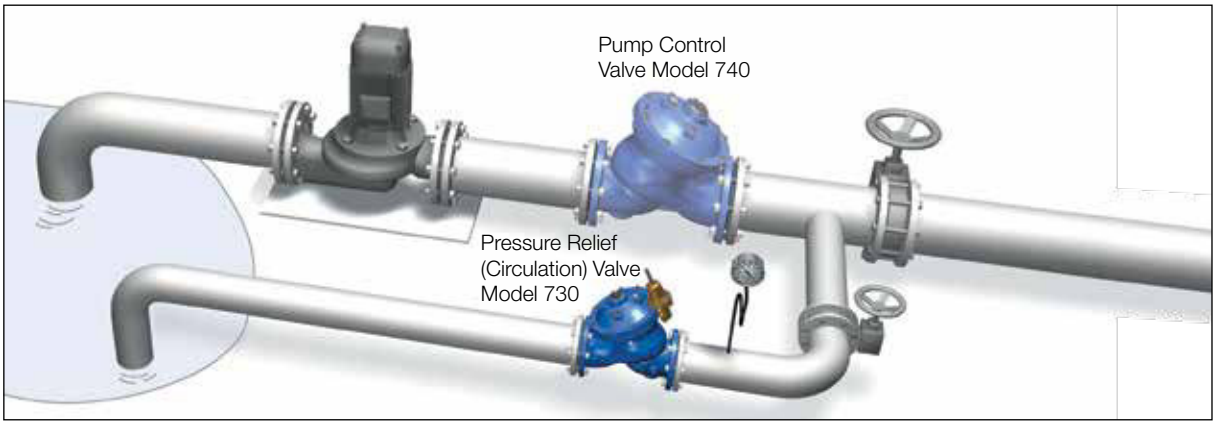


Valve Regulates

Typical Applications

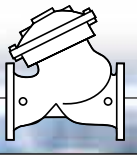
Safeguarding Pump Minimum Flow

The Model 730 relieves over pressure caused by excessive pump discharge during low demand. To keep a constant discharge pressure, the difference between pumped flow and consumer demand can be circulated back to pump suction.



Circulation valves are often exposed to severe cavitation because valve ΔP and velocity are usually high while downstream pressure is very low. On the other hand, the valves operate under these conditions for relatively short periods. Increased valve durability for applications requiring long operating periods will be achieved by using cavitation resistant materials, adding a downstream orifice, installing an upstream pressure reducing valve, increasing valve size, or any combination of these choices.

BERMAD Waterworks



700 Series

Technical Data

Size Range: DN40-900 ; 1½–36”
End Connections (Pressure Ratings):
Flanged: ISO PN16, PN25 (ANSI Class 150, 300)
Threaded: BSP or NPT
Others: Available on request
Valve Patterns: “Y” (globe) & angle, globe (DN600-900 ; 24”-36”)
Working Temperature: Water up to 80°C ; 180°F
Standard Materials:
Body & Actuator: Ductile Iron
Internals: Stainless Steel, Bronze & coated Steel
Diaphragm: Synthetic Rubber Nylon fabric-reinforced
Seals: Synthetic Rubber
Coating: Fusion Bonded Epoxy, RAL 5005 (Blue) approved for drinking water or Electrostatic Polyester Powder

Differential Pressure Calculation

$$\Delta P = \left(\frac{Q}{(Kv;Cv)}\right)^2$$

ΔP = Differential Pressure for fully open valve (bar; psi)

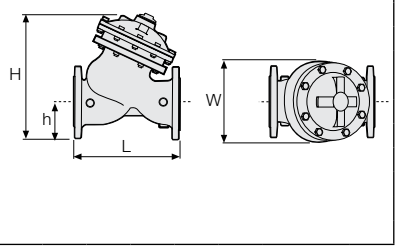
Q = Flow rate (m^3/h; gpm)

Kv = Metric system - valve flow coefficient (flow in m^3/h at 1 bar ΔP with 15°C water)

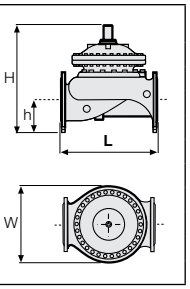
Cv = US system - Valve flow coefficient (flow in gpm at 1 psi ΔP with 60°F water)
Cv = 1.155 Kv

Flow Data & Dimensions Table

		DN / Size	40	1.5”	50	2”	65	2.5”	80	3”	100	4”	150	6”	200	8”	250	10”	300	12”	350	14”	400	16”	450	18”	500	20”
Flow Data	700ES	Kv / Cv - Flat	54	62	57	66	60	69	65	75	145	167	395	456	610	705	905	1,045	1,520	1,756	-	-	2,250	2,599	-	-	4,070	4,701
		Kv / Cv - V-Port	46	53	48	56	51	59	55	64	123	142	336	388	519	599	769	888	1,292	1,492	-	-	1,913	2,209	-	-	3,460	3,996
	700 & 700EN	Kv / Cv - “Y” Flat	42	49	50	58	55	64	115	133	200	230	460	530	815	940	1,250	1,440	1,850	2,140	1,990	2,300	3,310	3,820	3,430	3,960	3,550	4,100
		Kv / Cv - “Y” V-Port	36	41	43	49	47	54	98	113	170	200	391	450	693	800	1,063	1,230	1,573	1,820	1,692	1,950	2,814	3,250	2,916	3,370	3,018	3,490
700-ES	PN16; 25	L (mm / inch)	230	9.1	230	9.1	290	11.4	310	12.2	350	13.8	480	18.9	600	23.6	730	28.7	850	33.5	-	-	1,100	43.3	-	-	1,250	49.2
		W (mm / inch)	150	5.9	165	6.5	185	7.3	200	7.9	235	9.3	300	11.8	360	14.2	425	16.7	530	20.9	-	-	626	24.6	-	-	838	33
		h (mm / inch)	80	3.1	90	3.5	100	3.9	105	4.1	125	4.9	155	6.1	190	7.5	220	8.7	250	9.8	-	-	320	12.6	-	-	385	15.2
		H (mm / inch)	240	9.4	250	9.8	250	9.8	260	10.2	320	12.6	420	16.5	510	20.1	605	23.8	725	28.5	-	-	895	35.2	-	-	1,185	46.7
		Weight (Kg/lb)	10	22	10.8	23.8	13.2	29	15	33	26	57.2	55	121	95	209	148	326	255	561	-	-	437	960	-	-	1,061	2,334
700-EN	PN16; 25	L (mm / inch)	-	-	-	-	-	-	310	12.2	350	13.8	480	18.9	600	23.6	730	28.7	850	33.5	-	-	-	-	-	-	-	-
		W (mm / inch)	-	-	-	-	-	-	200	7.9	235	9.3	320	12.6	390	15.4	480	18.9	550	21.7	-	-	-	-	-	-	-	-
		h (mm / inch)	-	-	-	-	-	-	100	3.9	118	4.6	150	5.9	180	7.1	213	8.4	243	9.6	-	-	-	-	-	-	-	-
		H (mm / inch)	-	-	-	-	-	-	305	12	369	14.5	500	19.7	592	23.3	733	28.9	841	33.1	-	-	-	-	-	-	-	-
		Weight (Kg/lb)	-	-	-	-	-	-	21	46.2	31	68.2	70	154	115	253	198	436	337	741	-	-	-	-	-	-	-	-
700 Flanged	“Y” PN16 Class 150	L (mm / inch)	205	8.1	210	8.3	222	8.7	250	9.8	320	12.6	415	16.3	500	19.7	605	23.8	725	28.5	733	28.9	990	39	1,000	39.4	1,100	43.3
		W (mm / inch)	155	6.1	165	6.5	178	7	200	7.9	223	8.8	320	12.6	390	15.4	480	18.9	550	21.7	550	21.7	740	29.1	740	29.1	740	29.1
		h (mm / inch)	78	3.1	83	3.3	95	3.7	100	3.9	115	4.5	143	5.6	172	6.8	204	8	242	9.5	268	10.6	300	11.8	319	12.6	358	14.1
		H (mm / inch)	239	9.4	244	9.6	257	10.1	305	12	366	14.4	492	19.4	584	23	724	28.5	840	33.1	866	34.1	1,108	43.6	1,127	44.4	1,167	45.9
		Weight (Kg/lb)	9.1	20	10.6	23	13	29	22	49	37	82	75	165	125	276	217	478	370	816	381	840	846	1,865	945	2,083	962	2,121
	“Y” PN25 Class 300	L (mm / inch)	205	8.1	210	8.3	222	8.7	264	10.4	335	13.2	433	17	524	20.6	637	25.1	762	30	767	30.2	1,024	40.3	1,030	40.6	1,136	44.7
		W (mm / inch)	155	6.1	165	6.5	185	7.3	207	8.1	250	9.8	320	12.6	390	15.4	480	18.9	550	21.7	570	22.4	740	29.1	740	29.1	750	29.5
		h (mm / inch)	78	3.1	83	3.3	95	3.7	105	4.1	127	5	159	6.3	191	7.5	223	8.8	261	10.3	295	11.6	325	12.8	357	14.1	389	15.3
		H (mm / inch)	239	9.4	244	9.6	257	10.1	314	12.4	378	14.9	508	20	602	23.7	742	29.2	859	33.8	893	35.2	1,133	44.6	1,165	45.9	1,197	47.1
		Weight (Kg/lb)	10	22	12.2	27	15	33	25	55	43	95	85	187	146	322	245	540	410	904	434	957	900	1984	967	2,132	986	2,174
700 Threaded	“Y” PN16; 25 Class 150; 300	L (mm / inch)	155	6.1	155	6.1	212	8.3	250	9.8																		
		W (mm / inch)	122	4.8	122	4.8	122	4.8	163	6.4																		
		h (mm / inch)	40	1.6	40	1.6	48	1.9	56	2.2																		
		H (mm / inch)	201	7.9	202	8	209	8.2	264	10.4																		
		Weight (Kg/lb)	5.5	12	5.5	12	8	18	17	37																		
	Angle PN16; 25 Class 150; 300	L (mm / inch)	-	-	121	4.8	140	5.5	159	6.3																		
		W (mm / inch)	-	-	122	4.8	122	4.8	163	6.4																		
		R (mm / inch)	-	-	40	1.6	48	1.9	55	2.2																		
		h (mm / inch)	-	-	83	3.3	102	4	115	4.5																		
		H (mm / inch)	-	-	225	8.9	242	9.5	294	11.6																		
		Weight (Kg/lb)	-	-	5.5	12	7	15	15	33																		



		DN / Size	600	24”	700	28”	750	30”	800	32”	900	36”
Globe PN16 Class 150		L (mm / inch)	1,450	57.1	1,650	65	1,750	68.9	1,850	72.8	1,850	72.8
		W (mm / inch)	1,250	49.2	1,250	49.2	1,250	49.2	1,250	49.2	1,250	49.2
		h (mm / inch)	470	18.5	490	19.3	520	20.5	553	21.8	600	23.6
		H (mm / inch)	1,965	77.4	1,985	78.1	2,015	79.3	2,048	80.6	2,095	82.5
		Weight (Kg/lb)	3,250	7,150	3,700	8,140	3,900	8,580	4,100	9,020	4,250	9,350
Globe PN25 Class 300		L (mm / inch)	1,500	59.1	1,650	65	1,750	68.9	1,850	72.8	1,850	72.8
		W (mm / inch)	1,250	49.2	1,250	49.2	1,250	49.2	1,250	49.2	1,250	49.2
		h (mm / inch)	470	18.5	490	19.3	520	20.5	553	21.8	600	23.6
		H (mm / inch)	1,965	77.4	1,985	78.1	2,015	79.3	2,048	80.6	2,095	82.5
		Weight (Kg/lb)	3,500	7,700	3,700	8,140	3,900	8,580	4,100	9,020	4,250	9.370



Specify when ordering:

- Size
- Main model
- Additional features
- Pattern
- Body material
- End connection
- Coating
- Voltage & main valve position
- Tubing & Fittings materials
- Operational data (according to model)
- Pressure data
- Flow data
- Reservoir level data
- Settings

* Use Bermad’s Waterworks Ordering Guide

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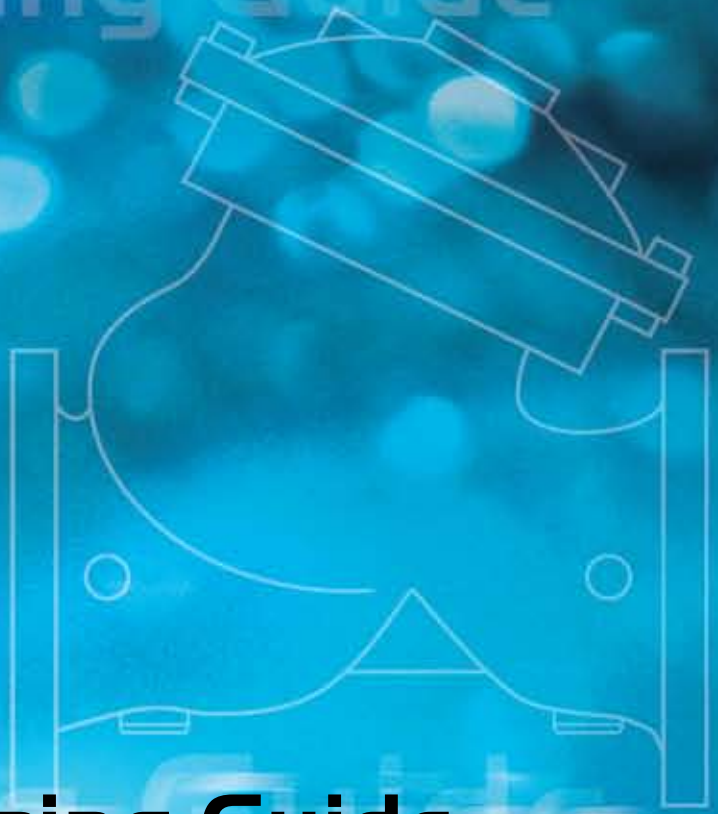
Ordering Guide

- Sector
- Size
- Primary Feature
- Additional Feature
  (Multiple Chioces Permitted)
- Pattern
- Construction Materials
- End Connections
- Coatings
- Voltage-Main Valve Position
  (When Solenoid De-energized)
- Tubing & Fittings
- Additional Attributes Unlimited Selection



BERMAD Ordering Guide

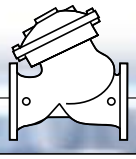
Hydraulic Control Valves

700 Series

Water Control Solutions

BERMAD

BERMAD Waterworks



Ordering Guide

700 Series

WW | **6"** | **720** | **55** | **Y** | **C**

Sector	Code
Waterworks	**WW**
Drinking Water	WD
WW Aggressive Water	WA
WW Seawater	WS
WW Air Conditioning	WC
WW Hot Water	WH

Pattern	Code
Oblique (1½-20")	**Y**
Angle (1½-18")	A
Globe(24-36")	G

Construction Materials	Code
Ductile Iron	**C**
Cast Steel	S
Stainless Steel 316	N
Nickel Aluminum Bronze	U

Other materials available on request.

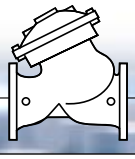
Size	
1½"	DN40
2"	DN50
2½"	DN65
3"	DN80
4"	DN100
5"	DN125
6"	DN150
8"	DN200
10"	DN250
12"	DN300
14"	DN350
16"	DN400
18"	DN450
20"	DN500
24"	DN600
28"	DN700
30"	DN750
32"	DN800
36"	DN900

Primary Features	Code
Basic Valve (Double Chambered Actuator)	700
Basic Valve (Single Chambered Actuator)	705
Solenoid Controlled Valve	710
Electronic Control Valve	718
Pressure Management Valve, Flow Compensated PRV	7PM
Pressure Reducing Control Valve	720
Pressure Sustaining & Reducing Valve	723
Differential Pressure Reducing Valve	726
Flow Control Valve, Constant Downstream Pressure	727
Electronic Pressure Reducing Valve	728
Pressure Sustaining Valve	730
Pressure Relief Valve, Quick Type	73Q
Pressure Sustaining Valve Remote Sensing Type	730R
Surge Anticipating Valve	735
Differential Pressure Sustaining Valve	736
Electronic Pressure Sustaining Valve	738
Booster Pump Control Valve, Single Chambered Actuator	740
Booster Pump Control Valve, Double Chambered Actuator	74Q
Booster Pump Control & Pressure Reducing Valve	742
Booster Pump Control & Pressure Sustaining Valve	743
Deep Well Pump Hydraulic Control Valve	744
Deep Well Pump Electric Control Valve	745
Booster Pump & Flow Control Valve	747
Pump Circulation & Pressure Sustaining Valve	748
Pump Circulation & Flow Control Valve	749
Level Control Valve	750
Level Control & Pressure Sustaining Valve	753
Level & Flow Control Valve	757
Level Sustaining Valve (Reservoir Outlet)	75A
Hydraulic Check Valve	760
Flow Control Valve	770
Flow Control & Pressure Reducing Valve	772
Flow Control & Pressure Sustaining Valve	773
Burst Control Valve (Excessive Flow)	790
Burst Control & Pressure Reducing Valve	792
Check Valve (Lift Type)	70N
Strainer (Stone and Gravel Trap)	70F

Other primary features available on request.

Additional Features (Multiple Choices Permitted)	Code
No Additional Feature	00
Closing and Opening Speed Control	03
Differential Pressure	06
Hydraulic Override	09
Check-Lock	11
High Sensitivity Pilot	12
Electronic Control	18
Check Feature	20
Independent Flow Check (24-32" only)	2S
Solenoid Controlled & Check Feature	25
Pressure Reducing Feature	2Q
Two-Stage Opening	30
Relief Override	3Q
Electrically Selected Multi-Level Setting	45
Downstream Over Pressure Guard	48
Closing Surge Prevention	49
Motorized Pilot	4S
Electronic Multi-Level Setting - Type 4R	4R
Electronic Multi-Level Setting - Type 4T	4T
Hydraulic Control	50
Hydraulic Accelerator Control	54
Solenoid Controlled	55
Electric Override	59
Modulating Horizontal Float	60
Bi-Level Electric Float	65
Bi-Level Vertical Float	66
Modulating Vertical Float	67
Bi-Directional Flow	70
Altitude Pilot	80
Modulating Altitude Control	82
Sustaining Altitude Pilot	83
Hydraulic Positioning	85
Bi-Level Altitude Control	86
Altitude Control with Bi-Directional Flow	87
2-6 meter ; 7-20 feet Setting	M1
2-14 meter ; 7-46 feet Setting	M6
5-22 meter ; 17-72 feet Setting	M5
15-35 meter ; 49-115 feet Setting	M4
25-70 meter ; 82-230 feet Setting	M8
Closing at Downstream Pressure Drop	91
Proportional	PD

Other additional features available on request.



I6 **EB** **4AC** **CB** **F**

	End Connections		Code
Flanged	ISO - 10		10
	ISO - 16		16
	ISO - 25		25
	ANSI - 150		A5
	ANSI - 300		A3
	BST - D		BD
	JIS - 16		J6
	JIS - 20		J2
Threaded	BSP	(up to 3")	BP
	BSP - 25 bar		PH
	NPT		NP
	NPT - 25 bar		NH

Other end connections available on request.

		Voltage-Main Valve Position (When Solenoid De-energized)	Code
24V	AC	24VAC/50Hz - Normally Closed	4AC
		24VAC/50Hz - Normally Open	4AO
		24VAC/50Hz - Last Position	4AP
		24VAC/60Hz - Normally Closed	46C
		24VAC/60Hz - Normally Open	46O
		24VAC/60Hz - Last Position	46P
	DC	24VDC - Normally Closed	4DC
		24VDC - Normally Open	4DO
		24VDC - Last Position	4DP
		24VDC - Latch Solenoid	4DS
220V	AC	220VAC/50-60Hz Last Position	2AP
		220VAC/50-60Hz Normally Closed	2AC
		220VAC/50-60Hz Normally Open	2AO
		220VAC/50-60Hz Motorized Ball Valve - Last Position	2AM
	DC	220VDC - Normally Closed	2DC
		220VDC - Normally Open	2DO
		220VDC - Latch Solenoid	2DS
110V	AC	110VAC/50 - 60Hz Normally Closed	5AC
		110VAC/50 - 60Hz Normally Open	5AO
	DC	110VDC - Normally Closed	5DC
		110VDC - Normally Open	5DO
		110VDC - Latch Solenoid	5DS

Other electrical ratings available on request.

Tubing & Fittings	Code
St. St. 316 Tubing & Fittings	NN
Copper Tubing & Brass Fittings	CB
Plastic Reinforced Tubing & Brass Fittings	PB
Monel Tubing & Fittings	MM

Reduction Ratios Table

Valve Size	Plug Type	
	Flat Disk	V-Port
1½ - 2½" DN40 - 65	3.7	4
3" DN80	2.6	2.9
4" DN100	2.5	2.8
6" DN150	2.5	2.7
8" DN200	2.4	2.6
10" DN250	2.3	2.5
12-14" DN300 - 350	2.2	2.4
16-20" DN400 - 500	2.2	2.3
24-36" DN600 - 900	2.2	2.3

- The reduction ratios are based on flow velocity of 2.0-3.0 m/sec.
- Reduction ratio may vary at extreme flow velocity & upstream pressure.

Coatings	Code
Epoxy FB Blue RAL 5005	**EB**
Polyester Green RAL 6017	PG
Polyester Blue RAL 5010	PB
Uncoated	UC

Transparent Polyurethane top coating is available for epoxy coated valves. Other coatings available on request.

Additional Attributes Unlimited Selection	Code
V-Port Throttling Plug (U-Type)	V
Large Control Filter	F
Valve Position Indicator	I
Electric Limit Switch	S
Valve Position Transmitter	Q
Flow Stem	M
Lifting Spring	L
Balancing Piston Assembly	G
Orifice Assembly	U
Pressure Separator	d
Double Chambered (Active)	B
3-Way Control Loop	X
Manual Selector	Z
Flow Over the Seat	O
St. St. 316 Control Accessories	N
St. St. 316 Actuator Internal Assembly	D
St. St. 316 Internal Trim (Closure & Seat)	T
Delrin Bearing	R
High Grade Bearing & Stem	K
St. St. Bolts & Nuts	m
Special Elastomers for Seals & Diaphragm	E
Pressure Gauge	6

Other additional attributes are optional.
Please consult our sales department for further information.

BERMAD Standard Configuration

Ordering Guide

BERMAD Ordering Guide

Hydraulic Control Valves | 700 Series

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P07WE01 09

Flow Control Valve
with Solenoid Control

Model 770-55-U

- Limiting consumers over demand
- Controlling pipeline fill rate
- Pump overload & cavitation protection
- Switching between “on-duty” valves
- Selecting system flow regime

The Model 770-55-U Flow Control Valve with Solenoid Control is a hydraulically operated, diaphragm actuated control valve that maintains preset maximum flow, regardless of fluctuating demand or varying system pressure. The valve opens and shuts off in response to an electric signal.

Features and Benefits

- **Line pressure driven –** Independent operation
- **Hydraulic flow sensor (upstream installation)**
  - No moving parts
  - No electronic components
  - No need for flow straightening
- **Solenoid controlled**
  - Low power consumption
  - Wide range of pressure and voltage
  - Normally Open, Normally Closed or Last Position
- **In-line serviceable –** Easy maintenance
- **Double chamber design**
  - Moderated valve reaction
  - Protected diaphragm
- **Semi-straight flow –** Non-turbulent flow
- **Stainless Steel raised seat –** Cavitation damage resistant
- **Obstacle free, full bore –** Uncompromising reliability
- **V-Port Throttling Plug –** Low flow stability

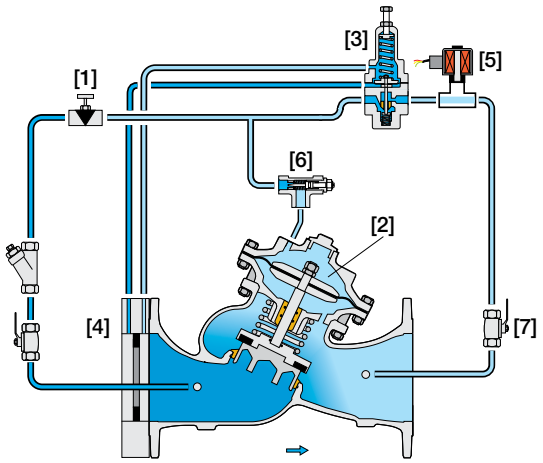
Major Additional Features

- Flow control (constant downstream pressure) – **727-U**
- Solenoid control & check feature – **770-25-U**
- High sensitivity pilot – **770-55-12-U**
- Pressure Reducing – **772-U**
- Electric override – **770-59-U**
- Level & flow control valve – **757-U**
- Pump & flow control valve – **747-U**
- Electronic control valve – **718-03**

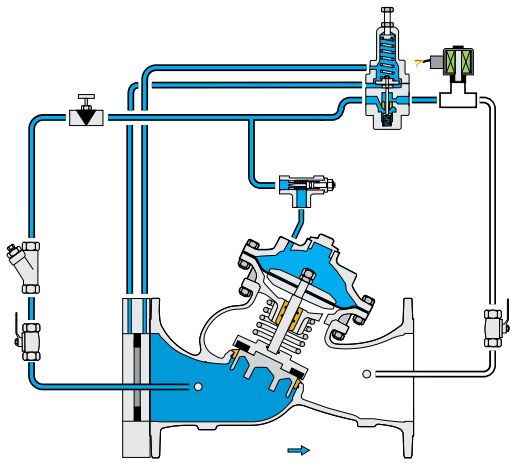
See relevant BERMAD publications.

Operation

The Model 770-55-U is a pilot controlled valve equipped with an adjustable, 2-Way flow pilot, an orifice assembly, and a solenoid pilot.
The needle valve **[1]** continuously allows flow from valve inlet into the upper control chamber **[2]**. The pilot **[3]** senses the differential pressure across the orifice plate **[4]**, and together with the solenoid **[5]**, controls outflow from the upper control chamber. Should orifice differential pressure rise above pilot setting, the pilot throttles, enabling pressure to accumulate in the upper control chamber, causing the main valve to throttle closed, thereby limiting flow to the pilot setting. Should orifice differential pressure fall below pilot setting, the pilot releases accumulated pressure causing the main valve to modulate open. Should the solenoid close, pressure in the upper control chamber accumulates causing the main valve to shut off.
Normally Closed, Normally Open and Last Position models are available.
The needle valve controls the closing speed.
The one-way flow control needle valve **[6]** stabilizes the valve's reaction in hard regulation conditions, by restricting the flow out of the control chamber.
The downstream cock valve **[7]** enables manual closing.



Energized Solenoid
Flow Control Mode



De-energized Solenoid
Valve Closed

Pilot System Specifications

Standard Materials:

Pilot:
Body: Stainless Steel 316 or Bronze
Elastomers: Synthetic Rubber
Spring: Stainless Steel
Solenoid:
Body: Brass or Stainless Steel
Elastomers: NBR or FPM
Enclosure: Molded epoxy
Tubing & Fittings:
Stainless Steel 316 or Copper & Brass
Accessories:
Stainless Steel 316, Brass and Synthetic Rubber Elastomers
Orifice Assembly:
Body: Fusion Bonded Epoxy Steel or Stainless Steel
Orifice Plate: Stainless Steel

Solenoid Electrical Data:

Voltages:
(ac): 24, 110-120, 220-240, (50-60Hz)
(dc): 12, 24, 110, 220
Power Consumption:
(ac): 30 VA, inrush; 15 VA (8W), holding or
70 VA, inrush; 40 VA (17.1W), holding
(dc): 8-11.6W

Values might vary according to specific solenoid model

Notes:

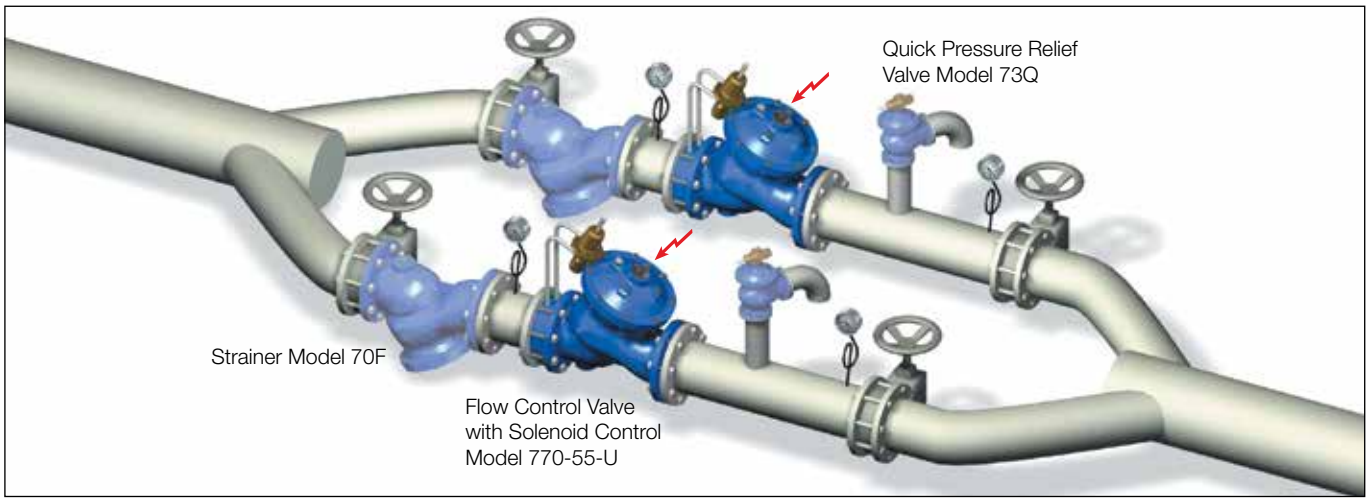
- Orifice diameter is calculated for each valve.
- Flow Setting Range:
  (-)15% & (+)25% from predetermined flow
- The orifice additional head loss is 0.2 bar ; 2.8 psi
- Orifice assembly adds 25mm ; 1" to valve length
- Recommended continuous flow velocity:
  0.3-6.0 m/sec ; 1-20 ft/sec
- Minimum operating pressure: 0.7 bar ; 10 psi.
  For lower pressure requirements consult factory
- When minimum head loss is essential and flow velocity is higher than 1.0 m/sec, consider using the Model 770-j equipped with a pitot tube flow sensor and high sensitivity flow pilot #7

Typical Applications

Parallel Valve Installation

In a distribution network, there is often a need to respond to several flow regimes. In flow control valves, the orifice limits the valve adjustment range to about ±15%. Parallel installation of two Model 770-55-U valves enable:

- Flow limiting for various flow regimes
- Equalizing operating hours between valves

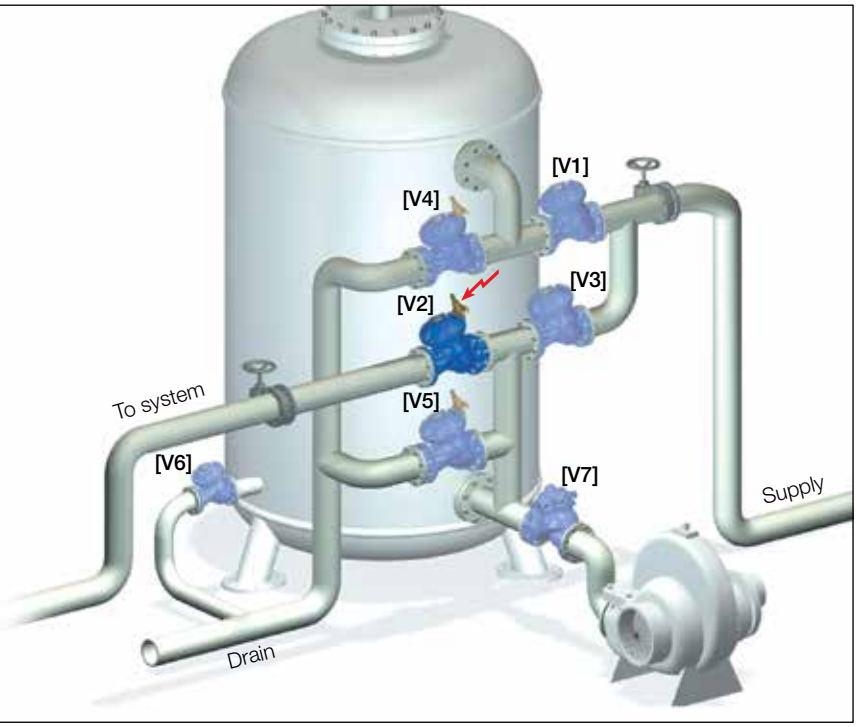


Filtration Systems

In a filter battery, installed as part of a water treatment system, excessive flow through any of the filters might cause:

- Unequal filter loading and blocking
- Reduced filter efficiency
- Structural damage to the filter element

The Model 770-55-U **[V2]** maintains the pre-set maximum flow through each of the filters. The solenoid control enables disconnecting each filter (in turn) from the filtration process allowing periodic back flushing.



[V1] Untreated water inlet - Model 710 (N.O.)
[V2] Treated water outlet - Model 770-55-U (N.O.)
[V3] Back flushing inlet - Model 710 (N.C.)
[V4] Back flushing outlet - Model 727-55-U (N.C.)
[V5] Rinse water outlet - Model 727-55-U (N.C.)
[V6] Scrubbing level drain - Model 710-B (N.C.)
[V7] Air scrubbing inlet - Model 710-B (N.C.)

See relevant BERMAD publications.

Technical Data

Size Range: DN40-900 ; 1½–36"
End Connections (Pressure Ratings):
Flanged: ISO PN16, PN25 (ANSI Class 150, 300)
Threaded: BSP or NPT
Others: Available on request
Valve Patterns: "Y" (globe) & angle, globe (DN600-900 ; 24"-36")
Working Temperature: Water up to 80°C ; 180°F
Standard Materials:
Body & Actuator: Ductile Iron
Internals: Stainless Steel, Bronze & coated Steel
Diaphragm: Synthetic Rubber Nylon fabric-reinforced
Seals: Synthetic Rubber
Coating: Fusion Bonded Epoxy, RAL 5005 (Blue) approved for drinking water or Electrostatic Polyester Powder

Differential Pressure Calculation

$$\Delta P = \left(\frac{Q}{(Kv;Cv)}\right)^2$$

ΔP = Differential Pressure for fully open valve (bar; psi)

Q = Flow rate (m^3/h; gpm)

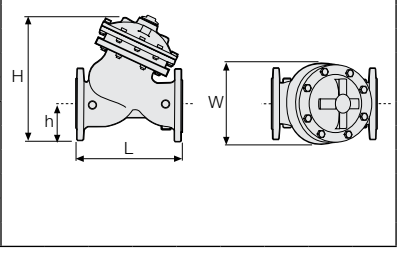
Kv = Metric system - valve flow coefficient (flow in m^3/h at 1 bar ΔP with 15°C water)

Cv = US system - Valve flow coefficient (flow in gpm at 1 psi ΔP with 60°F water)

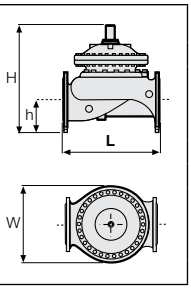
Cv = 1.155 Kv

Flow Data & Dimensions Table

		DN / Size	40	1.5"	50	2"	65	2.5"	80	3"	100	4"	150	6"	200	8"	250	10"	300	12"	350	14"	400	16"	450	18"	500	20"
Flow Data	700ES	Kv / Cv - Flat	54	62	57	66	60	69	65	75	145	167	395	456	610	705	905	1,045	1,520	1,756	-	-	2,250	2,599	-	-	4,070	4,701
		Kv / Cv - V-Port	46	53	48	56	51	59	55	64	123	142	336	388	519	599	769	888	1,292	1,492	-	-	1,913	2,209	-	-	3,460	3,996
	700 & 700EN	Kv / Cv - "Y" Flat	42	49	50	58	55	64	115	133	200	230	460	530	815	940	1,250	1,440	1,850	2,140	1,990	2,300	3,310	3,820	3,430	3,960	3,550	4,100
		Kv / Cv - "Y" V-Port	36	41	43	49	47	54	98	113	170	200	391	450	693	800	1,063	1,230	1,573	1,820	1,692	1,950	2,814	3,250	2,916	3,370	3,018	3,490
700-ES	PN16; 25	L (mm / inch)	230	9.1	230	9.1	290	11.4	310	12.2	350	13.8	480	18.9	600	23.6	730	28.7	850	33.5	-	-	1,100	43.3	-	-	1,250	49.2
		W (mm / inch)	150	5.9	165	6.5	185	7.3	200	7.9	235	9.3	300	11.8	360	14.2	425	16.7	530	20.9	-	-	626	24.6	-	-	838	33
		h (mm / inch)	80	3.1	90	3.5	100	3.9	105	4.1	125	4.9	155	6.1	190	7.5	220	8.7	250	9.8	-	-	320	12.6	-	-	385	15.2
		H (mm / inch)	240	9.4	250	9.8	250	9.8	260	10.2	320	12.6	420	16.5	510	20.1	605	23.8	725	28.5	-	-	895	35.2	-	-	1,185	46.7
		Weight (Kg/lb)	10	22	10.8	23.8	13.2	29	15	33	26	57.2	55	121	95	209	148	326	255	561	-	-	437	960	-	-	1,061	2,334
700-EN	PN16; 25	L (mm / inch)	-	-	-	-	-	-	310	12.2	350	13.8	480	18.9	600	23.6	730	28.7	850	33.5	-	-	-	-	-	-	-	-
		W (mm / inch)	-	-	-	-	-	-	200	7.9	235	9.3	320	12.6	390	15.4	480	18.9	550	21.7	-	-	-	-	-	-	-	-
		h (mm / inch)	-	-	-	-	-	-	100	3.9	118	4.6	150	5.9	180	7.1	213	8.4	243	9.6	-	-	-	-	-	-	-	-
		H (mm / inch)	-	-	-	-	-	-	305	12	369	14.5	500	19.7	592	23.3	733	28.9	841	33.1	-	-	-	-	-	-	-	-
		Weight (Kg/lb)	-	-	-	-	-	-	21	46.2	31	68.2	70	154	115	253	198	436	337	741	-	-	-	-	-	-	-	-
700 Flanged	"Y" PN16 Class 150	L (mm / inch)	205	8.1	210	8.3	222	8.7	250	9.8	320	12.6	415	16.3	500	19.7	605	23.8	725	28.5	733	28.9	990	39	1,000	39.4	1,100	43.3
		W (mm / inch)	155	6.1	165	6.5	178	7	200	7.9	223	8.8	320	12.6	390	15.4	480	18.9	550	21.7	550	21.7	740	29.1	740	29.1	740	29.1
		h (mm / inch)	78	3.1	83	3.3	95	3.7	100	3.9	115	4.5	143	5.6	172	6.8	204	8	242	9.5	268	10.6	300	11.8	319	12.6	358	14.1
		H (mm / inch)	239	9.4	244	9.6	257	10.1	305	12	366	14.4	492	19.4	584	23	724	28.5	840	33.1	866	34.1	1,108	43.6	1,127	44.4	1,167	45.9
		Weight (Kg/lb)	9.1	20	10.6	23	13	29	22	49	37	82	75	165	125	276	217	478	370	816	381	840	846	1,865	945	2,083	962	2,121
	"Y" PN25 Class 300	L (mm / inch)	205	8.1	210	8.3	222	8.7	264	10.4	335	13.2	433	17	524	20.6	637	25.1	762	30	767	30.2	1,024	40.3	1,030	40.6	1,136	44.7
		W (mm / inch)	155	6.1	165	6.5	185	7.3	207	8.1	250	9.8	320	12.6	390	15.4	480	18.9	550	21.7	570	22.4	740	29.1	740	29.1	750	29.5
		h (mm / inch)	78	3.1	83	3.3	95	3.7	105	4.1	127	5	159	6.3	191	7.5	223	8.8	261	10.3	295	11.6	325	12.8	357	14.1	389	15.3
		H (mm / inch)	239	9.4	244	9.6	257	10.1	314	12.4	378	14.9	508	20	602	23.7	742	29.2	859	33.8	893	35.2	1,133	44.6	1,165	45.9	1,197	47.1
		Weight (Kg/lb)	10	22	12.2	27	15	33	25	55	43	95	85	187	146	322	245	540	410	904	434	957	900	1984	967	2,132	986	2,174
700 Threaded	"Y" PN16; 25 Class 150; 300	L (mm / inch)	155	6.1	155	6.1	212	8.3	250	9.8																		
		W (mm / inch)	122	4.8	122	4.8	122	4.8	163	6.4																		
		h (mm / inch)	40	1.6	40	1.6	48	1.9	56	2.2																		
		H (mm / inch)	201	7.9	202	8	209	8.2	264	10.4																		
		Weight (Kg/lb)	5.5	12	5.5	12	8	18	17	37																		
	Angle PN16; 25 Class 150; 300	L (mm / inch)	-	-	121	4.8	140	5.5	159	6.3																		
		W (mm / inch)	-	-	122	4.8	122	4.8	163	6.4																		
		R (mm / inch)	-	-	40	1.6	48	1.9	55	2.2																		
		h (mm / inch)	-	-	83	3.3	102	4	115	4.5																		
		H (mm / inch)	-	-	225	8.9	242	9.5	294	11.6																		
		Weight (Kg/lb)	-	-	5.5	12	7	15	15	33																		



		DN / Size	600	24"	700	28"	750	30"	800	32"	900	36"
Globe PN16 Class 150		L (mm / inch)	1,450	57.1	1,650	65	1,750	68.9	1,850	72.8	1,850	72.8
		W (mm / inch)	1,250	49.2	1,250	49.2	1,250	49.2	1,250	49.2	1,250	49.2
		h (mm / inch)	470	18.5	490	19.3	520	20.5	553	21.8	600	23.6
		H (mm / inch)	1,965	77.4	1,985	78.1	2,015	79.3	2,048	80.6	2,095	82.5
		Weight (Kg/lb)	3,250	7,150	3,700	8,140	3,900	8,580	4,100	9,020	4,250	9,350
Globe PN25 Class 300		L (mm / inch)	1,500	59.1	1,650	65	1,750	68.9	1,850	72.8	1,850	72.8
		W (mm / inch)	1,250	49.2	1,250	49.2	1,250	49.2	1,250	49.2	1,250	49.2
		h (mm / inch)	470	18.5	490	19.3	520	20.5	553	21.8	600	23.6
		H (mm / inch)	1,965	77.4	1,985	78.1	2,015	79.3	2,048	80.6	2,095	82.5
		Weight (Kg/lb)	3,500	7,700	3,700	8,140	3,900	8,580	4,100	9,020	4,250	9.370



Specify when ordering:

- Size
- Main model
- Additional features
- Pattern
- Body material
- End connection
- Coating
- Voltage & main valve position
- Tubing & Fittings materials
- Operational data (according to model)
- Pressure data
- Flow data
- Reservoir level data
- Settings

* Use Bermad's Waterworks Ordering Guide

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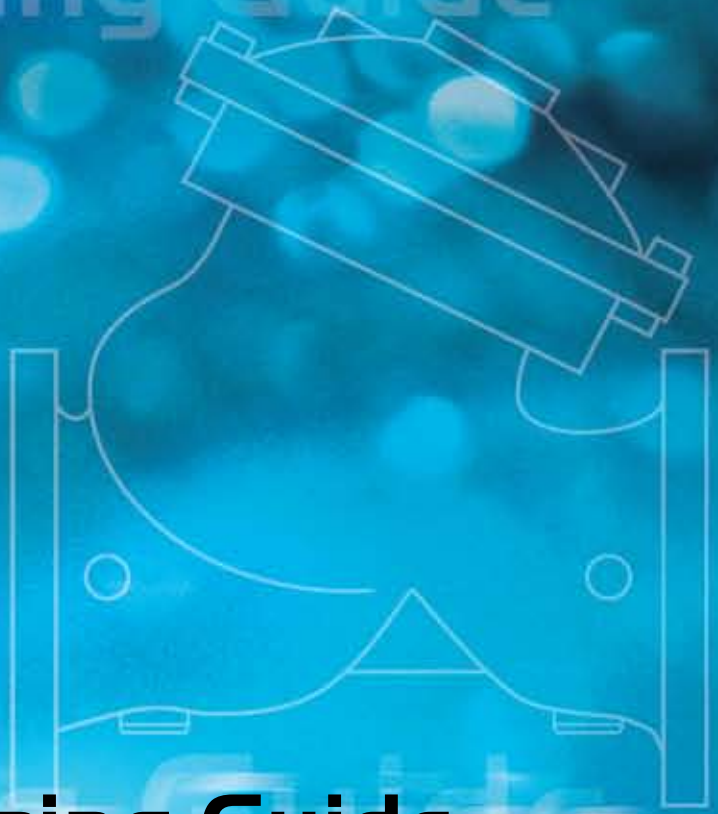
Ordering Guide

- Sector
- Size
- Primary Feature
- Additional Feature
  (Multiple Chioces Permitted)
- Pattern
- Construction Materials
- End Connections
- Coatings
- Voltage-Main Valve Position
  (When Solenoid De-energized)
- Tubing & Fittings
- Additional Attributes Unlimited Selection



BERMAD Ordering Guide

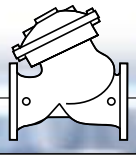
Hydraulic Control Valves

700 Series

Water Control Solutions

BERMAD

BERMAD Waterworks



Ordering Guide

700 Series

WW | **6"** | **720** | **55** | **Y** | **C**

Sector	Code
Waterworks	**WW**
Drinking Water	WD
WW Aggressive Water	WA
WW Seawater	WS
WW Air Conditioning	WC
WW Hot Water	WH

Pattern	Code
Oblique (1½-20")	**Y**
Angle (1½-18")	A
Globe(24-36")	G

Construction Materials	Code
Ductile Iron	**C**
Cast Steel	S
Stainless Steel 316	N
Nickel Aluminum Bronze	U

Other materials available on request.

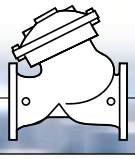
Size	
1½"	DN40
2"	DN50
2½"	DN65
3"	DN80
4"	DN100
5"	DN125
6"	DN150
8"	DN200
10"	DN250
12"	DN300
14"	DN350
16"	DN400
18"	DN450
20"	DN500
24"	DN600
28"	DN700
30"	DN750
32"	DN800
36"	DN900

Primary Features	Code
Basic Valve (Double Chambered Actuator)	700
Basic Valve (Single Chambered Actuator)	705
Solenoid Controlled Valve	710
Electronic Control Valve	718
Pressure Management Valve, Flow Compensated PRV	7PM
Pressure Reducing Control Valve	720
Pressure Sustaining & Reducing Valve	723
Differential Pressure Reducing Valve	726
Flow Control Valve, Constant Downstream Pressure	727
Electronic Pressure Reducing Valve	728
Pressure Sustaining Valve	730
Pressure Relief Valve, Quick Type	73Q
Pressure Sustaining Valve Remote Sensing Type	730R
Surge Anticipating Valve	735
Differential Pressure Sustaining Valve	736
Electronic Pressure Sustaining Valve	738
Booster Pump Control Valve, Single Chambered Actuator	740
Booster Pump Control Valve, Double Chambered Actuator	74Q
Booster Pump Control & Pressure Reducing Valve	742
Booster Pump Control & Pressure Sustaining Valve	743
Deep Well Pump Hydraulic Control Valve	744
Deep Well Pump Electric Control Valve	745
Booster Pump & Flow Control Valve	747
Pump Circulation & Pressure Sustaining Valve	748
Pump Circulation & Flow Control Valve	749
Level Control Valve	750
Level Control & Pressure Sustaining Valve	753
Level & Flow Control Valve	757
Level Sustaining Valve (Reservoir Outlet)	75A
Hydraulic Check Valve	760
Flow Control Valve	770
Flow Control & Pressure Reducing Valve	772
Flow Control & Pressure Sustaining Valve	773
Burst Control Valve (Excessive Flow)	790
Burst Control & Pressure Reducing Valve	792
Check Valve (Lift Type)	70N
Strainer (Stone and Gravel Trap)	70F

Other primary features available on request.

Additional Features (Multiple Choices Permitted)	Code
No Additional Feature	00
Closing and Opening Speed Control	03
Differential Pressure	06
Hydraulic Override	09
Check-Lock	11
High Sensitivity Pilot	12
Electronic Control	18
Check Feature	20
Independent Flow Check (24-32" only)	2S
Solenoid Controlled & Check Feature	25
Pressure Reducing Feature	2Q
Two-Stage Opening	30
Relief Override	3Q
Electrically Selected Multi-Level Setting	45
Downstream Over Pressure Guard	48
Closing Surge Prevention	49
Motorized Pilot	4S
Electronic Multi-Level Setting - Type 4R	4R
Electronic Multi-Level Setting - Type 4T	4T
Hydraulic Control	50
Hydraulic Accelerator Control	54
Solenoid Controlled	55
Electric Override	59
Modulating Horizontal Float	60
Bi-Level Electric Float	65
Bi-Level Vertical Float	66
Modulating Vertical Float	67
Bi-Directional Flow	70
Altitude Pilot	80
Modulating Altitude Control	82
Sustaining Altitude Pilot	83
Hydraulic Positioning	85
Bi-Level Altitude Control	86
Altitude Control with Bi-Directional Flow	87
2-6 meter ; 7-20 feet Setting	M1
2-14 meter ; 7-46 feet Setting	M6
5-22 meter ; 17-72 feet Setting	M5
15-35 meter ; 49-115 feet Setting	M4
25-70 meter ; 82-230 feet Setting	M8
Closing at Downstream Pressure Drop	91
Proportional	PD

Other additional features available on request.



I6 **EB** **4AC** **CB** **F**

	End Connections		Code
Flanged	ISO - 10		10
	ISO - 16		16
	ISO - 25		25
	ANSI - 150		A5
	ANSI - 300		A3
	BST - D		BD
	JIS - 16		J6
	JIS - 20		J2
Threaded	BSP	(up to 3")	BP
	BSP - 25 bar		PH
	NPT		NP
	NPT - 25 bar		NH

Other end connections available on request.

		Voltage-Main Valve Position (When Solenoid De-energized)	Code
24V	AC	24VAC/50Hz - Normally Closed	4AC
		24VAC/50Hz - Normally Open	4AO
		24VAC/50Hz - Last Position	4AP
		24VAC/60Hz - Normally Closed	46C
		24VAC/60Hz - Normally Open	46O
		24VAC/60Hz - Last Position	46P
	DC	24VDC - Normally Closed	4DC
		24VDC - Normally Open	4DO
		24VDC - Last Position	4DP
		24VDC - Latch Solenoid	4DS
220V	AC	220VAC/50-60Hz Last Position	2AP
		220VAC/50-60Hz Normally Closed	2AC
		220VAC/50-60Hz Normally Open	2AO
		220VAC/50-60Hz Motorized Ball Valve - Last Position	2AM
	DC	220VDC - Normally Closed	2DC
		220VDC - Normally Open	2DO
		220VDC - Latch Solenoid	2DS
110V	AC	110VAC/50 - 60Hz Normally Closed	5AC
		110VAC/50 - 60Hz Normally Open	5AO
	DC	110VDC - Normally Closed	5DC
		110VDC - Normally Open	5DO
		110VDC - Latch Solenoid	5DS

Other electrical ratings available on request.

Tubing & Fittings	Code
St. St. 316 Tubing & Fittings	NN
Copper Tubing & Brass Fittings	CB
Plastic Reinforced Tubing & Brass Fittings	PB
Monel Tubing & Fittings	MM

Reduction Ratios Table

Valve Size	Plug Type	
	Flat Disk	V-Port
1½ - 2½" DN40 - 65	3.7	4
3" DN80	2.6	2.9
4" DN100	2.5	2.8
6" DN150	2.5	2.7
8" DN200	2.4	2.6
10" DN250	2.3	2.5
12-14" DN300 - 350	2.2	2.4
16-20" DN400 - 500	2.2	2.3
24-36" DN600 - 900	2.2	2.3

- The reduction ratios are based on flow velocity of 2.0-3.0 m/sec.
- Reduction ratio may vary at extreme flow velocity & upstream pressure.

Coatings	Code
Epoxy FB Blue RAL 5005	**EB**
Polyester Green RAL 6017	PG
Polyester Blue RAL 5010	PB
Uncoated	UC

Transparent Polyurethane top coating is available for epoxy coated valves. Other coatings available on request.

Additional Attributes Unlimited Selection	Code
V-Port Throttling Plug (U-Type)	V
Large Control Filter	F
Valve Position Indicator	I
Electric Limit Switch	S
Valve Position Transmitter	Q
Flow Stem	M
Lifting Spring	L
Balancing Piston Assembly	G
Orifice Assembly	U
Pressure Separator	d
Double Chambered (Active)	B
3-Way Control Loop	X
Manual Selector	Z
Flow Over the Seat	O
St. St. 316 Control Accessories	N
St. St. 316 Actuator Internal Assembly	D
St. St. 316 Internal Trim (Closure & Seat)	T
Delrin Bearing	R
High Grade Bearing & Stem	K
St. St. Bolts & Nuts	m
Special Elastomers for Seals & Diaphragm	E
Pressure Gauge	6

Other additional attributes are optional.
Please consult our sales department for further information.

BERMAD Standard Configuration

Ordering Guide

BERMAD Ordering Guide

Hydraulic Control Valves | 700 Series

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P07WE01 09

VIBRANTZ TECHNOLOGIES™

vibrantz.com

Pyrolox®
Advantage

TECHNICAL MANUAL

NSF Certified to NSF/ANSI 61

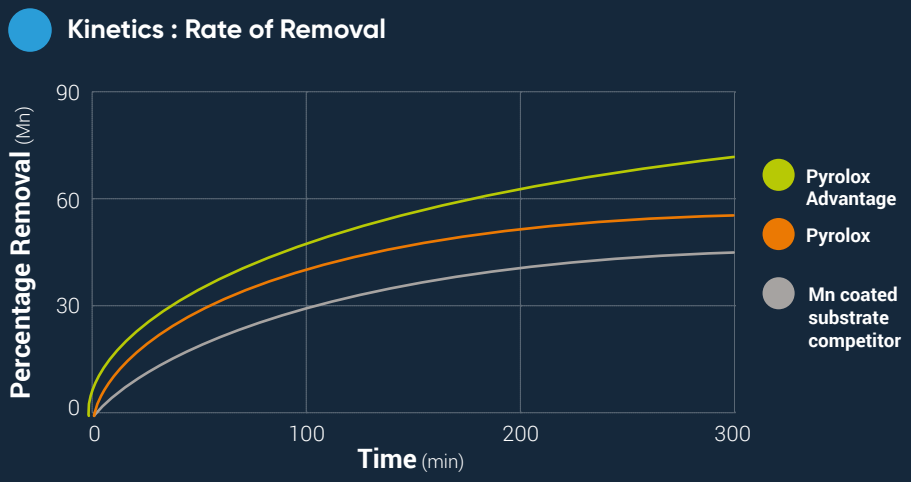
Capability

Pyrolox Advantage is the cleanest, lightweight solution for the removal or iron, manganese, arsenic, and/or hydrogen sulphide in water.

Pyrolox Advantage can be used to remove a range of soluble inorganic impurities from raw water by oxidation to insoluble form, precipitation, and flocculation. The media can be used in a catalytic configuration with a supplemental oxidant (eg. OCl- or dissolved O2) or as a depleted resource requiring regeneration or replacement (eg. cartridge)

Removal of Fe2+ & Mn2+

The most common application for this media is iron and manganese removal. Manganese minerals have a well-documented record of capability for removal of these species[1]. Pyrolox Advantage removes soluble ions by the same mechanism as natural ore products, but faster and with better efficiency at low contaminant concentration. Results of our kinetic measurements are given in the table below.



Pyrolox Advantage Value

vibrantz.com

Features	Customer Benefits
• **Lightweight** (engineered media with a lower density core and highest purity MnO2 surface)	✓ **Lower backwash rate** ✓ **Lower transportation costs** ✓ **Lower cost per cubic foot than competitive Mn coated products**
• **Highly porous surface area with durable, high-purity MnO2 coating**	✓ **Improved performance in Mn and Fe removal** ✓ **Allows for a smaller filter footprint** ✓ **Higher oxidation (higher removal capacity) than competing medias allowing for higher service flow rates**
• **True MnO2 coating** • **12.5% MnO2** (highest Mn content of any lightweight media)	✓ **No pre-treatment required** ✓ **Longer run times between backwash**
• **1,000 microns particle size** (by volume diffraction)	✓ **Does not stratify when used with sand in a mixed bed** (stays homogenous/mixed)
• **Engineered, quality-controlled product** (manufactured by Prince)	✓ **Cleanest start-up** (virtually no start up fines) ✓ **Reduced operational time and lower costs at the filter commissioning stage** ✓ **Directly certified by NSF** (not a 3rd party)
• **No regeneration required**	✓ **Does not require potassium permanganate or other chemicals** ✓ **Only requires sodium hypochlorite**
• **Engineered to be naturally catalytic** (mimicking pure manganese wore)	✓ **Provides high performance even without activation** ✓ **Will continue to perform its function in non-ideal conditions**

[1] *Removal of Soluble Manganese by Oxide-coated Filter Media, Knocke et al. (1991) https://doi.org/10.1002/j.1551-8833.1991.tb07201.x*

Technical Parameters

vibrantz.com

Physical Properties

MnO2%	12.5%	
Media Substrate	Silica Sand	
Colour and Form	Black, free-flowing sand	
Bulk Density as packed[2]	1350 kg/m^3	84 lb/ft^3
True Density (SG)	2700 kg/m^3	170 lb/ft^3
Porosity	50 %	

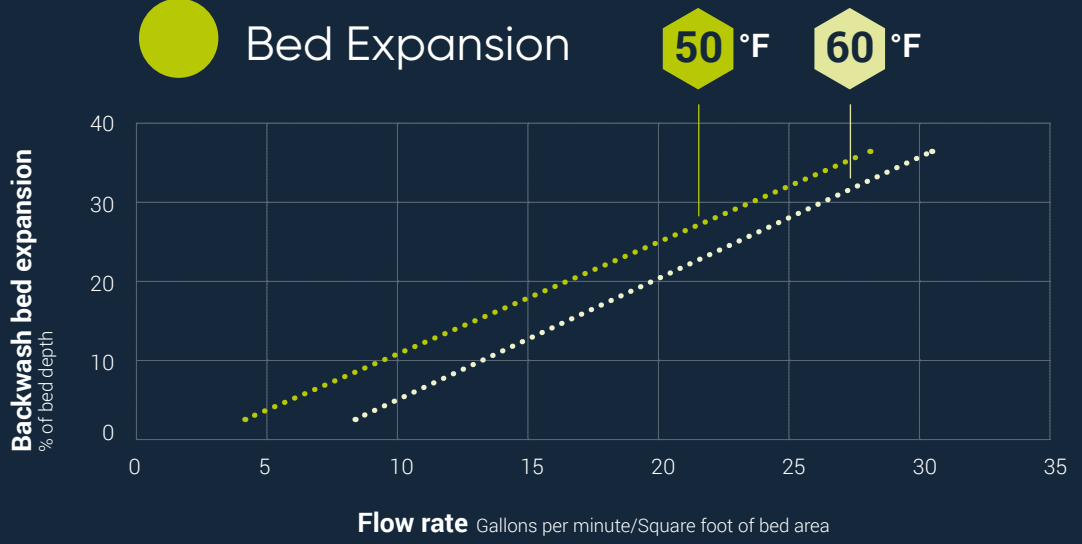
Sizing

Mesh Size[3]	16 - 44 (BS/ISO)	18 - 45 (ASTM)
Effective Size	560 µm	
Uniformity Coefficient	1.5	

Operating Conditions

pH Range[4]	5.5 - 10	
Freeboard	40 %	
Service Flow Rate	5 - 25 m/hr	2 - 10 gpm/ft2
Backwash Rate 20-30% bed expansion	30-45 m/hr	12 - 18 gpm/ft2
Backwash	Time 5 minutes	
Minimum Bed Depth	300mm	12 in
Minimum Empty Bed Contact Time EBCT	4 minutes	
Adsorption Capacity	Mn 1000 mg / kg	Fe > 10000 mg / kg

Bed Expansion



Pyrolox Advantage

[2] *Range of tapped to loose bulk density 1300 - 1500 kg/m^3 (81 – 94 lb/ft^3)*
[3] *Range represents the 5 % to 95 % retained on mesh*
[4] *Mn-based media are not suitable for treating water below pH 6.2 (BS:EN 13752:2012)*

Use of Product

Selection

Media depth, volume, and flow rate must be selected to optimise the bed contact time and achieve the desired reduction in contaminant concentration.

Commissioning

Pyrolox Advantage is engineered to be naturally catalytic (mimicking pure manganese ore) so it provides high performance even without activation. We acknowledge that the filter installation will require sterilization prior to use; the use of sodium hypochlorite is recommended and has no detrimental effect on the media. The use of hydrogen peroxide is not recommended at any stage based on the advice of BS:EN 13752:20125; it can lead to increased manganese concentrations if used with any manganese- based media.

Use

Pyrolox Advantage can be used in gravity or pressurized systems. Treated water should be monitored and regular backwashing performed. In catalytic configuration, the incoming raw water requires 60% oxygen saturation for optimum removal of iron and hypochlorite (OCl-) levels commensurate with the manganese concentration.

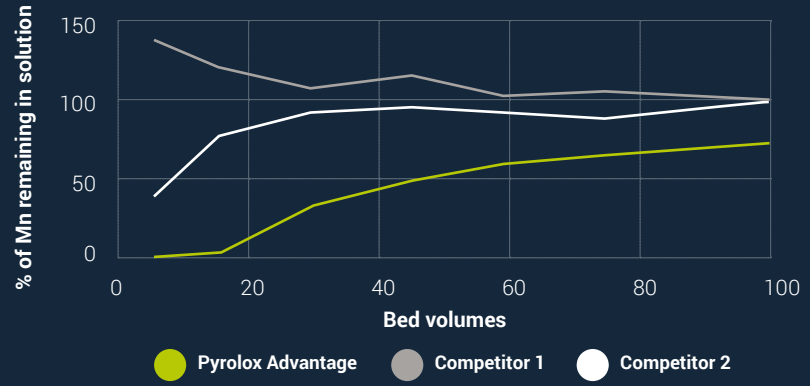
Where the level of dissolved oxygen is insufficient. Cl2 demand can be estimated from the level of Fe and Mn in the raw water as follows:

Cl2 1:1 Fe (mg/L)
Cl2 2:1 Mn (mg/L)

Backwash

Iron and manganese are precipitated and retained by the filter media. Periodic backwashing is required to ensure the efficiency of the filter media. Excessive run time without backwashing, or incomplete backwashing, will reduce the filter efficiency and deplete the oxidation capacity of the media surface. Maximum run time should be determined by the filter designer specific to the raw water composition. Typical bed expansion is 20%-30%.

Pyrolox Advantage is the Only Manganese Coated Media that Removes Almost 100% of Mn at Start-up



- **Does not depend on activation to perform**
- **Engineered to be naturally catalytic (out of the box catalytic)**
- **Does not require potassium permanganate**

[5] *Products used for treatment of water intended for human consumption. Annexe A*

Regeneration

In catalytic use, the media does not require regeneration. If media is used without sufficient dissolved oxygen or oxidising source (eg. hypochlorite) the surface will become depleted and require regeneration. Regeneration can be achieved using only sodium hypochlorite, but the time and concentration must be determined by the user. Pyrolox Advantage does not require potassium permanganate or other chemicals.

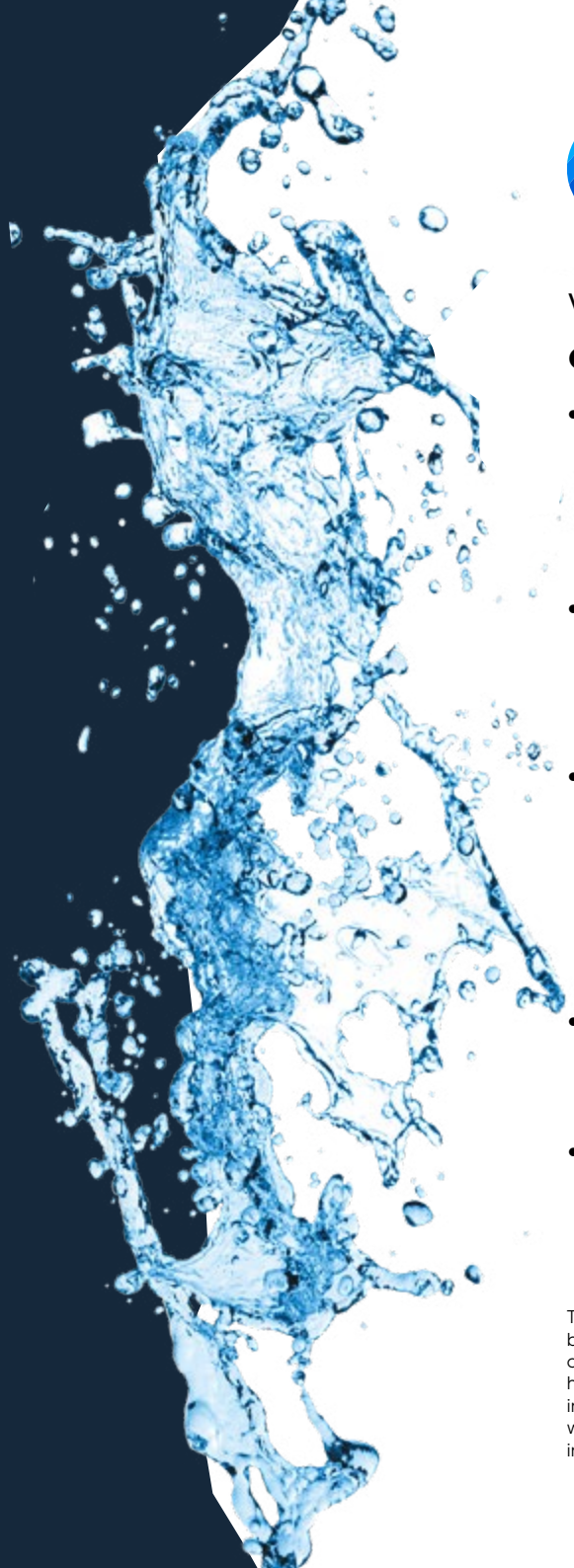
We recommend hypochlorite for compliance with local regulations and optimum performance. Where existing procedures allow for the use of other oxidants with Mn-based media these can be
used with our Pyrolox range but care should be taken for pressure relief and monitoring of Mn removal efficacy.

Removal of As3+

Pyrolox Advantage can be used to remove soluble arsenic indirectly by co-precipitation with Fe. This requires either the presence of Fe in the raw water or the addition of Fe ahead of the filter system. Pyrolox Advantage has no inherent capacity to remove arsenic ions and should not be used non-catalytically for the treatment of arsenic-contaminated raw water in the
absence of soluble iron.

Typical application requires Fe : As ratio of 30:1. Co-precipitation and removal is a function of bed-contact, pH and ion concentration. For this reason, Vibrantz recommends that filter designers pilot a small installation to confirm efficacy for specific situations. When treating water with > 10 ppb As it may be necessary to add a second polishing stage to the process.

Pyrolox Advantage



VIBRANTZ TECHNOLOGIES™

Vibrantz is the go-to for all **manganese dioxide** filter media needs

- **World leader in manganese chemicals**
  - ✓ Broadest manganese filter media product range
  - ✓ we have combined our proprietary aggregates coating process with our world class synthetic manganese dioxide production
  - ✓ ISO 9001 certification at all Vibrantz manufacturing locations
- **Technical expertise**
  - ✓ Manganese water treatment lab in the UK
  - ✓ Collaboration with Cranfield University for testing
  - ✓ Product testing & analytical services for manganese media
- **Responsiveness & flexibility of supply**
  - ✓ Not traded - products are manufactured by Vibrantz
  - ✓ Quality, consistency, and availability direct from the manufacturer
  - ✓ Strong production base & backup production locations
  - ✓ NSF Certified
  - ✓ For the European market, we control the specification to BS EN 13752:2012
- **Security of raw material supply**
  - ✓ Only select high quality raw materials from mines with long term reserves
  - ✓ Long term relationships with first and second source suppliers
- **Global distribution**
  - ✓ Regional sales force
  - ✓ Ships internationally

The information and recommendations contained herein are based on data we believe to be reliable and does not imply any warranty or performance guarantee, as conditions and methods of use of our products are beyond our control. The data herein is determined using Vibrantz's standard test methods. Hazard and safety information with respect to this product is available in the applicable SDS. Vibrantz will not be liable under any circumstance for consequential or incidental damages, including but not limited to, lost profits resulting from the use of our products.

Appendix F. Water Quality Lab Test Results

eurofins | Environment Testing Edge Analytical

Burlington, WA *(a)*
1620 S Walnut St - Burlington, WA 98233 - **800.755.9295** • 360.757.1400

Bellingham, WA *Microbiology (b)*
805 Orchard Dr Ste 4 - Bellingham, WA 98225 - 360.715.1212

Portland, OR *Microbiology/Chemistry (c)*
9725 SW Commerce Cr Ste A2 - Wilsonville, OR 97070 - 503.682.7802

Corvallis, OR *Microbiology/Chemistry (d)*
1100 NE Circle Blvd, Ste 130 - Corvallis, OR 97330 - 541.753.4946

Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

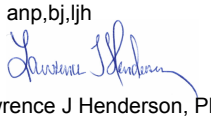
NELAP ACCREDITED TNI LABORATORY
OR NELAP 4072

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Facet, Inc.
9706 4th Avenue NE #300
Seattle, WA 98115

Reference Number: 24-34657
Project: South Whidbey Parks & Rec

Date Collected: 12/17/24 09:15
System ID Number:
Lab Number: **046-66744**
Sample Location:
Sample Purpose: Investigative or Other
Sample Composition:
Approved by: anp,bj,ljh
Authorized by:



Lawrence J Henderson, PhD
Director of Laboratories, Vice President

Field ID: Well 2 - Raw
System Group Type:
System Name:
County:
Source Number:
Multiple Sources:
Date Received: 11/19/24
Report Date: 12/26/24
Sample Type:
Sampled By: Kris Keenen
Sampler Phone:

Sample Comment:

DOH#	ANALYTES	**RESULTS**	UNITS	SRL	Trigger	**MCL**	Analyst	METHOD	Lab	Analyzed	COMMENT
	DISSOLVED ORGANIC CARBON	**1.32**	mg/L	0.50			rmc	SM5310 B	a	12/23/24	
0	TOTAL ORGANIC CARBON	**1.80**	mg/L	0.15			rmc	SM5310 B	a	12/04/24	
	EPA Regulated										
4	ARSENIC	**0.0010**	mg/L	0.001	0.010	**0.010**	bj	200.8	a	11/25/24	
20	NITRATE-N	**ND**	mg/L	0.100	5	**10**	ebvp	300.0	a	12/18/24 13:33	
114	NITRITE-N	**ND**	mg/L	0.10	0.50	**1.0**	ebvp	300.0	a	12/18/24 13:33	
	EPA Regulated (Secondary)										
8	IRON	**1.21**	mg/L	0.05	0.3	**0.3**	bj	200.7	a	11/26/24	
10	MANGANESE	**0.201**	mg/L	0.001	0.050	**0.05**	bj	200.7	a	11/26/24	
15	HARDNESS as Calcium Carbonate	**98.3**	mg/L	3.3			bj	200.7	a	11/26/24	
	Other										
0	*SULFIDE AS S	**ND**	mg/L	0.05	0.100		ath	SM4500-S2 F	a	11/22/24	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.
ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).
An * in front of the parameter name indicates it is not NELAP accredited but it is accredited through WSDOH or USEPA Region 10.

These test results meet all the requirements of NELAC, unless otherwise stated in writing, and relate only to these samples.
If you have any questions concerning this report contact Lawrence J Henderson, PhD, Director of Laboratories, Vice President, at the toll-free phone number above.

FORM: IOC_ST

eurofins | Environment Testing Edge Analytical

Burlington, WA *(a)*
1620 S Walnut St - Burlington, WA 98233 - **800.755.9295** • 360.757.1400

Bellingham, WA *Microbiology (b)*
805 Orchard Dr Ste 4 - Bellingham, WA 98225 - 360.715.1212

Portland, OR *Microbiology/Chemistry (c)*
9725 SW Commerce Cr Ste A2 - Wilsonville, OR 97070 - 503.682.7802

Corvallis, OR *Microbiology/Chemistry (d)*
1100 NE Circle Blvd, Ste 130 - Corvallis, OR 97330 - 541.753.4946

Bend, OR *Microbiology (e)*
20332 Empire Blvd Ste 4 - Bend, OR 97701 - 541.639.8425

NELAP ACCREDITED TNI LABORATORY
OR NELAP 4072

INORGANIC COMPOUNDS (IOC) REPORT

Client Name: Facet, Inc.
9706 4th Avenue NE #300
Seattle, WA 98115

Reference Number: 24-34657
Project: South Whidbey Parks & Rec

Date Collected: 11/15/24 12:30
System ID Number:
Lab Number: **C567-66744**
Sample Location:
Sample Purpose: Investigative or Other
Sample Composition:
Approved by: anp,bj,ljh
Authorized by:

Lawrence J Henderson, PhD
Director of Laboratories, Vice President

Field ID: Well 2 - Raw
System Group Type:
System Name:
County:
Source Number:
Multiple Sources:
Date Received: 11/19/24
Report Date: 12/26/24
Sample Type:
Sampled By: Kris Keenen
Sampler Phone:

Sample Comment:

DOH#	ANALYTES	**RESULTS**	UNITS	SRL	Trigger	**MCL**	Analyst	METHOD	Lab	Analyzed	COMMENT
0	*AMMONIA-N	**0.60**	mg/L	0.010			spm2	350.1	a	11/26/24	

NOTES:

SRL (State Reporting Level): indicates the minimum reporting level required by the Washington Department of Health (DOH).
MCL (Maximum Contaminant Level) maximum permissible level of a contaminant in water established by EPA; Federal Action Levels are 0.015 mg/L for Lead and 1.3 mg/L for Copper. Sodium has a recommended limit of 20 mg/L. A blank MCL value indicates a level is not currently established.
Trigger Level: DOH Drinking Water Response level. Systems with compounds detected in excess of this level are required to take additional samples. Contact your regional DOH office.
ND (Not Detected): indicates that the parameter was not detected above the Specified Reporting Limit (SRL).
An * in front of the parameter name indicates it is not NELAP accredited but it is accredited through WSDOH or USEPA Region 10.

These test results meet all the requirements of NELAC, unless otherwise stated in writing, and relate only to these samples.
If you have any questions concerning this report contact Lawrence J Henderson, PhD, Director of Laboratories, Vice President, at the toll-free phone number above.

FORM: IOC_ST

Appendix G. Treatment Design Calculations

Hypochlorination Oxidative Demand Calculations

Water System Name: South Whidbey Parks & Rec District
Water System I.D. Number: 02660 E
Source: S01 (Well 2 - AGA 524)
Date: 1/31/2025

Contaminant	Concentration (mg/L) [1]	Free Chlorine Demand Factor	Chlorine demand (mg/L)
Arsenic [2]	0.0010	0.95	0.00095
Iron - In Source Water [3]	1.21	0.64	0.77
Iron - Added $FeCl_2$		0.64	
Manganese [3]	0.201	1.29	0.259
Ammonia - as N	0.60	10.0	6.0
Total Organic Carbon (TOC)	1.80	0.10	0.18
Hydrogen Sulfide [a]	0	2.1	0
Hydrogen Sulfide [b]		8.4	
Nitrite - as N	0	5.0	0
Organic Nitrogen		1.0	
Total	N/A	N/A	7.2

[1] *Non-detect test results are reported as zero.*

[2] *4/18/1990 water quality lab testing.*

[3] *6/8/2021 water quality lab testing.*

[a] Demand factor listed is for oxidation of hydrogen sulfide to elemental sulfur.

[b] Demand factor listed is for oxidation of hydrogen sulfide to sulfuric acid.

Hypochlorination Worksheet Calculations
DOH Water System Design Manual - June 2020

Water System Name: South Whidbey Parks & Rec District
Water System I.D. Number: 02660 E
Source: S01 (Well 2 - AGA 524)
Date: 1/31/2025

Water System Operating Parameters

Pressure at Sodium Hypochlorite Injection Point		40	psi
Average Day Demand	ADD	5,000	gpd
Maximum Day Demand	MDD	11,000	gpd
Flow Rate at Sodium Hypochlorite Injection Point	Qs	35	gpm
Peak Hour Demand	PHD	90	gpm

Values Used for PHD Calculation	MDD	11,000	gpd/ERU
Equation 3-2, WSDM 2020 Edition	PF	3.6	

Estimated Required Sodium Hypochlorite Dose

	Demand	7.2	ppm (mg/L)
	Residual	1.0	ppm (mg/L)
Required Sodium Hypochlorite Dose	Cs	8.2	ppm (mg/L)

Sodium Hypochlorite Metering Pump Requirements

Proposed Raw Sodium Hypochlorite Solution Concentration	Cc	12.5%	
Volume		16	cups
	or	1	gallons
Dilution Water Volume		4	gallons
Total Volume of Diluted Solution		5	gallons
Sodium Hypochlorite Concentration of Diluted Solution	Cf	25,000	ppm (mg/L)
Required Metering Pump Rate	Qf	0.69	gph

Sodium Hypochlorite Metering Pump Specifications

Pump Make	**LMI**		
Pump Model	**PD061-A40HI**		
Maximum Injection Pressure of Pump		50	psi
Greater than or Equal to Pressure at Injection Point?		Yes	
Maximum Stroke Rate of Pump		160	strokes/min
Minimum Pumping Rate		0.002	gph
Maximum Pumping Rate		1.75	gph
Desired Pumping Rate		0.69	gph
Percent of Maximum Pumping Rate		39%	
Midrange of Pump Output (20% - 80%)?		Yes	

Sodium Hypochlorite Solution Tank

Size of Tank		50	gal
Percentage of System Demand Supplied by Tank		100%	
	Current Buildout		
	ADD	MDD	
Daily Water Usage (System Wide)	5,000	11,000	gpd
Daily Pumping Duration	2.4	5.2	hours/day
Estimated Daily Solution Used	1.6	3.6	gpd
Days to Empty	30	14	days
Shelf Life of Diluted Solution		2	months

Filter Sizing Calculations
DOH Water System Design Manual - June 2020

Water System Name: South Whidbey Parks & Rec District
Water System I.D. Number: 02660 E
Source: S01 (Well 2 - AGA 524)
Date: 1/31/2025

Water System Operating Parameters

Average Day Demand	ADD	5,000	gpd/ERU
Desired Treatment System Capacity		35	gpm

Raw Water Quality

Iron Concentration	1.21	ppm (mg/L)
Manganese Concentration	0.201	ppm (mg/L)

Filter Vessel Sizing

Flow Rate to Filters	Qs	35	gpm
Filter Diameter		18	in
Filter Media Depth		42	in
Filter Quantity		4	filters
Surface Area per Filter		1.77	sf/filter
Total Filter Surface Area (All Filters)		7.07	sf
Filter Loading Rate (All Filters in Service)		5.0	gpm/sf
Flow Rate per Filter (All Filters in Service)		8.8	gpm/filter
Filter Loading Rate (During Backwash with One Filter Out of Service)		6.60	gpm/sf
Flow Rate per Filter (During Backwash with One Filter Out of Service)		11.7	gpm/filter

Pre-Filter Chlorine Contact Time

Filter Height	60	in
Filter Diameter	18	in
Filter Media Depth	42	in
Filter Headspace	18	in
Filter Quantity	4	filters
Headspace Volume	20	gal
Total Contact Volume	20	gal
Pre-Filter Contact Time	2.3	minutes

Backwash Frequency

$KMnO_4$ Demand Equivalent	10,000	mg/cf
Iron Concentration	1.21	ppm (mg/L)
Iron Equivalence	1	:1
Effective Iron Concentration	1.21	ppm (mg/L)
Manganese Concentration	0.201	ppm (mg/L)
Manganese Equivalence	2	:1
Effective Manganese Concentration	0.402	ppm (mg/L)
Total Effective Concentration	1.61	ppm (mg/L)
Media Volume per Filter	6.2	cf/filter
Filter Quantity	4	filters
Total Media Volume	24.7	cf
Total Binding Capacity	247,400	mg
Theoretical Filter Capacity Before Backwash	40,495	gallons
Theoretical Filter Run Time Before Backwash	19	hours
Recommended Initial Run Time Before Backwash	12	hours
Recommended Initial Filter Capacity Before Backwash	25,200	gallons
Average Backwash Frequency	5.0	days

Backwash Quantity

Backwash Rate per Filter Area	17	gpm/sf
Surface Area per Filter	1.77	sf/filter
Backwash Rate per Filter	30	gpm
Backwash Duration per Filter	5	min
Rinse Duration	0	min
Backwash Quantity per Filter	150	gal/filter
Filter Quantity	4	filters
Total Backwash Quantity	600	gallons
Backwash Loss	2.3%	

Appendix H. Full-Scale Pilot Test Worksheet

FACET

South Whidbey Parks & Rec District - Iron and Manganese Treatment System

Full-Scale Pilot Test Worksheet

Concentration of Raw Sodium Hypochlorite: _____ %

Amount of Raw Sodium Hypochlorite: _____ gallons

Dilution Water Volume: _____ gallons

Total Diluted Solution Volume: _____ gallons

Metering Pump Make and Model: _____

Manual Speed Setting: _____ %

Treatment Influent Flow Rate: _____ gpm

Backwash Rate: _____ gpm

Backwash Duration Per Filter: _____ min

Water Production Data						Raw Water Quality Data (Before Chlorine Injection)			Pre-Filter Water Quality Data (After Chlorine Injection)		Treated Water Quality Data (After Filters)				
Approximate Filter Run Time (Hours)	Approximate Gallons Treated	Actual Filter Run Time (Hours) [1]	Treatment Building Meter Reading	Date	Time	Iron Field Test (mg/L)	Manganese Field Test (mg/L)	Collect Water for Lab Sample? [2]	Free Chlorine Residual Field Test (mg/L)	Total Chlorine Residual Field Test (mg/L)	Free Chlorine Residual Field Test (mg/L) (Target: 1.0 mg/L)	Total Chlorine Residual Field Test (mg/L)	Iron Field Test (mg/L) (MCL: 0.3 mg/L)	Manganese Field Test (mg/L) (MCL: 0.05 mg/L)	Collect Water for Lab Sample? [2]
0	0							Yes							Yes
5	10,500							-							Yes
10	21,000							-							Yes
15	31,500							Yes							Yes
20	42,000							-							Yes
25	52,500							-							Yes
30	63,000							Yes							Yes

[1] Actual filter run time shown on filter control panel when data was recorded.

[2] Lab samples to be tested for iron, manganese, and silica.

Testing Performed by: _____

Date(s): _____

FACET

South Whidbey Parks & Rec District – Iron and Manganese Treatment System
Full-Scale Pilot Test Instructions

1. Turn flow control solenoid valve to OFF.
2. Set pumphouse valves for filter to waste operations.
3. Set chlorine metering pump manual speed setting to the percentage indicated on the plans.
4. Turn flow control solenoid valve to AUTO.
5. Confirm the chlorine metering pump is running.
6. Let well pump run for 15 minutes.
7. Measure free and total chlorine residuals of treated water.
8. If free chlorine residual is approximately 1.0 mg/L and total chlorine residual is 1.2 mg/L or less, proceed to Step 9. If free and total chlorine residuals are not as specified, consult with the engineer, adjust chlorine metering pump manual speed setting, and repeat Steps 6 through 8.
9. Record the chlorine metering pump manual speed setting that satisfies the requirements of Step 8 on the *Full-Scale Pilot Test Worksheet*.
10. Turn flow control solenoid valve to OFF.
11. Set pumphouse valves for filter to reservoir operations.
12. On the filter control panel, set the backwash frequency to 50 hours of filter run time.
13. Manually initiate backwash cycle on filter control panel.
14. Turn flow control solenoid valve to HAND.
15. During backwash, confirm backwash meter is reading the correct backwash flow rate as indicated on the plans. Adjust backwash throttling valve as required. Once backwash flow rate requirement is satisfied, record backwash flow rate the *Full-Scale Pilot Test Worksheet*.
16. Manually initiate one full backwash cycle with the backwash flow rate setting indicated on the plans. Observe complete backwash cycle and confirm target backwash flow rate and duration are maintained throughout the duration of each individual filter backwash.
17. Turn flow control solenoid valve to AUTO.
18. Start full-scale pilot test run. Collect and record all data requested on the *Full-Scale Pilot Test Worksheet*. Label all water quality samples for laboratory testing as either “Raw Water” or “Treated Water” and label with the corresponding “Approximate Filter Run Time (Hours)” value at the time the samples are collected. The well and treatment system should both be running for a minimum of 15 minutes before and during all sample collections.
19. Continue validation test run until the filters have been run for 30 hours and all requested data and water quality samples have been collected.
20. Manually initial one full backwash cycle.
21. On filter control panel, set backwash frequency to 12 hours of filter run time.
22. Send completed *Validation Test Worksheet* and water quality laboratory results to engineer.

Appendix I. Purification Plant Criteria Worksheet

Operator Certification

Water Treatment Purification Plant Criteria Worksheet

331-749 • June 2024

ABC Classification: WTPO

WTP Address & Contact Person		System Name
Plant Name/Source Numbers South Whidbey Parks & Rec District/Source 02		**System ID#** 02660 E
Address Physical: 5475 Maxwelton RD Contact: Jeffrey J. Olson, PO Box 699		
City Physical: Langley Contact: Newberg	**State** Physical: WA Contact: OR	**Zip Code +4** (Link to USPS Zip Code Lookup) Physical: 98260-0136 Contact: 97132
Phone Number (503) 554-8333		**Fax Number** (If applicable.) Fax number

A groundwater supply with only chlorination is considered a distribution system, not a water treatment facility. The addition of any chemical to a public water supply, other than a disinfectant, will be considered a treatment facility and should use this rating worksheet to determine the classification of the facility.* Unless otherwise noted, give full amount of points in the "Your Plant" box.

**With the exception of unit processes installed to allow in-line fluoridation, in-line chlorination, or chemical addition to inhibit corrosion are not included within the scope of the term "water treatment plant" per WAC 246-292-040(c).*

Example Table

Raw water quality is subject to or has elevated:	Points	Your Plant
Correct: Taste and/or odor levels	3	3
Incorrect: Taste and/or odor levels	3	1

***Note**: Do not double count. If the plant has two horizontal-flow (rectangular basins), DO NOT give 10 points, give 5 points. If the plant has more than one type of unit for each process, give points once for each unit.*

Item	Points Possible	Your Facility
Size		
Design flow average day, or peak month s average day, whichever is larger (1 point per 0.5 MGD. Round up.) Design flow: Consider this to be the design capacity of the plant. Examples: 9.2 MGD = 19 points, 4.7 MGD = 10 points (20 points maximum allowed)	1 – 20	1
Water Supply Sources (Rating based on public health significance)		
Seawater/saltwater	0	0
Groundwater	0	0
Groundwater under direct influence of surface water (GWI)	8	0
Surface water	10	0
Average Raw Water Quality Variation—Applies to all sources (surface and groundwater). Key is the effect on treatment process changes that would be necessary to achieve optimized performance. • Little or no variation—no treatment provided except disinfection (0 points) • Minor variation, e.g. "high quality" surface source appropriate for slow sand filtration (1 point) • Moderate variation in chemical feed, dosage changes made: monthly (2 points), weekly (3 points), or daily (4 points) • Variation significant enough to require pronounced and/or very frequent changes (5 points) • Severe variation—source subject to non-point discharges, agricultural/urban storm runoff, flooding (7 points) • Raw water quality subject to agricultural or municipal waste point source discharges (8 points) • Raw water quality subject to industrial waste pollution (10 points)	0 – 10	2
Raw water quality is subject to:		
• Taste and/or odor for which treatment process adjustments are routinely made	2	0
• Color > 15 CU (not due to precipitated metals). See exceptions in note at end of Example Table, page 1.	3	0
• Iron or/and manganese > MCL: Fe (2 points), Mn (3 points) (3 points maximum allowed) ○ See exceptions in note at end of Example Table, page 1.	2 – 3	3
• Algal growths for which treatment process adjustments are routinely made	3	0
Chemical Treatment/Addition Processes		
Fluoridation	4	0
Disinfection/Oxidation *(Note: Points are additive to a maximum of 15 points allowed for this category.)* CHECK _X_ ALL THAT APPLY: Chlorination: • Hypochlorites (5 points) X ○ If generated on site (add 1 point) ○ Chlorine gas (8 points) ○ Chloramination (10 points) ○ Chlorine dioxide (10 points) • Ozonation (10 points) • UV Irradiation (2 points) • Iodine, Peroxide, or similar (5 points) • Potassium permanganate (4 points) [If used with greensand filtration do not give 4 points]	0 - 15	5
pH adjustment for process control (e.g., pH adjustment aids coagulation)	4	0
Stability or Corrosion Control (If the same chemical is used for both Corrosion Control and pH adjustment, count points only once)	4	0

Item	Points Possible	Your Facility
Coagulation/Flocculation & Filter Aid		
Primary coagulant addition	6	0
Coagulant aid/Flocculant chemical addition (in addition to primary coagulant use)	2	0
Flocculation	2	0
Filter aid addition (Non-ionic/anionic polymers)	2	0
Clarification/Sedimentation		
Sedimentation (plain, tube, plate)	4	0
Contact adsorption	6	0
Other clarification processes (air flotation, ballasted clarification, etc.)	6	0
Up-flow clarification ("sludge blanket clarifier") [2]	8	0
Filtration		
Granular media filtration (Surface water/GWI) ≤ 3 gpm/sq ft	10	0
Granular media filtration (Surface water/GWI) > 3 gpm/sq ft	20	0
Groundwater filtration	6	6
Membrane filtration • For compliance with a primary regulation (10 points) • For compliance with a secondary regulation (6 points)	6 - 10	0
Diatomaceous earth (pre-coat filtration)	10	0
Cartridge/bag	5	0
Pre-filtration (staged cartridges, pressure sand w/o coagulation, etc.): add one point per stage to maximum of 3 points	1 – 3	0
Slow sand	5	0
Other Treatment Processes		
Aeration	3	0
Air stripping (including diffused air, packed tower aeration)	5	0
Ion-exchange/softening	5	0
Greensand filtration	10	0
Lime-soda ash softening (includes chemical addition, mixing/flocculation/clarification/filtration—do not add points for these processes separately)	20	0
Granular activated carbon filter (do not assign points when included as a bed layer in another filter)	5	0
Powdered activated carbon	2	0
Blending sources with significantly different water quality • To achieve MCL compliance (4 points) • For aesthetic reasons (2 points)	2 – 4	0
Reservoir management employing chemical addition	2	0
Electrodialysis	15	0
Other: Certification authority may assign 2 to 15 additional points for processes not listed elsewhere in this document. (Specify) Click or tap here to enter text.	2 – 15	0
Residuals Disposal		
• Discharge to surface, sewer, or equivalent (0 points) • On-site disposal, land application (1 point) • Discharge to lagoon/drying bed, with no recovery/recycling, e.g. downstream outfall (1 point) • Backwash recovery/recycling: discharge to basin or lagoon and then to source (2 points) • Backwash recovery/recycling: discharge to basin or lagoon and then to plant intake (3 points)	0 – 3	1

Item	Points Possible	Your Facility
Facility Characteristics		
Instrumentation—Use of SCADA or similar instrumentation systems to provide data, with: • Monitoring/alarm only, no process operation—plant has no automated shutdown capability (0 points) • Limited process operation, e.g. remote shutdown capability (1 point) • Moderate process operation—alarms and shutdown, plus partial remote operation of plant (2 points) • Extensive or total process operation—alarms and shutdown, full remote operation of plant possible (4 points)	0 - 4	0
	TOTAL	18

See WAC 246-292-050 for minimum certification requirements.

Class I	30 points or less	Class III	56-75 points
Class II	31-55 points	Class IV	76 points and greater

Form Completed by	Kristopher Keenan, PE
Phone	(360) 331-4131 ext. 211
Date	1/32/2025

Notes

[1]**Raw water quality** is subject to:

- Taste and/or odor for which treatment process adjustments are routinely made (2 points). 1) T&O issue has been identified in a pre-design report, etc., 2) a process has been installed to address, and 3) operational control adjustments are made at least seasonally. Do not give points for T&O when there is no specific additional impact on operation. E.g. if a system is already pre-chlorinating for disinfection, give no points for T&O.
- Color > 15 CU (not due to precipitated metals) (3 points) with following exceptions. Color will be considered elevated and points assigned when levels exceed 75 Color Units (CU) for conventional filtration, 40 CU for direct filtration, or 15 CU for all other technologies, except reverse osmosis (no points given for color for reverse osmosis).
- Iron and/or manganese > MCL: Fe (2 points), Mn (3 points) (3 points maximum allowed) ***with following exceptions.*** Iron and manganese levels will be considered elevated and points assigned if they are greater than the MCL, except for applications of manganese greensand filters. For applications of manganese greensand filters, iron and manganese levels will be considered elevated when their combined level exceeds 1.0 mg/L (3 points allowed).
- Algal growths for which treatment process adjustments are routinely made (3 points). Raw water will be considered subject to algae growths when treatment processes are specifically adjusted due to the presence of high levels of algae on at least a weekly basis for at least two months each year.

[2]**Upflow clarification** ("sludge blanket clarifier")—8 points. Also known as sludge blanket clarification. Includes such proprietary units as Super-Pulsator. These units include processes for flocculation and sedimentation. Important note: these are not the same as adsorption clarifiers.

Water Treatment Definitions

Definitions reprinted from Glossary of Water and Wastewater Terms, used with permission from Office of Water Programs, California State University, Sacramento.

Adsorption

The gathering of a gas, liquid, or dissolved substance on the surface or interface zone of another material.

Aeration

The process of adding air to water. Air can be added to water by passing air through water or passing water through air.

Air stripping

A treatment process used to remove dissolved gases and volatile substances from water. Large volumes of air are bubbled through the water being treated to remove (strip out) the dissolved gases and volatile substances.

Chloramination

The application of chlorine and ammonia to water to form chloramines for the purpose of disinfection.

Diatomaceous earth

A fine, siliceous (made of silica) "earth" composed mainly of the skeletal remains of diatoms.

Direct filtration

A method of treating water which consists of the addition of coagulant chemicals, flash mixing, coagulation, minimal flocculation, and filtration. The flocculation facilities may be omitted, but the physical-chemical reactions will occur to some extent. The sedimentation process is omitted.

Electrodialysis

The selective separation of dissolved solids on the basis of electrical charge, by diffusion through a semipermeable membrane across which an electrical potential is imposed.

Reverse osmosis

The application of pressure to a concentrated solution which causes the passage of a liquid from the concentrated solution to a weaker solution across a semipermeable membrane. The membrane allows the passage of the water (solvent) but not the dissolved solids (solutes).

SCADA system

The Supervisory Control And Data Acquisition system is a computer-monitored alarm, response, control and data acquisition system used by drinking water facilities to monitor their operations.

Stabilization

Processes that convert organic materials to a form that resists change. Organic material is stabilized by bacteria which convert the material to gases and other relatively inert substances. Stabilized organic material generally will not give off obnoxious odors.

Washington State Department of HEALTH

To request this document in another format, call 1-800-525-0127. Deaf or hard of hearing customers, please call 711 (Washington Relay) or email doh.information@doh.wa.gov. If in need of translation services, call 1-800-525-0127.

Ferry Information – Mukilteo/Clinton

Current Round Trip Fare information. Annual adjustments usually go into effect in October and are published in August. Washington State Ferries (WSF) also sells Multi-Ride Commuter Cards (see pricing below). Multi-ride commuter cards can only be used for vehicles under 22' long.

Fare Description	Quantity	Cost
Passenger		
Adult (age 19 - 64)	0	$6.25
Senior (age 65 & over) / Disability	0	$3.10
Youth (age 18 and under)	0	*No Charge*
Multi-Ride Commuter Card 10 Ride	0	$50.45
WSF Monthly Pass 31 Ride	0	$80.70
Bicycle Surcharge Only (19 and over)	0	$1.00
Vehicle, Motorcycle, and Stowage Fares		
Vehicle Under 14' (less than 168") & Driver	0	$21.90
Vehicle Under 22' (standard veh) & Driver	0	$27.80
Vehicle U14' (less than 168") & Sr/Disability Driver	0	$18.70
Vehicle U22' (standard veh) & Sr/Disability Driver	0	$24.60
Multi-Ride Commuter Card - Vehicle U14' & Driver 20 Ride	0	$141.95
Multi-Ride Commuter Card - Vehicle U22' & Driver 20 Ride	0	$179.05
Motorcycle & Driver / Stowage Fare	0	$12.10
Motorcycle & Senior/Disability Driver / Stowage Fare	0	$8.90
Multi-Ride Commuter Card - Motorcycle & Driver 20 Ride	0	$80.30
Vehicle Length-Based		
Vehicle Under 30' Under 7'2 in.	0	$41.20
Vehicle Under 30' Over 7'2 in.	0	$81.40
Vehicle Under 40'	0	$108.20
Vehicle Under 50'	0	$135.00
Vehicle Under 60'	0	$161.80
Vehicle Under 70'	0	$188.60
Vehicle Under 80'	0	$215.40
Cost per foot over 80'	0	$2.70

Business Accounts:

https://wsdot.wa.gov/travel/washington-state-ferries/tickets/business-accounts

Business Accounts let companies provide their employees with an easy way to pay their fares. WSF will issue as many charge cards as the company needs. These cards can be used to pay for any fare or multi-ride product available at vehicle and passenger tollbooths. Companies will be billed monthly and must be paid by check only.

Commercial and oversized vehicles on ferries:

https://wsdot.wa.gov/travel/washington-state-ferries/rider-information/commercial-and-oversized-vehicles-ferries

Notes:

1. The normal schedule is a ferry every 30 minutes and the trip takes about 20 minutes.
2. Reservations are not available for the Mukilteo/Clinton route.
3. It is critical for GCs to look at commercial and oversized vehicle web page listed above. Oversize and/or Overweight vehicles require at least 2-day advance notice to WSF.
4. Clearance height varies by ferry – drivers will need to check schedule pages for vessels in use on Mukilteo/Clinton route each travel day as they can change.
5. Vehicles over 40’ long should arrive 45 minutes to 1 hour ahead of the ferry they want to catch

Date published: June 2, 2025