Bainbridge Island
Metro Park & Recreation District

PROJECT MANUAL

Ray Williamson Pool Renovation

April 25, 2024

BID SET
Phase 1

Consultants:
Stemper Architecture Collaborative
The Greenbusch Group Engineers
TFWB Engineers
MLA Engineering

Bainbridge Island
Metro Park & Recreation District

PROJECT MANUAL FOR

PROJECT NO. 20223

RAY WILLIAMSON POOL IMPROVEMENTS
PHASE 1

8521 Madison Ave. N.
Bainbridge Island, WA 98110

Contact:

Matthew Keough, Project Manager
mattk@biparks.org

Michelle Miller, Procurement Manager
michellem@biparks.org

DIVISION 00

Bidding Requirements, Contract Forms, & Conditions of the Contract

ADVERTISEMENT FOR BIDS

April 25, 2024

Bainbridge Island Metropolitan Park & Recreation District (BIMPRD)
Ray Williamson Pool Improvements, Phase 1

BID NOTICE

The Bainbridge Island Metropolitan Park and Recreation District will receive sealed bids for the following project:

PROJECT:	20223 Ray Williamson Pool Improvements, PHASE 1
PROJECT MANAGER:	Matthew Keough, mattk@biparks.org
PROCUREMENT MANAGER:	Michelle Miller, michellem@biparks.org
ESTIMATED BID COST: RANGE	$3,100,000 TO $3,500,000
SUBMITTAL TIME/DATE/LOCATION:	**Prior to 2:00p m on Tuesday, May 21,** submit hand delivered bid(s) to Bainbridge Island Recreation Center, Administration Office (front desk) located at: **11700 Meadowmeer Circle NE, Bainbridge Island, 98110.** Bids received after the appointed time set for receipt will be returned unopened. Mail to: **11700 Meadowmeer Circle NE, Bainbridge Island, 98110** ATTN: Michelle Miller, Procurement Manager All bid submissions must be hand delivered and/or physically mailed/couriered to Michelle Miller, Procurement Manager. No electronic bids will be received. Bids will be opened and publicly read aloud **Tuesday, May 21 at 2:15 pm** in person. There will be no virtual link available for this event.
ISSUED BY:	BIMPRD; All of the bidding documents are on file in the office of the Owner. Bona fide bidders may obtain bidding documents online at: www.biparks.org/doing-business.
CONTACTS:	Questions may be directed to Michelle Miller, Procurement Manager, at michellem@biparks.org. Any questions pertaining to the bid documents must be submitted in writing. The deadline for contractor questions regarding this project shall be submitted by close of business day on Tuesday, May 14, 2024.
PRE-BID MEETING AND SITE VISIT:	The Pre-bid Meeting is **mandatory**. Prospective bidders may attend one of the following Pre-bid Meetings:

First Pre-Bid Meeting: Thursday, May 02 at 11:00 am

Second Pre-Bid Meeting: Monday, May 06 at 3:30pm

Both meetings will be held at 8521 Madison Ave N, Bainbridge Island, WA 98110. A walk through of the site will be available to prospective Bidders after the pre-bid conference.

GENERAL PROJECT DESCRIPTION: The Ray Williamson Pool Renovation project includes but is not limited to: replacement of low slope roof, storefront system at office 101, swing out entrance doors, clerestories, skylight, electrical service and panel upgrades, HV system , replacement of fluorescent lighting with LED fixtures and lighting control upgrades, repair of exterior brick, rehabilitation and reuse of the Locker Rooms (Men's and Women's) in to a filter room and expanded office areas, office area improvements, refurbishing the existing fire sprinkler piping and other corroded equipment and accessory items in the Ray Williamson Pool at the Bainbridge Island Aquatics Center building. The project will adhere to ADA requirements.

BIDDING DOCUMENTS: The bidding documents shall consist of:

1. Bid Notice
2. Instructions to Bidders
3. General Conditions
4. Bid Form/Bidder's Proposal and Proposal Signature Sheet
5. Bidder's Bond
6. Sample Performance and Payment Bond
7. Sample Retainage Bond
8. Sample Contract for Construction Services
9. Washington State Prevailing Wage Rates (refer to link below)
10. Technical Specifications and List of Drawings listed in the Table of Contents of Drawings

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General Preliminary Information to Prospective Bidders:

1] PREVAILING WAGE RATE: The State of Washington Prevailing Wage Rates are applicable for this project located in Kitsap County. Bidders are responsible to verify and use the most recent prevailiang wage rates. The "Effective Date" for this project is the Bid Form due date above. The applicable prevailing wage rates may be found on the Department of Labor & Industries website located at https://secure.lni.wa.gov/wagelookup/.

2] PERMITTING: Bainbridge Island Metro. Park & Recreation District (BIMPRD) has concluded building permitting with Washington State Department of Health and L&I. Thebuilding permit will be distributed to the awarded Contractor prior to Start of Work. All other permits (eg: electrical, demo) will be acquired by Contractor.

3] BID SECURITY : Each bid must be accompanied by a certified check for 5% of the total maximum amount of the bid, made payable to the Owner, or a bid bond in the form furnished by the Owner for 5% of the total maximum amount of the bid, as a guarantee that the bidder will promptly execute a valid contract with the Owner in accordance with the bidding documents. If a bid bond is used, the 5% may be shown in dollars and cents or the form may be filled in by inserting therein, in lieu of dollars of cents, "5% of the amount of the accompanying proposal." Bonds must be satisfactory to the Owner. Check or bid bond of the successful bidder will be returned immediately upon execution of contract in acceptance of performance and payment bond. All other checks will be returned upon execution of the contract. The Bidder acknowledges that the Owner will suffer substantial damages if Bidder refuses to enter the Contract or furnish the required bonds but that such damages are difficult to determine with precision. If the Bidder refuses to enter into such Contract or fails to furnish such bonds if required (all within the required time), then the Owner may elect to retain and forfeit the good security or Bid Bond as liquidated damages (and not a penalty) or collect actual damages from the Bidder.

4] REJECTION OF BIDS: The Owner shall have the right to reject any or all bids or any items of the bid and in particular to reject a bid not accompanied by any required bid security or data required by the bidding documents or bid in any way incomplete or irregular. Any or all bids may be rejected for good cause.

5] CONTRACT AWARD

a. The contract shall be awarded to the lowest responsible bidder. The Owner reserves the right to waive informalities or technical defects as of the interest of the Owner may require.
b. No bidder may withdraw his/her bid after the hour set for the opening of bids or before the award of the contract.
c. Proposals must be made on the Bidder's Proposal Form.

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PART 1 – GENERAL

1.01 **ARTICLE 1 OF BIDDING DOCUMENTS - DEFINITIONS**

1.1 Bidding Documents include the Bid Notice, Invitation to Bid, Instructions to Bidders, General Conditions for Bainbridge Island Metropolitan Park and Recreation District Public Works Projects, , Unique Project Conditions if applicable, Bidder's Proposal and Proposal Signature Sheet, Subcontractor Listing Form if project is estimated at $1,000,000 or more, Bidder's Bond, Sample Faithful Performance and Payment Bond, Sample Retainage Bond, Sample Escrow Agreement, Sample Contract for Construction Services, Washington State Prevailing Wage Rates and Benefit Code Key, Davis-Bacon Wage Determinations if project has Federal Funding, Technical Specifications and List of Drawings listed in the Table of Contents, Drawings if applicable, and any addenda issued prior to receipt of bids.
The Contract Documents proposed for the work consist of the Contract for Construction Services, the conditions of the Contract (General, Supplementary and any other conditions), applicable Washington State Prevailing Wage Rates and Benefit Code Key, applicable Davis Bacon Wage Determinations if project has Federal Funding, the Drawings and Specifications, and all addenda issued prior to and all modifications issued after execution of the Contract.

1.2 All definitions set forth in the General Conditions for Bainbridge Island Metropolitan Park and Recreation District Public Works Projects, and in other Contract Documents are applicable to the Bidding Documents.

1.3 Addenda are written, or graphic instruments issued by the Architect prior to the execution of the Contract, which modify the Bidding Documents by additions, deletions, clarifications, or corrections.

1.4 A Bid is a complete and properly signed proposal to do the Work or designated portion thereof for the sums stipulated therein, submitted in accordance with the Bidding Documents.

1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which work may be added or from which work may be deleted for sums stated in Alternate Bids.

1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials or services as described in the Bidding Documents or in the proposed Contract Documents.

1.8 A Bidder is a person or entity who submits a Bid.

1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials or labor for a portion of the Work.

1.02 **ARTICLE 2 OF BIDDING DOCUMENTS - BIDDER'S REPRESENTATIONS**

2.1 Each Bidder by making his Bid represents that:

2.1.1 He has read and understands the Bidding Documents and his Bid is made in accordance therewith.

2.1.2 He has visited the site, has familiarized himself with the local conditions under which the Work is to be performed, and has correlated his observations with the requirements of the proposed Contract Documents.

2.1.3 His Bid is based upon the materials, systems, and equipment required by the Bidding Documents without exception.

1.03 **ARTICLE 3 OF BIDDING DOCUMENTS**

3.1 **COPIES OF BIDDING DOCUMENTS**

3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Invitation to Bid for the fee designated. This will be considered a sale and will involve no refunding.

3.1.2 Bidding Documents may be issued directly to Sub-Bidders.

3.1.3 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor the Architect assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

3.1.4 The Owner or the Architect in making copies of the Bidding Documents available on the above terms does so only for the purpose of obtaining Bids on the Work and does not confer a license or grant for any other use.

3.2 **INTERPRETATIONS OR CORRECTION OF BIDDING DOCUMENTS**

3.2.1 Bidders or Sub-bidders shall promptly notify the Architect of any ambiguity, inconsistency, or error, which they may discover upon examination of the Bidding Documents or of the site and local conditions.

3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven (7) days prior to the date for receipt of Bids.

3.2.3 Any interpretation, correction, or change of the Bidding Documents will be made by Addendum. (See 3.4) Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections, and changes.

3.3 **SUBSTITUTIONS**

3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten (10) days prior to the date for receipt of Bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the substitute would require shall be included. The burden of proof of the merit of the proposed substitute is upon the proposer. The Architect /Owner's decision of approval or disapproval of a proposed substitution shall be final and binding.

3.3.3 If the Architect/Owner approves any proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner. Should any proposed product substitution require any re-design work by the Architect/Owner or his consultants to accommodate the substitute product, costs for such redesign work shall be included in the Bid amount and shall be paid to the Architect at his usual rates/Owner at reasonable rates for the time expended in the required re-design work.

3.3.4 No substitutions will be considered after the Contract award unless specifically provided in the Contract Documents.

3.3.5 Substitution requests shall be made only on the Substitution Request Form found hereinafter. Fill in all data requested on the form and such form shall be received by the Architect at least ten (10) days prior to the date for receiving bids.

3.4 **ADDENDA**

3.4.1 Bidders shall acknowledge receipt of all addenda to this solicitation by identifying the addenda numbers in the space provided for this purpose on the Bid Form. Failure to dos o may result in the bid being declared non-responsive.

3.4.2 Addenda will be mailed or delivered to all who are known by the Architect/Owner to have received a complete set of Bidding Documents. Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

3.4.3 No Addenda will be issued later than four (4) days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one, which includes postponements of the date for receipt of Bids.

3.4.4 Each Bidder shall ascertain prior to submitting his bid that he has received all Addenda issued, and he shall acknowledge their receipt in his Bid.

3.5 DRAWINGS AND PROJECT MANUALS, COORDINATION

3.5.1 Prior to submitting a bid proposal for work being bid upon, examine and coordinate all Bidding Documents with all other contracts to be awarded separately from but in connection with the work being bid upon, so that Bidder is fully informed as to conditions affecting work under contract being bid upon. Failure to do so shall not be cause for any additional costs for work caused therefrom.

1.04 ARTICLE 4 - BIDDING PROCEDURE

4.1 PREPARATION OF BIDS - CONSTRUCTION

4.1.1 Bids shall be submitted on forms identical to the form included with the Bidding Documents. Bids must be: 1] submitted on the Bid Form, or copies of forms, furnished by the Owner, and 2] signed in ink. The person signing a bid must initial each change appearing on any Bid Form. If the bid is made by a corporation, it shall be signed by the corporation's authorized designee. The address of the Bidder shall be typed or printed on the Bid Form in the space provided.

4.1.2 the Bid Form may require Bidders to submit bid prices for one or more items on various bases including: 1] lump sum base bid; 2] lump sum bid alternate prices; 3] unit prices; or 4] any combination of items 1 through 3 above.

4.1.3 If the solicitation includes alternate bid items, failure to bid on alternates may disqualify the bid. If bidding on all items is not required, Bidders should insert the words "no bid" in the space provided for any item on which no price is submitted.

4.1.4 All blanks on the bid form shall be filled in by typewriter or manually in ink. Where so indicated by the makeup of the bid form, sums shall be expressed in both words and figures, and in case of discrepancy between the two, the amount written in words shall govern. Any interlineation, alteration, or erasure must be initialed by the signer of the Bid.

4.1.5 The prices in the Bid shall include all applicable federal, state, and local taxes for the job site, Bainbridge Island, Kitsap County, Washington.

4.1.6 Each copy of the Bid shall include the legal name of the Bidder and a statement that the Bidder is a sole proprietor, a partnership, a corporation, or some other legal entity. Each proposal signature sheet shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A bid by a corporation shall further give the state of incorporation and have the corporate seal, if there is one, affixed. A bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

4.1.7 Substitute bid forms will not be considered unless this solicitation authorizes their submission.

4.2 BID SECURITY

4.2.1 When the sum of the base bid plus all additive bid alternates (as applicable) is $35,000.00 or less, bid security is not required.

When the sum of the base bid plus all additive alternates is greater than $35,000.00, a bid guarantee in the amount of 5% of the base bid amount is required. Failure of the Bidder to provide bid guarantee when required shall render the bid non-responsive.

4.2.2 Each Bid shall be accompanied by a bid security in the form and amount required by the Owner pledging that the Bidder will enter into a Contract with the Owner on the terms stated in his Bid and will, if required, furnish bonds as described hereunder in Article 7 covering the faithful performance of the Contract and the payment of all obligations arising thereunder. The Bidder acknowledges that the Owner will suffer substantial damages if Bidder refuses to enter the Contract or furnish the required bonds but that such damages are difficult to determine the precision. If the Bidder refuses to enter into such Contract or fails to furnish such bonds if required (all within the required time), then the Owner may elect to retain and forfeit the good security of Bid Bond as liquidated damages (and not a penalty) or collect actual damages from the Bidder.

4.2.3 The surety bond shall be written on the Bid Bond form supplied with the Bidding documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of his power of attorney.

4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn, or (c) all Bids have been rejected.

The Owner will return bid guarantees (other than the bid bond) to unsuccessful Bidders as soon as practicable, but not sooner than the execution of a contract with the successful Bidder.

4.2.5 **SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA FORMS (BRC)**

A] Submission and Evaluation of the BRC – the apparent low Bidder must submit the BRC, all forms, and any additional documentation to the Owner within 3 Business Days of receipt of the request or as otherwise acceptable to the Owner. The documentation must detail the Bidder's, or Subcontractor's experience with the precise experience requirements as stated in the Contract. Refer to Section 00 43 00.

B] Compliance History – the Bidder must answer questions on the BRC demonstrating their compliance history and capabilities in performing these categories. The Owner may use a Bidder's past compliance history as part of the determination responsibility.

C] Personnel – the Bidder certifies, by submitting the BRC, that it will assign the named personnel to the Project. In the event it becomes necessary for the Bidder to substitute personnel during the life of the Contract, the following provisions apply:

1] Before substituting a new project manager or superintendent, the Contractor must submit for the approval of the Owner, a current resume for the new personnel

documenting that the new personnel comply with the supplemental bidder responsibility criteria established for the project.

2] The Owner may suspend the project if the Contractor substitutes a project manager or superintendent without the Owner's approval. The Contractor is fully liable for the additional costs resulting from the suspension of work and no adjustments in the Contract Time resulting from suspension of work will be allowed.

D] Work Experience— If specific work experience criteria are required in the Project Manual, the Bidder must document on the BRC that it meets the specified criteria. The Owner will verify that the specified work experience criteria is met by the apparent low Bidder. It is the Bidder's responsibility to verify that the names and phone numbers provided for references are current to ensure the Owner's ability to contact references and verify Bidder work experience. If the Owner is unable to contact references to verify Bidder or Subcontractor experience due to circumstances beyond its control, the Owner reserves the right to determine work experience based on the information available to the Owner.

4.3 **SUBCONTRACTORS**

4.3.1 When the Owner's estimate of the project cost exceeds $1,000,000 (including additive alternates), the bidder is required to list 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. 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 nonresponsive and, therefore, void. If the bidder does not intend to award any subcontracts for the base bid and alternates, the bidder shall so indicate on their subcontractor list. (Reference RCW 39.30.060)

4.3.2 Failure to meet this requirement shall render the bidder's bid non-responsive and, therefore, void.

4.3.3 The Bidder's list of subcontractors shall be submitted on the "Subcontractor Listing" form included with the bid documents.

4.3.4 The successful Bidder shall not be permitted to change Subcontractors named on the Subcontractor Listing without the prior written consent of the Owner and as stipulated in the General Conditions.

4.4 **SUBMISSION OF BIDS**

4.4.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed envelope. The envelope shall be addressed to the Bainbridge Island Metropolitan Park and Recreation District and shall be identified with the Project name, the Bidder's name, and address and, if applicable, the designated portion of the Work for which the Bid submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

4.4.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids indicated in the Invitation to Bid, or any extension thereof made by Addendum. Bids received after the time and date for receipt of Bids will be returned unopened.

4.4.3 All Bids shall be logged by the Owner upon receipt. The Bidder shall assume full responsibility that the Bid be logged, as well as assuming full responsibility for timely delivery at the location designated for receipt of Bids. A Bidder mailing its Bid bears the risk of non-receipt and the risk of failure to log or inaccurate logging.

4.4.4 Oral, telephonic Bids are invalid and will not receive consideration.

4.4.5 The bid prices shown for each item on the Bid Form shall include all labor, material, equipment, overhead, and compensation to complete all of the work for that item.

4.4.6 The actual cost of the public utility hookup fees will be a direct reimbursement to the Contractor or paid directly to the permitting agency by the Owner. Fees should not be included by the Bidder in the bid amount.

4.4.7 The Bidder agrees to hold the base bid prices for sixty (60) days from date of opening.

4.4.8 The bid amounts shall not include Washington State Sales Tax (WSST). All other taxes imposed by law shall be included in the bid amount. The Owner will include WSST in progress payments. The Contractor shall pay the WSST to the Department of Revenue and shall furnish proof of payment to the Owner if requested.

4.5 **MODIFICATION OR WITHDRAWAL OF BID**

4.5.1 A Bid may not be modified, withdrawn, or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting his Bid.

4.5.2 Prior to the time and date designated for receipt of Bids, any Bid submitted may be modified or withdrawn by written notice to the Owner at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder, written confirmation over the signature of the Bidder shall be mailed and postmarked on or before the date and time set for receipt of Bids, and it shall be so worded as not to reveal the amount of the original Bid.

4.5.3 Withdrawn Bids may be resubmitted up to the time designated for the receipt of Bids provided they are then fully in conformance with these Instructions to Bidders.

4.5.4 Bid security shall be in an amount sufficient for the Bid as modified or resubmitted.

1.05 ARTICLE 5 - CONSIDERATION OF BIDS

5.1 OPENING OF BIDS

5.1.1 The properly identified Bids received on time will be opened publicly and will be read aloud. An abstract of the Base Bids and Alternate Bids, if any, will be made available to Bidders. This information may be obtained by contacting the Project Manager, Matthew Keough.

5.2 REJECTION OF BIDS

5.2.1 The Owner shall have the right to reject any or all Bids or any items of the Bid and to reject a Bid not accompanied by any required Bid security or by other data required by the Bidding Documents, or to reject a Bid, which is in any way incomplete or irregular. Any or all bids may be rejected for good cause.

5.2.2 If Owner determines that an apparent low bidder is not responsible, Owner will provide its reasons for the determination in writing to the bidder. The bidder may appeal the determination by within three (3) days of its receipt of Owner's determination presenting additional information to Owner. If bidder provides this additional information, Owner will provide a final and binding written determination to the bidder.

5.3 ACCEPTANCE OF BID (AWARD)

5.3.1 It is the intent of the Owner to award a Contract to the lowest responsible Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive any informality, irregularity, or technical defect in any Bid or Bids received and to accept the Bid or Bids, which, in its judgment, is in its best interests. In selecting the most responsible Bidder, consideration will be given to financial standing and the general competency of the Bidder for the performance of the work covered by the proposal.

5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in Article 9, and to determine the lowest and best Bidder on the basis of the sum of the Base Bid and the Alternates accepted, together with considerations of responsibility and compliance.

1.06 ARTICLE 6 - POST BID INFORMATION

6.1 CONTRACTOR'S QUALIFICATION STATEMENT

6.1.1 Bidders to whom award of a Contract is under consideration may be required to submit to the Owner, upon request, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

6.2 **SUBMITTALS**

6.2.1 The bidder shall, within seven days of notification of selection for the award of a Contract for the Work, submit the following information to the Architect/Owner:
.1 a designation of the Work to be performed by the Bidder with his own forces;
.2 the names of the suppliers of items, systems, materials and equipment proposed for the Work;
.3 A list of names of the Subcontractors or other persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

6.2.2 The Bidder will be required to establish to the satisfaction of the Architect and the Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

6.2.3 Prior to the award of the Contract, the Architect/Owner will notify the Bidder in writing if either the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity. If the Owner or Architect has reasonable objection to any such proposed person or entity, the Bidder may, at his option, (1) withdraw his Bid, or (2) submit an acceptable substitute person or entity with an adjustment in his bid price to cover the difference in cost occasioned by such substitution. The Owner may, at his discretion, accept the adjusted bid price or he may disqualify the Bidder. In the event of either withdrawal or disqualification under this Subparagraph, bid security will not be forfeited, notwithstanding the provisions of Paragraph 4.5.1.

6.2.4 Persons and entities proposed by the Bidder and to whom the Owner has and the Architect have made no reasonable objection under the provisions of Subparagraph 6.2.3 must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and the Architect.

1.07 **ARTICLE 7 - FAITHFUL PERFORMANCE AND LABOR AND MATERIAL PAYMENT BOND**

7.1 **BOND REQUIREMENTS**

7.1.1 Prior to execution of the Contract, the Bidder shall furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder in such form and amount as the Owner may prescribe. Bonds may be secured through the Bidder's usual sources from a company licensed to do business in Washington State and excellently rated. The cost of such bonds shall be included in the Bid.

7.2 **TIME OF DELIVERY AND FORM OF BONDS**

7.2.1 The bidder shall deliver the required bonds to the Owner not later than the date of execution of the Contract, or if the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

7.2.2 The bonds shall be written on Faithful Performance Bond and Labor and Material Payment Bond forms provided by the Owner.

7.2.3 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his power of attorney.

1.08 **ARTICLE 8 - AGREEMENT BETWEEN OWNER AND CONTRACTOR**

8.1 **FORM TO BE USED**

8.1.1 Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on the attached “Agreement for Construction Services”.

8.2 **EXECUTION OF AGREEMENT**

8.2.1 A Bidder whose proposal is accepted shall sign the written Agreement between Owner and Contractor within ten (10) days from the date of mailing of a Notice from Owner to Bidder of acceptance of his proposal. Failure to so execute the Agreement shall result in forfeiture of the Bidder's bond or certified check.

END OF SECTION

Bainbridge Island Metropolitan Park & Recreation District (BIMPRD)
11700 Meadowmeer Circle NE.
Bainbridge Island 98110

Contract: 20223

BID FORM

In compliance with the contract documents, the following bid form is submitted:

	Description	Price
A.	**BASE BID (without tax):**	
B.	**SUBTOTAL (without tax):**	
C.	State Sales Tax @_____%	
D.	**TOTAL BID (WITH TAX):** **(B + C)**	

BIDDER:_____
(Print Business Name)

The Owner reserves the right to accept or reject any or all bids within sixty (60) days of the bid date.

The Owner shall have the right to reject any or all bids or any items of the bid and in particular to reject a bid not accompanied by any required bid security or data required by the bidding documents or bid in any way incomplete or irregular. Any or all bids may be rejected for good cause.

TIME FOR COMPLETION

Contract Time: the undersigned hereby agrees to Substantially Complete all the work under the Base Bid (and accepted Alternates) within **226** calendar days after the date of Notice-To-Proceed.

Final Completion: All the Work shall be fully and finally completed in accordance with the contract documents within 21 calendar days after the dates of Substantial Completion.

LIQUIDATED DAMAGES

The undersigned agrees to pay the Owner as liquidated damages the sum of **$400** for each consecutive calendar day that is in default after the Contract Time. Liquidated damages shall be deducted from the contract invoice after taxes and retainage.

RECEIPT OF ADDENDA

Receipt of the following addenda is acknowledged:

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

1.01 BID

A. The undersigned Bidder hereby certifies to have personally and carefully examined the Contract Documents issued for: **Ray Williamson Pool Renovation, Phase 1**

B. The Bidder has examined the site where the Work is to be performed and the conditions affecting the Work;

C. The undersigned Bidder declares that they have read and fully understands the Notice inviting bids and each and every other Contract Document referred to therein and agrees to all of the terms, conditions and provisions contained therein; that they have examined the site of the work and have made the investigations and formed the estimates as to all conditions and contingencies referred to in and required by the Contract Documents, and they propose and agree that if their bid as submitted in the Proposal be accepted, they will contract in the form provided to perform all of the work and in the manner required by the Contract Documents and to complete the same within the time stipulated; that they will accept in full payment therefor the prices named herein. Said prices are to include and cover the furnishing of all materials, the performing of all labor

requisite or proper, supervision, overhead, profit, taxes (excluding State sales tax), and the providing of all necessary machinery, tools, appurtenances, equipment and other means required to fully complete this contract, except as otherwise specifically provided in the Specifications.

D. Bidder further agrees that they will sign the contract in accordance with the Proposal as accepted and furnish the required bonds within ten (10) days from date of mailing of said notice of acceptance to them at their address as given below or within such additional time as may be allowed by the Owner, but in any event within twenty (20) days after said mailing; upon their failure or refusal to do so within said time, the certified or cashier's check or bidder's bond, accompanying their bid, and the money payable thereon, shall be forfeited to and become the property of the owner as liquidated damages (and not a penalty) for such failure or refusal, provided, that if said bidder shall execute the contract and furnish the required bonds within the time aforesaid, their certified or cashier's check, if furnished, shall be returned to them within three (3) days thereafter, and the bid bond, if furnished, shall become void.

E. Bidder agrees that their Proposal shall remain open and not withdrawn for a period of not less than sixty (60) days from the date of opening bids.

F. No extra will be allowed if an increase becomes necessary due to an error or omission of contractor or any subcontractor.

G. Written “Changes in Work” will be issued formalizing any authorized changes.

H. Owner will evaluate bids to determine the lowest Total Price offered by responsive, responsible bidder. The Owner reserves the right to reject a bid in the event it is determined that any price for any bid item is unreasonable, unbalanced, or otherwise not in the best interest of Owner. A contract will be awarded, if at all, based on the lowest Total Price of responsive, responsible bidder.

I. Owner reserves the right, but without obligation, to weigh the irregularities and informalities. The Owner further reserves the right to reject any portion of any bid, and/or to reject all bids. Construction shall be completed within contract days declared from the written notice to proceed. If not completed by such date, the Contractor shall be liable to the District for damages. The Contractor acknowledges and agrees to abide by all provisions of the General Conditions Article 3.07, Damages for Failure to Achieve Timely Completion.

J. Attached forms: Bidder's Bond or Certified/Cashier's Check.

1.02 DECLARATION

I DECLARE, UNDER PENALTY OF PERJURY UNDER THE LAWS OF THE STATE OF WASHINGTON, AS FOLLOWS:

A. **BID:** I agree to perform the Work in compliance with the Bid Documents, for the prices stated in Section 00 41 00, Paragraph 1.01 of the Bid Form.

B. **NON-DISCRIMINATION:** I agree to ensure equal opportunity for employment and to engage in Affirmative Efforts in the solicitation of women and minorities and WMBE firms for participation on this Contract in accordance with SMC Ch. 20.42 and RCW 35.22.650.

C. **NON-COLLUSION:** I have not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free, competitive bidding in the preparation and submission of a Bid to the Owner for consideration in the award of a contract on the improvement described in the Bid Documents.

D. My bid takes into account the requirements imposed by Section 00 73 16, Article 1.09, which waives, with respect to the Owner only, the Contractor's immunity under RCW Title 51, (Industrial Insurance) of the Revised Code of Washington.

E. I agree to comply with the requirements regarding subcontracting, and the purchase of supplies or materials from firms that are not debarred or otherwise disqualified from doing business with the City under the provisions of SMC Ch. 20.42 or SMC Ch. 20.70.

F. Responsible Bidder Requirements: My bid acknowledges that I am in compliance with all of the responsible bidder requirements under RCW 39.04.350, including: having a certificate of registration under RCW 18.27 prior to bidding; a UBI number; industrial insurance coverage if required under Title 51 RCW; an employment security number under Title 50; and a state excise tax registration number under Title 82 and have received training on requirements related to public works and prevailing wage by Labor and Industries or approved training provider under RCW 39.04.350, and chapter 39.12 or are exempted by Labor and Industries. https://secure.lni.wa.gov/verify. I affirm I am not disqualified from bidding on any public works contract under RCW 39.06 or RCW 39.12.065(3) or on the System for Award Management, (sam.gov). I will provide proof of these requirements if requested.

Providing the following information is MANDATORY in order to meet "Responsible Bidder" requirements. Failure to provide this information may disqualify your bid as being "Non-Responsive".
If your business is not required to have one of the following numbers, provide an explanation.

GENERAL BUSINESS INFORMATION			
Business Name:			
Business Street Address:			
Business Mailing Address:			
Business Phone, general:		**Business Fax:**	
If the above address is not in the State of Washington please fill in the following:			
Washington State Office Address:			
State in which the Company is formed:			
Please complete the following:			
State of WA UBI No.:			
State of WA Contractor Registration No.:			
State Excise Tax Registration No.			
CONTACT INFORMATION			
Primary Contact for Award (Name and Title):			
Primary Contact Phone:		**Email:**	
Administration Contact (Name and Title):			
Administration Contact Phone:		**Email:**	
INSURANCE INFORMATION			
Name of Insurance Company:			
Name of Insurance Contact:			
Insurance Contact Phone:		**Email:**	

[cont'd on next page]

- Is the payment of Worker's Comp (Industrial Insurance) Premiums current? If your business does not have a Worker's Comp account with the WA State Dept of Labor & Industries, please explain why:
    - Yes
    - No (If no, you are not eligible to bid on this project)
    - No Account – Explain Why:

      _____

- Are you disqualified from bidding on public works projects in the State of Washington?
    - Yes (If yes, you are not eligible to bid on this project)
    - No

OFFICIAL AUTHORIZED TO SIGN FOR BIDDER:

I certify (or declare) under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct:	
Location or Place Executed (City, State):	**Print Name and Title:**
Date:	**Signature:**

End of Section 00 41 00

Subcontractor List

Prepared in compliance with RCW 39.30.060 as amended

To Be Submitted with the Bid Proposal

Project Name Ray Williamson Pool Improvements, Phase 1

Failure to list subcontractors with whom the bidder, if awarded the contract, will directly subcontract for performance of the work of structural steel installation, rebar installation, heating, ventilation and air conditioning, plumbing, as described in Chapter 18.106 RCW, and electrical, as described in Chapter 19.28 RCW or naming more than one subcontractor to perform the same work will result in your bid being non-responsive and therefore void.

Subcontractor(s) with whom the bidder will directly subcontract that are proposed to perform the work of structural steel installation, rebar installation, heating, ventilation and air conditioning, plumbing, as described in Chapter 18.106 RCW, and electrical as described in Chapter 19.28 RCW must be listed below. The work to be performed is to be listed below the subcontractor(s) name.

To the extent the Project includes one or more categories of work referenced in RCW 39.30.060, and no subcontractor is listed below to perform such work, the bidder certifies that the work will either (i) be performed by the bidder itself, or (ii) be performed by a lower tier subcontractor who will not contract directly with the bidder.

Subcontractor Name _____

Work to be performed _____

_____

_____

_____

Subcontractor Name _____

Work to be performed _____

_____

_____

_____

Subcontractor Name _____

Work to be performed _____

_____

_____

_____

Subcontractor Name _____

Work to be performed _____

_____

_____

_____

Subcontractor Name _____

Work to be performed _____

_____

_____

_____

Add sheets as necessary for a complete list of subcontractors.

Division 00
Supplemental Bidder
Responsibility Criteria

Low Responsible Bidder

It is the intent of the Owner to award a contract to the lowest responsive and responsible Bidder. In determining the Bidder's responsibility, the Owner shall consider an overall accounting of the items listed below. Potential Bidders may request the Owner modify the Bidder responsibility criteria. The request must be in writing and submitted at least 7 days prior to the bid opening.

The apparent low bidder shall submit the required information within **two (2)** business days of receiving request from Owner. This request may be made in the form of a telephone call or email message. The required information shall be provided on the referenced forms bound herein. Electronic copies may be made available upon request. Failure to submit such information to the satisfaction of the Owner within the time provided may render the Bidder as not responsible.

Required Information/Criteria

For the purposes of the Supplemental Bidder Responsibility evaluation process, the scope of this project generally involves low slope roof replacement, exterior masonry repair and coating, TI renovation at old locker room area, HVAC systems replacement, storefront systems replacement at TI renovation area, electrical service upgrades and lighting, fire sprinkler cleaning and coating.

1. **Experience of Contractor on Projects of Similar Size and Complexity**
   Contractor is required to have successfully completed at least 5 projects of similar type, size and complexity to this project, each with a contract amount of at least $ 3,000,000, within the last 10 years.

   List of Completed Projects (Use Form 1, Contractor Experience Detail)
   Provide a list of all the construction contracts $ 3,000,000 and above your firm has completed within the past 10 years, giving the name of the project; name, address, and phone numbers of Owner and architect representatives; final contract amount; date of completion; and percentage of the cost of the work performed with your firm's own forces. This information will be used for reference reviews.

2. **Experience of Key Personnel**

   Experience of Project Manager (Use Form 2, Résumé of Key Personnel for Proposed Contract)

Submit resume and references for the proposed Project Manager. This person shall have managed, as lead project manager, a minimum of 3 projects of similar type, size and complexity to this project, and successfully completed those projects within the last 10 years.

Experience of Superintendent (Use Form 2, Résumé of Key Personnel for Proposed Contract)

Submit resume and references for the proposed project Superintendent. This person shall have performed as the lead Superintendent for a minimum of 3 projects of similar type, size and complexity to this project, and successfully completed those projects within the last 10 years.

3. **Diverse Business Inclusion Plan (Not Required)**

4. **Apprenticeship (Not Required)**

5. **References from Owners and Architects for Previous Projects (Owner uses Form 5, Reference Evaluation Questionnaire)**

   The Owner may check references by contacting owners and architects of the bidder's previous projects regarding the bidder's performance and that of key staff. A reference score sheet will be utilized and the rating shall be satisfactory or better on a five-category scale with "satisfactory" at mid-scale.

Overall Scoring (Form 6, Responsibility Criteria Evaluation Score Sheet)

The Owner will use this form to complete and document the overall evaluation process.

Supplemental Bidder Responsibility
Form 1 - Contractor Experience Detail
Project: Ray Williamson Pool Renovations (BIMPRD)

Business Contact Information

Contractor Name:		Total years in Business:
Mailing Address:		
Business Phone:		Former business name(s) & Dates:
Contact Name and Title:		
Contact Phone:	Contact Email:	Reason for name change(s):

*List Projects Completed Within The Time Specified By Division 00, or Are In Progress

* Project Name & Location:	Description Of Project:	Owner:	Architect:	Project Manager Name:	Original Contract Amount:	$	Is this project relevant to proposed project?
					Final Contract Amount:	$	
		Address:	Address:		Original Contract Days		**Yes** ☐
				Superintendent Name:	Time Extensions Granted Days		**No** ☐
		Phone:	Phone:		Completion Date:		
	As Prime ☐ Or Sub: ☐						

Supplemental Bidder Responsibility
Form 2 - Resume of Key Personnel for Proposed Contract
Project: Ray Williamson Pool Renovations (BIMPRD)

Name:	Role in this Contract:	Years Experience	
		Total	With Current Firm
Firm Name and Location (City and State):			
Training/Education/Specialization:			
Years of Experience in the Proposed Role:			

RELEVANT PROJECTS	
Project Title:	Year Completed
Project Owner:	
Brief Description (Brief scope, size, cost, etc.) and specific role:	Check if project performed with current firm. ☐ If performed with different firm list the firm name
Reference Name & Contact Information:	
Project Owner:	Project Architect:
Name:	Name:
Phone:	Phone:
E-mail	E-mail:

RELEVANT PROJECTS	
Project Title:	Year Completed
Project Owner:	
Brief Description (Brief scope, size, cost, etc.) and specific role:	Check if project performed with current firm. ☐ If performed with different firm list the firm name
Reference Name & Contact Information:	
Project Owner:	Project Architect:
Name:	Name:
Phone:	Phone:
E-mail	E-mail:

RELEVANT PROJECTS		
Project Title:		Year Completed
Project Owner:		
Brief Description (Brief scope, size, cost, etc.) and specific role:		Check if project performed with current firm. ☐ If performed with different firm list the firm Name
Reference Name & Contact Information:		
Project Owner:	Project Architect:	
Name:	Name:	
Phone:	Phone:	
E-mail	E-mail:	

RELEVANT PROJECTS		
Project Title:		Year Completed
Project Owner:		
Brief Description (Brief scope, size, cost, etc.) and specific role:		Check if project performed with current firm. ☐ If performed with different firm list the firm Name
Reference Name & Contact Information:		
Project Owner:	Project Architect:	
Name:	Name:	
Phone:	Phone:	
E-mail	E-mail:	

RELEVANT PROJECTS		
Project Title:		Year Completed
Project Owner:		
Brief Description (Brief scope, size, cost, etc.) and specific role:		Check if project performed with current firm. ☐ If performed with different firm list the firm Name
Reference Name & Contact Information:		
Project Owner:	Project Architect:	
Name:	Name:	
Phone:	Phone:	
E-mail	E-mail:	

Supplemental Bidder Responsibility
Form 5 - Reference Evaluation Questionnaire
Project: Ray Williamson Pool Renovations (BIMPRD)

Evaluated Firm :
Project Manager:
Superintendent:
Evaluated Project Name:

☐ Prime
☐ Subcontractor

Approx. Start Date	Approx. End Date	Approx. Final Project Cost

PERFORMANCE EVALUATION

Rating Criteria - Rate on a scale of 1 to 5

- **5** = **Superior** based on performance (would hire this firm/individual again)
- **4** = **More than Satisfactory**
- **3** = **Satisfactory** based on performance (would hire this firm/individual again)
- **2** = **Less than Satisfactory**
- **1**= **Totally Unsatisfactory** based on performance (would never hire the firm/individual again)

	Criteria	Rating		
		Company	PM	Super
1	Ability to meet client's expectations			
2	Quality of workmanship			
3	Ability to manage project costs and minimize change orders			
4	Ability to maintain project schedule			
5	Ability to manage subcontractors			
6	Professionalism, leadership and communication in issues management (RFI, shop drawing submittal, timely resolution of issues/questions)			
7	Ability to follow the owner's rules, regulations, and requirements (housekeeping, safety, etc.)			
8	Ability to manage closeout process (Prompt submittal of punch list, warranty, as-builts, operation manuals, tax clearances, etc.)			
9	Comfort level in hiring firm or individual again based on performance			
	Total Score			
	Average Score			

Evaluator Information	
Name of Evaluator:	Title:
Firm/Company Name:	
Firm Address:	
Phone:	Email:

Form 6 – Supplemental Responsibility Criteria Evaluation Score Sheet

Project Title	Ray Williamson Pool Renovation, Phase 1
Project Number	20223
Project Manager	Matthew Keough
Project Location	8521 Madison Ave., N. Bainbridge Island, WA 98110
Project Owner	Bainbridge Island Metro Parks and Recreation Department

1. Experience of Contractor - On projects of similar size & complexity (Form 1)	Pass or Fail

2. Experience of Key Personnel (Form 2)	
Superintendent	Pass or Fail
Project Manager	Pass or Fail
Other(s) if specified in Division 00	Pass or Fail

3. Diverse Business Inclusion Plan (Form 3) *(Applies only to projects with Diverse Business Plan Inclusion requirements)*	Pass, Fail, or N/A

4. Contractor Compliance with Apprenticeship Requirements - Requirements were met or if not, a good faith effort was demonstrated (Forms 1 & 4) *Applies only to projects with apprenticeship participation requirements; i.e. MACC over $1M*	Not Scored

5. References from Previous Projects (Form 5) Evaluate contractor's references information and using the rating numbers: 1 = NOT Satisfactory (requires a written comment below) 2 = Less THAN Satisfactory 3 = Satisfactory 4 = More THAN Satisfactory 5 = Superior	Rating **Score 1-5** (3 is Satisfactory)
Company	
Project Manager	
Superintendent	
Total Score:	
Average score (divide total score by number of ratings)	

In determining the bidder responsibility, an overall accounting of the ratings shall be made. A score of "Pass" is required for categories 1 - 4 and an average score of 3.0 or higher is required to meet the minimum Supplemental Bidder Responsibility requirements.

Comments _____

Determination ☐ Responsible
☐ Not Responsible (Preliminary Determination)

Evaluated by _____ Date _____
PM (Typed or Printed Name)

_____
Signature

1.01 GENERAL

A. The authorized Bid Form must be submitted to:
   1. Physical address:
      Bainbridge Island Metro Park & Recreation District
      11700 Meadowmeer Cir NE
      Bainbridge Island, WA 98110
   2. Mailing address:
      Bainbridge Island Metro Park & Recreation District
      11700 Meadowmeer Cir NE
      Bainbridge Island, WA 98110

B. The authorized Bid Form must be submitted by 2:00 PM, Tuesday, May 21, the date designated for receipt of Bids in the Bid Documents.

C. If sending by courier (UPS, FedEx, etc.) the physical street address must be used. If mailing by regular US mail, the Post Office Box must be used. Bidders are responsible for ensuring that the proper Zip code is used. Bainbridge Island Metro Park & Recreation District will not be responsible for a late bid.

1.02 BID (SECTION 00 41 00)

A. Have you enclosed with your Bid the Bid Guaranty for not less than 5% of the maximum Bid amount that could be awarded including retail sales tax?

B. Have you Bid on all items including Additives, Alternates, and Deductives (when indicated)?

1.03 DECLARATION (SECTION 00 41 00)

A. Have you provided all information requested?

B. Has the official authorized to represent the Bidder signed the Declaration?

C. Have you acknowledged all Addenda?

1.04 COMPLIANCE

A. All of the above items in Articles 1.01 through 1.04 must be completed or your bid may be declared non-responsive.

1.06 BIDDER/SUBCONTRACTOR LIST (ATTACHMENT B TO SECTION 00 41 00 – BID FORM

A. Within <u>two hours</u> after Bid Opening, submit a Bidder/Subcontractor list indicating:
   1. Trade
   2. Name of the subcontractor
   3. Subcontractor UBI#
   4. Category of work
   5. Whether the bidder will self-perform the work
   6. N/A – if this project does not include this work.

B. Failure to complete, sign, and submit the Bidder/Subcontractor list within two hours after Bid opening will result in the bid being delcared non-responsive.

1.07 SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA FORMS

A. The Supplemental Bidder Responsibilty Critieria Form and any additional documentation shall be submitted to PC within three (3) Business Days of receipt of request. See Section 00 21 13, Paragraph 4.2.5.

B. Failure to complete, sign, and submit the above may result in the Bidder being declared not responsible.

END OF SECTION

BAINBRIDGE ISLAND METROPOLITAN PARK AND RECREATION DISTRICT
AGREEMENT FOR CONSTRUCTION SERVICES

This agreement is entered into the date below written between the BAINBRIDGE ISLAND METROPOLITAN PARK AND RECREATION DISTRICT, a Washington special purpose district (the "District"), and _____, referred to as *"Contractor"* for the project **RAY WILLIAMSON POOL IMPROVEMENTS, PHASE 1**

1) Services Rendered by *Contractor*: *Contractor* shall provide the professional services as defined in this Agreement and as necessary to accomplish the Scope of the Services. *Contractor* shall furnish all services, labor and related equipment to conduct and complete the work, except as specifically noted otherwise in this agreement.

2) Terms of Payment:

A) Payment. The District shall pay *Contractor* for cost reimbursable services: (check one)
(_) Hourly, plus actual expenses, in accordance with Attachment A, but not more than a total of _____;
( ) Fixed Sum: a total amount of $_____ *(see attachment A)*
(_) Other: _____.

B) Invoicing. *Contractor* shall submit monthly invoices for services performed in a previous calendar month in a format acceptable to the District. Each project and each task with a project shall be the subject of a separate invoice. *Contractor* shall maintain time and expense records according to industry standards and provide them to the District upon request.

C) Payments to *Contractor*. All invoices shall be paid by mailing a check within 60 days of receipt of a proper invoice and W-9 form. Checks will be mailed to address indicated on W-9 submitted by *Contractor.*

D) Final Payment. Final payment of any balances will be made upon completion of the Scope of Service (See Attachment A) and receipt of all deliverables and all project- related documents and data that are required under this Agreement.

E) Satisfaction of Scope of Services. If the services rendered do not meet the requirements of this Agreement, *Contractor* shall timely correct or modify the work to comply with this Agreement. The District may withhold payment for such work until it meets the requirements of the Agreement. Satisfaction of services will be the degree of skill and diligence normally employed by professional engineers and consultants performing the same or similar services.

3) Discrimination and Compliance with Laws:

A) *Contractor* agrees not to discriminate against any employee or any other person in the performance of the Agreement because of race, creed, color, national origin, marital status, sex, age, veteran's status, disability or other circumstances prohibited under federal state or local laws, except for a bona fide occupational qualification.

B) *Contractor* shall comply with all federal, state and local laws and ordinances applicable to the work to be done under the Agreement. Violation of Paragraph 3 shall be a material breach of this Agreement and grounds for cancellation, termination or suspension of the District.

4) Term and Termination of Agreement:

A) This Agreement shall become effective upon execution by both parties and shall continue in full force until _____ unless sooner terminated by either party pursuant to Section 4(B) below.

B) This Agreement may be terminated by either party without cause upon 30-days written notice, in which event all finished or unfinished documents, reports, data or other material or work of pursuant to this Agreement shall be submitted to the District, and *Contractor* shall be entitled to just equitable compensation at the rate set forth in Paragraph 2 for any satisfactory work completed prior to the date of termination.

5) Intellectual Property:

A) Any and all intellectual property developed in the course of the Scope of Services is a direct result of the Agreement whose rights are controlled by the District.

B) Ownership of intellectual property developed solely as a result of the Agreement is owned by the District, this pertains to any digitized material, technical data, software, reports and permits.

6) General Administration:

A) District Authorization and its Designee. The Director of the District, or his designee, shall be the District's representative and shall oversee and approve all services to be performed, coordinate all communications and review and approve all invoices under this Agreement.

B) Independent Contractor. Contractor's relationship with District is that of an independent contractor. Contractor is free to engage in other independent contracting activities, provided that such activities do not conflict with or interfere with Contractor's duties hereunder. Contractor has the sole right to control and direct the means, manner and method by which the services required by this Agreement will be performed. Contractor is in business for itself and is not economically dependent on District. Nothing in this Agreement, or in the business dealings or relationship between the parties, shall be construed to create the relationship of employee and employer, partners or joint ventures. Contractor warrants to District that it will pay all applicable taxes and withholdings, and will make all filings with governmental entities, as required as a result of execution of this Agreement and compensation received by it hereunder. Contractor agrees to defend, indemnify and hold District harmless from and against any and all claims, actions, penalties, fees, assessments, liabilities and expenses (including reasonable attorney fees) arising out of or relating in way whatsoever to Contractor's breach of the warranty in this Section 6.B

C) Lower Tier Subcontracts. *Contractor* shall not sublet or assign any of the work covered by the Agreement, except with the prior written approval of the District and in strict compliance with the terms, provisions, and conditions of the Agreement. *Contractor* will bind all Lower Tier Subconsultants to the Provisions of this Agreement.

D) No Additional Relationship or Burden Implied. Neither this Agreement nor any Lower Tier subcontract will create any contractual relationship between any Lower Tier Subconsultant and the District nor any liability onto the District from any Lower Tier Subconsultant.

E) Access to and Retention of Records. Contractor will maintain project and accounting records for required six (6) year WA State retention period in accordance with RCW 40.14.070, and make them available for examination by the District upon request. Records will also be made available to the District to fulfill any public record request received by the District. (See Section 9: Public Records Act). If Contractor does not want to retain the project and accounting records for the six (6) year length of time stipulated in the WA State Retention Schedule, Contractor will turn the records over to the District who will assume responsibility for retaining them for the required length of time.

F) Notice of Delay. The time schedule for the performance of services set forth under this Agreement is based on *Contractor's* anticipation of the orderly and continuous progress of the project. If *Contractor* is delayed in the performance of services by conditions that are beyond its control, *Contractor* shall notify the District in writing of the cause of the delay and the amount of the delay anticipated. Such notice shall be delivered to the District within five (5) days of the time *Contractor* is aware of the delay.

G) Permits, Licenses and Fees: *Owner* will obtain and pay for all permits and licenses required by law that are associated with *Contractor's* performance of the Scope of Services and will give all necessary notices.

H) The GENERAL CONDITIONS FOR BAINBRIDGE ISLAND METROPOLITAN PARK AND RECREATION DISTRICT PUBLIC WORKS PROJECTS ("General Conditions") are incorporated herein by this reference as if fully set forth herein. If there is a conflict between this Agreement and the General Conditions, the General Conditions control.

7) Insurance: *Contractor* will maintain throughout this Agreement the following insurance and will submit certificates verifying such to the District:

A) Worker's compensation insurance as required by Washington State.

B) Comprehensive automobile and vehicle liability insurance covering claims for injuries to members of the public and damages to property of others arising from the use of motor vehicles, including onsite and offsite operations, and owned, or non-owned or hired vehicles, with $2,000,000 combined single limits.

C) Comprehensive general liability insurance covering claims for injuries arising out of claims for injuries arising out of any negligent act or omission of *Contractor* or of any of its employees, agents, or subcontractors with $2,000,000 per occurrence/$4,000,000 aggregate.

D) All insurance certificates will state that the insurance carrier will give the District thirty (30) days' notice of any cancelation of the policies. Excepting the Worker's Compensation Insurance secured by the *Contractor*, the District will be named on all policies as an additional insured. The *Contractor* shall furnish the District with verification of insurance and endorsements required by the agreement. The District reserves the right to require complete, certified copies of all required insurance policies at any time.

8) Hold Harmless:

The Contractor shall protect, defend, indemnify and save harmless District, its officers, employees and agents from any and all costs, claims, judgments, awards of damages, and expenses (including reasonable attorney fees)arising out of or in any way resulting from (i) the negligent acts or omissions, or intentional misconduct, of Contractor, its officers, employees and agents in performing this Agreement and/or (ii) material breach of this Agreement by Contractor.

Should a court of competent jurisdiction determine that this Agreement is subject to RCW 4.24.115, then, in the event of liability for damages arising out of bodily injury to persons or damages to property caused by or resulting from the concurrent negligence of the Contractor and the District, its officers, officials, employees, and volunteers, the Contractor's liability hereunder shall be only to the extent of the Contractor's negligence. It is further specifically and expressly understood that the indemnification provided herein constitutes the Contractor's waiver of immunity under Industrial Insurance, Title 51 RCW, solely for the purposes of this indemnification. This waiver has been mutually negotiated by the parties.

The District shall protect, defend, indemnify and save harmless Contractor, its officers, employees and agents from any and all costs, claims, judgments and awards of damages, and expenses (including reasonable attorney fees) arising out of or in any way resulting from (i) the grossly negligent acts or omissions, or intentional misconduct, of the District, its officers, employees or agents in performing this Agreement and/or (ii) material breach of this Agreement by the District. The provisions of this Section 8 shall survive the expiration or termination of this Agreement.

9) Public Records Act

A) This Agreement and all public records associated with this Agreement shall be available for inspection and copying by the public where required by the Public Records Act, Chapter 42.56 RCW (the "Act"). To the extent that public records then in the custody of the Contractor are needed for the Park District to respond to a request under the Act, as determined by the Park District, the Contractor agrees to make them promptly available to the Park District.

B) If the Contractor considers any portion of any record provided to the Park District under this Agreement, whether in electronic or hard copy form, to be protected from disclosure under law, the Contractor shall clearly identify any specific information that it claims to be confidential or proprietary. If the Park District receives a request under the Act to inspect or copy the information so identified by the Contractor and the Park District determines that release of the information is required by the Act or otherwise appropriate, the Park District's sole obligations shall be to notify the Contractor (a) of the request and (b) of the date that such information will be released to the requester unless the Contractor obtains a court order to enjoin that disclosure pursuant to RCW 42.56.540. If the Contractor fails to timely obtain a court order enjoining disclosure, the Park District will release the requested information on the date specified.

C) The Park District has, and by this section assumes, no obligation on behalf of the Contractor to claim any exemption from disclosure under the Act. The Park District shall not be liable to the Contractor for releasing records not clearly identified by the Contractor as confidential or proprietary. The Park District shall not be liable to the Contractor for any records that the Park District releases in compliance with this section or in compliance with an order of a court of competent jurisdiction.

10) General Provisions:

A) Waivers. No waiver by either party of any default by the other party in the performance of any provision of this Agreement will operate as, or be construed as, a waiver of any future default, whether like or different in character.

B) Force Majure. Neither party to this Agreement will be liable to the other party for delays in performing the Scope of Services, or for the direct or indirect costs resulting from such delays, that may result from labor strikes, riots, war, acts of governmental catastrophe, or any other cause beyond the reasonable control or contemplation of either party.

C) Authorization to Proceed. Execution of the Agreement by the District will be authorization for *Contractor* to proceed with the Scope of Services, unless otherwise provided for in this Agreement.

D) No Third- Party Beneficiaries. This Agreement gives no rights or benefits to anyone other than *Contractor* and the District and has no third-party beneficiaries.

E) Dispute Resolution. In the event of a dispute between the parties arising under or relating in any way whatsoever to this Agreement, the parties shall attempt to resolve it through good faith negotiation. If the dispute is not resolved through such negotiation, the parties shall attempt to resolve it through mediation in Kitsap County, Washington, with a neutral, third-party mediator mutually agreed upon by the parties, with the costs of mediation shared equally by the parties. If the dispute is not resolved through mediation, then upon written demand by one of the parties it shall be referred to an arbitrator mutually agreed upon by the parties. The arbitration process shall be conducted in accordance with RCW 7.04A, except as modified herein. The arbitration hearing shall be held in Kitsap County, Washington. All remedies, legal and equitable, available in court shall also be available in arbitration. The arbitrator's decision shall be final and binding, and judgment may be entered thereon in any court of competent jurisdiction. In any dispute arising out of this Agreement, including arbitration, the substantially prevailing party shall be entitled to recover its reasonable attorney fees and costs from the other party. This Agreement shall be governed by and construed in accordance with the laws of the State of Washington, without regard to conflict of law principles thereof. Venue of any dispute shall lie exclusively in Kitsap County.

F) Contractor may not assign its rights or obligations arising under this Agreement without the prior written consent of District.

G) If any provision of this Agreement shall be determined by a court of competent jurisdiction to be unenforceable, the remaining provisions of this Agreement are severable, and the unenforceability of any single provision herein shall not affect the remaining provisions of this Agreement.

H) Those provisions of this Agreement that have or could have effect after termination of this Agreement, which include, without limitation, dispute resolution and indemnification provisions, shall survive termination of this Agreement and be fully applicable and enforceable thereafter.

I) This Agreement represents the entire agreement between the parties, supersedes all prior agreements and understandings, and may be changed only by written amendment executed by both parties. This Agreement may be executed in counterparts, and facsimile and pdf signatures shall be deemed the equivalent of original signatures for all purposes.

11) Attachments and Schedules:
The following attachments and schedules are hereby made a part of this Agreement:

Attachment A – Complete Bid Package & Bid Submitted

Accepted for the Bainbridge Island Metropolitan Park and Recreation District

BY: _____

Title: _____

Date: _____

Accepted for *CONTRACTOR*

BY: _____

Title: _____
Date: _____

SEPARATE DOCUMENTS

Ray Williamson Pool Improvements Project, Phase 1 Contract Documents

PART 1 - GENERAL

1.01 SAMPLE FORMS

A. A sample copy of each of the following forms is included in this Section.

B. The number indicated after the title of each form refers to the subsection of the Project Manual where requirements relating to the form are located.

C. The following forms are included in this Section 00 60 00:

1. Bidder's Bond
2. Faithful Payment And Performance Bond
3. Retainage Bond Form
4. Certification of Compliance with Wage Payment Statutes
5. Subcontractor List Form (Refer to Section 00 41 00)
6. Substitution Request Form (Refer to Section 01 63 00)
7. Request For Information (RFI)

PART 2 – PRODUCTS

Not applicable.

PART 3 - EXECUTION

Not applicable.

BIDDER'S BOND

(Not necessary when certified or cashier's check accompanies bid)

We, the undersigned principal and surety, and our heirs, executors, administrators, successors and assigns, are jointly and severally held and firmly bound to the Bainbridge Island Metropolitan Park and Recreation District of Bainbridge Island, Washington, a municipal corporation ["DISTRICT"], in the principal sum

of_____

($), to be paid and forfeited to the District if the bid of the undersigned principal for _____ under the project entitled _____ shall be accepted and the proposed Contract awarded to said principal, and said principal shall fail or refuse to execute the Agreement in accordance with said bid as accepted and to furnish the bonds required in connection therewith within the time and form required. Otherwise, this obligation to be void.

WITNESS our hands this _____ day of _____ 2024.

_____

Principal
By:

_____

Title

_____

Surety

SEAL
By:

Attorney-in-Fact

_____

A notarial certificate of attorney-in-fact and seal of surety must be attached. If executed by an attorney-in-fact, proof of current authority must be attached.

FAITHFUL PERFORMANCE AND PAYMENT BOND

KNOW ALL MEN BY THESE PRESENT

That we,_____ , as Principal, and _____, as Surety, are held and firmly bound to the Bainbridge Island Metropolitan Park and Recreation District of Bainbridge Island, Washington, a municipal corporation ["DISTRICT"] in the sum of _____Dollars ($_____), lawful money of the United States of America, for the payment of which sum, well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, by these present.

The condition of the above obligation is such that, whereas said Principal has been awarded and is about to enter into the annexed contract, with the DISTRICT

_____
_____ and to which reference is hereby made for all particulars, and is required by DISTRICT to give this bond in connection with the execution of said contract;

NOW THEREFORE, if said Principal as Contractor under said contract fails to perform all of the covenants, terms, conditions and stipulations of said contract on his or its part to be done and performed at the times and in the manner specified therein, or if said Principal shall fail to pay all of his subcontractors, suppliers, material men, and laborers on said work, or if all materials used and workmanship employed in the performance of the contract shall not be free from defects, or if any defects should appear therein with a period of one year from the date of acceptance by DISTRICT of the work under the contract and the said Principal and Contractor shall fail to repair, replace and correct such defects at his or its own expense and to the satisfaction of the Owner within thirty (30) days after notice thereof by DISTRICT, said Principal and Surety will pay the DISTRICT the amount of all its loss, cost, expense, damages and liability on account of any and all of the foregoing, not exceeding, however, the sum set forth above, and in case suit is brought upon this bond said Surety shall also pay a reasonable attorney's fee to be fixed by the court.

The Said Principal and Surety agree that any change, extension of time, alterations or additions to said contract or work or materials required thereunder shall not in any manner release either the Principal or the Surety from the obligations of this bond; and said Surety hereby waives notice of any such change, extension of time, alteration or additions to said contact or performance required thereunder.

IN WITNESS WHEREOF, the Principal and the Surety have executed this instrument in duplicate this_____ day of _____ 2024.

Surety	Principal
By:	By:
Its	Its

RETAINAGE BOND

KNOW ALL MEN BY THESE PRESENT

That we,_____ , as Principal, and _____, as Surety, are jointly and severally held and firmly bound to the Bainbridge Island Metropolitan Park and Recreation District, Washington, a municipal corporation ["DISTRICT"] and are similarly held and bound unto the beneficiaries of the trust fund created by RCW 60.28 as their heirs, executors, administrators, successors and assigns, in the penal sum of _____ Dollars ($_____), lawful money of the United States of America, plus 5% of any increase in the contract amount that have occurred or may occur due to change orders, increases in the quantities or the addition of any new item of work.

WHEREAS, on the_____ day of_____ , 2024 , the said Principal executed Contract No._____ , with the DISTRICT for_____ .

WHEREAS, said contract and RCW 60.28 requires the DISTRICT to withhold from the Principal the sum of 5% of monies earned by the Contractor on estimates during the progress of construction, hereinafter referred to as earned retained funds.

AND NOW WHEREAS, Principal has requested that the DISTRICT not retain any future earned retained funds and that they release all of a portion of the current amount of earned retained funds as allowed under RCW 60.28.

NOW THEREFORE, the condition of this obligation is such that if the Principal shall use the earned retained funds which will not be retained or shall use such funds which are now being released, for the trust fund purposes of RCW 60.28, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

IN WITNESS WHEREOF, the Principal and the Surety have caused these presents to be duly signed and sealed this_____ day of_____, 2024.

Surety	Principal
By:	By:
Its	Its

Certification of Compliance with Wage Payment Statutes

The bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date April 16, 2024 the bidder is not a "willful" violator, as defined in RCW 49.48.082, of any provision of chapters 49.46, 49.48, or 49.52 RCW, as 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. I declare under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

_____
Bidder's Business Name

_____
Signature of Authorized Official*

_____
Printed Name

_____
Title

_____ _____ _____
Date City State or country

Check One:
Sole Proprietorship ☐ Partnership ☐ Joint Venture ☐ Corporation ☐

State of Incorporation, or if not a corporation, State where business entity was formed:

_____

If a co-partnership, give firm name under which business is transacted:

_____

** If a corporation, proposal must be executed in the corporate name by the president or vice-president (or any other corporate officer accompanied by evidence of authority to sign). If a co-partnership, proposal must be executed by a partner.*

REQUEST FOR INFORMATION

Project: **RWP Pool Improvements, Phase I** *RFI #*_____
Project #: **20223**
Date: _____

Originator:
( ) Owner ( ) Architect
( ) General Contractor
( ) Consultant _____
( ) Sub-Contractor _____

Reference Data:
Spec.Sect.# _____ *Page #* _____ *Paragraph #* _____
Drawing # _____ *Titled:* _____
Sketch # _____ *Dated:* _____ *Titled:* _____

Is the problem isolated or general? _____

Attachments: _____

Description of Request: _____

Response Needed By: _____ *Prepared By:* _____

Extra Cost Anticipated? ☐ Yes ☐ No

Response: _____

By: _____ *Title:* _____ *Date:* _____

PART 1 - GENERAL PROVISIONS

1.01 DEFINITIONS

A. "Application for Payment" means a written request submitted by Contractor to A/E for payment of Work completed in accordance with the Contract Documents and approved Schedule of Values, supported by such substantiating data as Owner or A/E may require.

B. "Architect," "Engineer," or "A/E" means a person or entity lawfully entitled to practice architecture or engineering, representing Owner within the limits of its delegated authority.

C. "Change Order" means a written instrument signed by Owner and Contractor stating their agreement upon all of the following: (1) a change in the Work; (2) the amount of the adjustment in the Contract Sum, if any, and (3) the extent of the adjustment in the Contract Time, if any.

D. "Claim" means Contractor's exclusive remedy for resolving disputes with Owner regarding the terms of a Change Order or a request for equitable adjustment, as more fully set forth in part 8.

E. “Contract Award Amount” is the sum of the Base Bid and any accepted Alternates.

F. "Contract Documents" means the Advertisement for Bids, Instructions for Bidders, completed Form of Proposal, General Conditions, Modifications to the General Conditions, Supplemental Conditions, Public Works Contract, other Special Forms, Drawings and Specifications, and all addenda and modifications thereof.

G. "Contract Sum" is the total amount payable by Owner to Contractor for performance of the Work in accordance with the Contract Documents, including all taxes imposed by law and properly chargeable to the Work

H. "Contract Time" is the number of calendar days allotted in the Contract Documents for achieving Substantial Completion of the Work.

I. "Contractor" means the person or entity who has agreed with Owner to perform the Work in accordance with the Contract Documents.

J. “Day(s)” unless otherwise specified shall mean calendar day(s).

K. "Drawings" are the graphic and pictorial portions of the Contract Documents showing the design, location, and dimensions of the Work, and may include plans, elevations, sections, details, schedules, and diagrams.

L. "Final Acceptance" means the written acceptance issued to Contractor by Owner after Contractor has completed the requirements of the Contract Documents, as more fully set forth in Section 6.09 B.

M. "Final Completion" means that the Work is fully and finally completed in accordance with the Contract Documents, as more fully set forth in Section 6.09 A.

N. "Force Majeure" means those acts entitling Contractor to request an equitable adjustment in the Contract Time, as more fully set forth in paragraph 3.05A.

O. "Notice" means a written notice which has been delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended or, if delivered or sent by registered or certified mail, to the last business address known to the party giving notice.

P. "Notice to Proceed" means a notice from Owner to Contractor that defines the date on which the Contract Time begins to run.

Q. "Owner" means the Bainbridge Island Metro Park & Recreation District or its authorized representative with the authority to enter into, administer, and/or terminate the Work in accordance with the Contract Documents and make related determinations and findings.

R. "Person" means a corporation, partnership, business association of any kind, trust, company, or individual.

S. "Prior Occupancy" means Owner's use of all or parts of the Project before Substantial Completion, as more fully set forth in Section 6.08 A.

T. "Progress Schedule" means a schedule of the Work, in a form satisfactory to Owner, as further set forth in section 3.02.

U. "Project" means the total construction of which the Work performed in accordance with the Contract Documents may be the whole or a part and which may include construction by Owner or by separate contractors.

V. "Project Record" means the separate set of Drawings and Specifications as further set forth in paragraph 4.02A.

W. "Schedule of Values" means a written breakdown allocating the total Contract Sum to each principle category of Work, in such detail as requested by Owner.

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

Y. "Subcontract" means a contract entered into by Subcontractor for the purpose of obtaining supplies, materials, equipment, or services of any kind for or in connection with the Work.

Z. "Subcontractor" means any person, other than Contractor, who agrees to furnish or furnishes any supplies, materials, equipment, or services of any kind in connection with the Work.

AA. "Substantial Completion" means that stage in the progress of the Work when the construction is sufficiently complete, as more fully set forth in section 6.07.

BB. "Work" means the construction and services required by the Contract Documents, and includes, but is not limited to, labor, materials, supplies, equipment, services, permits, and the manufacture and fabrication of components, performed, furnished, or provided in accordance with the Contract Documents.

1.02 ORDER OF PRECEDENCE

A. Any conflict or inconsistency in the Contract Documents shall be resolved by giving the documents precedence in the following order.

1. Signed Public Works Contract, including any Change Orders.
2. Supplemental Conditions.
3. Modifications to the General Conditions.
4. General Conditions.
5. Specifications--provisions in Division 1 shall take precedence over provisions of any other Division.
6. Drawings--in case of conflict within the Drawings, large scale drawings shall take precedence over small scale drawings.
7. Signed and Completed Bid Form.

8. Instructions to Bidders.
9. Advertisement for Bids.

1.03 EXECUTION AND INTENT

A. Contractor makes the following representations to Owner:

1. The Contract Sum is reasonable compensation for the Work and the Contract Time is adequate for the performance of the Work, as represented by the Contract Documents;
2. Contractor has carefully reviewed the Contract Documents, visited and examined the Project site, become familiar with the local conditions in which the Work is to be performed, and satisfied itself as to the nature, location, character, quality and quantity of the Work, the labor, materials, equipment, goods, supplies, work, services and other items to be furnished and all other requirements of the Contract Documents, as well as the surface and subsurface conditions and other matters that may be encountered at the Project site or affect performance of the Work or the cost or difficulty thereof;
3. Contractor is financially solvent, able to pay its debts as they mature, and possesses sufficient working capital to complete the Work and perform Contractor's obligations required by the Contract Documents; and
4. Contractor is able to furnish the plant, tools, materials, supplies, equipment and labor required to complete the Work and perform the obligations required by the Contract Documents and has sufficient experience and competence to do so.

PART 2 - INSURANCE AND BONDS

2.01 CONTRACTOR'S LIABILITY INSURANCE

A. The Contractor shall procure and maintain for the duration of the Agreement, insurance against claims for injuries to persons or damage to property which may arise from or in connection with the performance of the work hereunder by the Contractor, their agents, representatives, employees or subcontractors.

B. No Limitation. Contractor's maintenance of insurance as required by the agreement shall not be construed to limit the liability of the Contractor to the coverage provided by such insurance, or otherwise limit the District's recourse to any remedy available at law or in equity.

Minimum Scope of Insurance

Contractor shall obtain insurance of the types described below:

1. Automobile Liability insurance covering all owned, non-owned, hired and leased vehicles. Coverage shall be written on Insurance Services Office (ISO) form CA 00 01 or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage.
2. Commercial General Liability insurance shall be written on ISO occurrence form CG 00 01 or the equivalent and shall cover liability arising from premises, operations, independent contractors, products-completed operations, stop gap liability, personal injury and advertising injury, and liability assumed under an insured contract. The District shall be named as an additional insured under the Contractor's Commercial General Liability insurance policy with respect to the work performed for the District.
3. Workers' Compensation coverage as required by the Industrial Insurance laws of the state of Washington.

Minimum Amounts of Insurance

Contractor shall maintain the following insurance limits:

1. Automobile Liability insurance with a minimum combined single limit for bodily injury and property damage of $2,000,000 per accident.
2. Commercial General Liability insurance shall be written with limits no less than $2,000,000 each occurrence, $4,000,000 general aggregate and a $4,000,000 products-completed operations aggregate limit.

C. Other Insurance Provisions

The insurance policies are to contain, or be endorsed to contain, the following provisions for Automobile Liability and Commercial General Liability insurance:

1. The Contractor's insurance coverage shall be primary insurance as respect the District. Any Insurance, self-insurance, or insurance pool coverage maintained by the District shall be excess of the Contractor's insurance and shall not contribute with it.

2. The Contractor's insurance shall be endorsed to state that coverage shall not be cancelled by either party, except after thirty (30) days prior written notice by certified mail, return receipt requested, has been given to the District.

D. Acceptability of Insurers

Insurance is to be placed with insurers with a current A.M. Best rating of not less than A:VII.

E. Verification of Coverage

Contractor shall furnish the District with original certificates and a copy of the amendatory endorsements, including but not necessarily limited to the additional insured endorsement, evidencing the insurance requirements of the Contractor before commencement of the work.

F. Subcontractors

Contractor shall ensure that each subcontractor of every tier obtain at a minimum the same insurance coverage and limits as stated herein for the Contractor. Upon request from the District, the Contractor shall provide evidence of such insurance.

2.04 PAYMENT AND PERFORMANCE BONDS

A. Payment and performance bonds for 100% of the Contract Award Amount, plus state sales tax, shall be furnished for the Work, using the Payment Bond and Performance Bond form published and available from the American Institute of Architects (AIA) – form A312. Prior to execution of a Change Order that, cumulatively with previous Change Orders, increases the Contract Award Amount by 15% or more, the Contractor shall provide either new payment and performance bonds for the revised Contract Sum, or riders to the existing payment and performance bonds increasing the amount of the bonds. The Contractor shall likewise provide additional bonds or riders when subsequent Change Orders increase the Contract Sum by 15% of more. No payment or performance bond is required if the Contract Sum is $150,000 or less and Contractor agrees that Owner may, in lieu of the bond, retain a percentage of the Contract Sum for the period as allowed by RCW 39.08.010.

2.05 ALTERNATIVE SECURITY

A. Contractor shall promptly furnish payment and performance bonds from an alternative surety as required to protect Owner and persons supplying labor or materials required by the Contract Documents if:

1. Owner has a reasonable objection to the surety; or
2. Any surety fails to furnish reports on its financial condition if requested by Owner.

2.06 BUILDER'S RISK

A. Contractor shall purchase and maintain property insurance in the amount of the Contract Sum including all Change Orders for the Work on a replacement cost basis until Substantial Completion. The insurance shall cover the interest of Owner, Contractor, and any Subcontractors, as their interests may appear.

B. Contractor property insurance shall be placed on an "all risk" basis and insure against the perils of fire and extended coverage and physical loss or damage including theft, vandalism, malicious mischief, collapse, false work, temporary buildings, debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for A/E's services and expenses required as a result of an insured loss.

C. Owner and Contractor waive all subrogation rights against each other, any Subcontractors, A/E, A/E's subconsultants, separate contractors described in section 5.20, if any, and any of their subcontractors, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this section or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by Owner as fiduciary. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

PART 3 - TIME AND SCHEDULE

3.01 PROGRESS AND COMPLETION

A. Contractor shall diligently prosecute the Work, with adequate forces, achieve Substantial Completion within the Contract Time, and achieve Final Completion within a reasonable period thereafter.

3.02 CONSTRUCTION SCHEDULE

A. Unless otherwise provided in Division 1, Contractor shall, within 14 days after issuance of the Notice to Proceed, submit a preliminary Progress Schedule. The Progress Schedule shall show the sequence in which Contractor proposes to perform the Work, and the dates on which Contractor plans to start and finish major portions of the Work, including dates for shop drawings and other submittals, and for acquiring materials and equipment.

B. Unless otherwise provided in Division 1, the Progress Schedule shall be in the form of a bar chart, or a critical path method analysis, as specified by Owner. The preliminary Progress Schedule may be general, showing the major portions of the Work, with a more detailed Progress Schedule submitted as directed by Owner.

C. Owner shall return comments on the preliminary Progress Schedule to Contractor within 14 days of receipt. Review by Owner of Contractor's schedule does not constitute an approval or acceptance of Contractor's construction means, methods, or sequencing, or its ability to

complete the Work within the Contract Time. Contractor shall revise and resubmit its schedule, as necessary. Owner may withhold a portion of progress payments until a Progress Schedule has been submitted which meets the requirements of this section.

D. Contractor shall utilize and comply with the Progress Schedule. On a monthly basis, or as otherwise directed by Owner, Contractor shall submit an updated Progress Schedule at its own expense to Owner indicating actual progress. If, in the opinion of Owner, Contractor is not in conformance with the Progress Schedule for reasons other than acts of Force Majeure as identified in section 3.05, Contractor shall take such steps as are necessary to bring the actual completion dates of its work activities into conformance with the Progress Schedule, or revise the Progress Schedule to reconcile with the actual progress of the Work.

E. Contractor shall promptly notify Owner in writing of any actual or anticipated event which is delaying or could delay achievement of any milestone or performance of any critical path activity of the Work. Contractor shall indicate the expected duration of the delay, the anticipated effect of the delay on the Progress Schedule, and the action being or to be taken to correct the problem. Provision of such notice does not relieve Contractor of its obligation to complete the Work within the Contract Time.

3.03 OWNER'S RIGHT TO SUSPEND THE WORK FOR CONVENIENCE

A. Owner may, at its sole discretion, order Contractor, in writing, to suspend all or any part of the Work for up to 90 days, or for such longer period as mutually agreed.

B. Upon receipt of a written notice suspending the Work, Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of cost of performance directly attributable to such suspension. Within a period up to 90 days after the notice is delivered to Contractor, or within any extension of that period to which the parties shall have agreed, Owner shall either:

1. Cancel the written notice suspending the Work; or
2. Terminate the Work covered by the notice as provided in the termination provisions of part 9.

C. If a written notice suspending the Work is cancelled or the period of the notice or any extension thereof expires, Contractor shall resume Work.

D. Contractor shall be entitled to an equitable adjustment in the Contract Time, or Contract Sum, or both, for increases in the time or cost of performance directly attributable to such suspension, provided Contractor complies with all requirements set forth in part 7.

3.04 OWNER'S RIGHT TO STOP THE WORK FOR CAUSE

A. If Contractor fails or refuses to perform its obligations in accordance with the Contract Documents, Owner may order Contractor, in writing, to stop the Work, or any portion thereof, until satisfactory corrective action has been taken.

B. Contractor shall not be entitled to an equitable adjustment in the Contract Time or Contract Sum for any increased cost or time of performance attributable to Contractor's failure or refusal to perform or from any reasonable remedial action taken by Owner based upon such failure.

3.05 DELAY

A. Any delay in or failure of performance by Owner or Contractor, other than the payment of money, shall not constitute a default hereunder if and to the extent the cause for such delay or failure of performance was unforeseeable and beyond the control of the party ("Force Majeure"). Acts of Force Majeure include, but are not limited to:

1. Acts of God or the public enemy;
2. Acts or omissions of any government entity;
3. Fire or any other casualty for which Contractor is not responsible;
4. Quarantine or epidemic;
5. Strike or defensive lockout; 6
6. Unusually severe weather conditions which could not have been reasonably anticipated; and
7. Unusual delay in receipt of supplies or products which were ordered and expedited and for which no substitute reasonably acceptable to Owner was available.

B. Contractor shall be entitled to an equitable adjustment in the Contract Time for changes in the time of performance directly attributable to an act of Force Majeure, provided it makes a request for equitable adjustment according to section 7.03. Contractor shall not be entitled to an adjustment in the Contract Sum resulting from an act of Force Majeure.

C. Contractor shall be entitled to an equitable adjustment in Contract Time, and may be entitled to an equitable adjustment in Contract Sum, if the cost or time of Contractor's performance is changed due to the fault or negligence of Owner, provided the Contractor makes a request according to sections 7.02 and 7.03.

D. Contractor shall not be entitled to an adjustment in Contract Time or in the Contract Sum for any delay or failure of performance to the extent such delay or failure was caused by Contractor or anyone for whose acts Contractor is responsible.

E. To the extent any delay or failure of performance was concurrently caused by the Owner and Contractor, Contractor shall be entitled to an adjustment in the Contract Time for that portion of the delay or failure of performance that was concurrently caused, provided it makes a request for equitable adjustment according to section 7.03, but shall not be entitled to an adjustment in Contract Sum.

F. Contractor shall make all reasonable efforts to prevent and mitigate the effects of any delay, whether occasioned by an act of Force Majeure or otherwise.

3.06 NOTICE TO OWNER OF LABOR DISPUTES

A. If Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay timely performance in accordance with the Contract Documents, Contractor shall immediately give notice, including all relevant information, to Owner.

B. Contractor agrees to insert a provision in its Subcontracts and to require insertion in all sub-subcontracts, that in the event timely performance of any such contract is delayed or threatened by delay by any actual or potential labor dispute, the Subcontractor or Sub-subcontractor shall immediately notify the next higher tier Subcontractor or Contractor, as the case may be, of all relevant information concerning the dispute.

3.07 DAMAGES FOR FAILURE TO ACHIEVE TIMELY COMPLETION

A. Liquidated Damages

1. Timely performance and completion of the Work is essential to Owner and time limits stated in the Contract Documents are of the essence. Owner will incur serious and substantial damages if Substantial Completion of the Work does not occur within the Contract Time. However, it would be difficult if not impossible to determine the exact amount of such damages. Therefore, liquidated damages will be set at $500 per day. Consequently, provisions for liquidated damages are included in the Contract Documents.

2. The liquidated damage amounts set forth in the Contract Documents will be assessed not as a penalty, but as liquidated damages for breach of the Contract Documents. This

amount is fixed and agreed upon by and between the Contractor and Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain. This amount shall be construed as the actual amount of damages sustained by the Owner, and may be retained by the Owner and deducted from periodic payments to the Contractor.

3. Assessment of liquidated damages shall not release Contractor from any further obligations or liabilities pursuant to the Contract Documents.

PART 4 - SPECIFICATIONS, DRAWINGS, AND OTHER DOCUMENTS

4.01 DISCREPANCIES AND CONTRACT DOCUMENT REVIEW

A. The intent of the Specifications and Drawings is to describe a complete Project to be constructed in accordance with the Contract Documents. Contractor shall furnish all labor, materials, equipment, tools, transportation, permits, and supplies, and perform the Work required in accordance with the Drawings, Specifications, and other provisions of the Contract Documents.

B. The Contract Documents are complementary. What is required by one part of the Contract Documents shall be binding as if required by all. Anything mentioned in the Specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in the Specifications, shall be of like effect as if shown or mentioned in both.

C. Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by Owner. If, during the performance of the Work, Contractor finds a conflict, error, inconsistency, or omission in the Contract Documents, it shall promptly and before proceeding with the Work affected thereby, report such conflict, error, inconsistency, or omission to A/E in writing.

D. Contractor shall do no Work without applicable Drawings, Specifications, or written modifications, or Shop Drawings where required, unless instructed to do so in writing by Owner. If Contractor performs any construction activity, and it knows or reasonably should have known that any of the Contract Documents contain a conflict, error, inconsistency, or omission, Contractor shall be responsible for the performance and shall bear the cost for its correction.

E. Contractor shall provide any work or materials the provision of which is clearly implied and is within the scope of the Contract Documents even if the Contract Documents do not mention them specifically.

F. Questions regarding interpretation of the requirements of the Contract Documents shall be referred to the A/E.

4.02 PROJECT RECORD

A. Contractor shall legibly mark in ink on a separate set of the Drawings and Specifications all actual construction, including depths of foundations, horizontal and vertical locations of internal and underground utilities and appurtenances referenced to permanent visible and accessible surface improvements, field changes of dimensions and details, actual suppliers, manufacturers and trade names, models of installed equipment, and Change Order Proposals (COP). This separate set of Drawings and Specifications shall be the "Project Record."

B. The Project Record shall be maintained on the project site throughout the construction and shall be clearly labeled "PROJECT RECORD". The Project Record shall be updated at least weekly noting all changes and shall be available to Owner at all times.

C. Contractor shall submit the completed and finalized Project Record to A/E prior to Final Acceptance.

4.03 SHOP DRAWINGS

A. "Shop Drawings" means documents and other information required to be submitted to A/E by Contractor pursuant to the Contract Documents, showing in detail: the proposed fabrication and assembly of structural elements; and the installation (i.e. form, fit, and attachment details) of materials and equipment. Shop Drawings include, but are not limited to, drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, samples, and similar materials furnished by Contractor to explain in detail specific portions of the Work required by the Contract Documents. For materials and equipment to be incorporated into the Work, Contractor submittal shall include the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the item. When directed, Contractor shall submit all samples at its own expense. Owner may duplicate, use, and disclose Shop Drawings provided in accordance with the Contract Documents.

B. Contractor shall coordinate all Shop Drawings, and review them for accuracy, completeness, and compliance with the Contract Documents and shall indicate its approval thereon as evidence of such coordination and review. Where required by law, Shop Drawings shall be stamped by an appropriate professional licensed by the state of Washington. Shop Drawings submitted to A/E without evidence of Contractor's approval shall be returned for resubmission. Contractor shall review, approve, and submit Shop Drawings with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of Owner or separate contractors. Contractor's submittal schedule shall allow a reasonable time for A/E review. A/E will review, approve, or take other appropriate action on the Shop Drawings. Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings until the respective submittal has been reviewed and the A/E has approved or taken other appropriate action. Owner and A/E shall respond to Shop Drawing submittals with reasonable promptness. Any Work by Contractor shall be in accordance with reviewed Shop Drawings. Submittals made by Contractor which are not required by the Contract Documents may be returned without action.

C. Approval, or other appropriate action with regard to Shop Drawings, by Owner or A/E shall not relieve Contractor of responsibility for any errors or omissions in such Shop Drawings, nor from responsibility for compliance with the requirements of the Contract Documents. Unless specified in the Contract Documents, review by Owner or A/E shall not constitute an approval of the safety precautions employed by Contractor during construction, or constitute an approval of Contractor's means or methods of construction. If Contractor fails to obtain approval before installation and the item or work is subsequently rejected, Contractor shall be responsible for all costs of correction.

D. If Shop Drawings show variations from the requirements of the Contract Documents, Contractor shall describe such variations in writing, separate from the Shop Drawings, at the time it submits the Shop Drawings containing such variations. If A/E approves any such variation, an appropriate Change Order will be issued. If the variation is minor and does not involve an adjustment in the Contract Sum or Contract Time, a Change Order need not be issued; however, the modification shall be recorded upon the Project Record.

E. Unless otherwise provided in Division I, Contractor shall submit to A/E for approval 5 copies of all Shop Drawings. Unless otherwise indicated, 3 sets of all Shop Drawings shall be retained by A/E and 2 sets shall be returned to Contractor.

4.04 ORGANIZATION OF SPECIFICATIONS

A. Specifications are prepared in sections which conform generally with trade practices. These sections are for Owner and Contractor convenience and shall not control Contractor in dividing the Work among the Subcontractors or in establishing the extent of the Work to be performed by any trade.

4.05 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS, AND OTHER DOCUMENTS

A. The Drawings, Specifications, and other documents prepared by A/E are instruments of A/E's service through which the Work to be executed by Contractor is described. Neither Contractor nor any Subcontractor shall own or claim a copyright in the Drawings, Specifications, and other documents prepared by A/E, and A/E shall be deemed the author of them and will, along with any rights of Owner, retain all common law, statutory, and other reserved rights, in addition to the copyright. All copies of these documents, except Contractor's set, shall be returned or suitably accounted for to A/E, on request, upon completion of the Work.

B. The Drawings, Specifications, and other documents prepared by the A/E, and copies thereof furnished to Contractor, are for use solely with respect to this Project. They are not to be used by Contractor or any Subcontractor on other projects or for additions to this Project outside the scope of the Work without the specific written consent of Owner and A/E. Contractor and Subcontractors are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications, and other documents prepared by A/E appropriate to and for use in the execution of their Work.

C. Contractor and all Subcontractors grant a non-exclusive license to Owner, without additional cost or royalty, to use for its own purposes (including reproduction) all Shop Drawings, together with the information and diagrams contained therein, prepared by Contractor or any Subcontractor. In providing Shop Drawings, Contractor and all Subcontractors warrant that they have authority to grant to Owner a license to use the Shop Drawings, and that such license is not in violation of any copyright or other intellectual property right. Contractor agrees to defend and indemnify Owner pursuant to the indemnity provisions in Sections 5.03 and 5.22 from any violations of copyright or other intellectual property rights arising out of Owner's use of the Shop Drawings hereunder, or to secure for Owner, at Contractor's own cost, licenses in conformity with this section.

D. The Shop Drawings and other submittals prepared by Contractor, Subcontractors of any tier, or its or their equipment or material suppliers, and copies thereof furnished to Contractor, are for use solely with respect to this Project. They are not to be used by Contractor or any Subcontractor of any tier, or material or equipment supplier, on other projects or for additions to this Project outside the scope of the Work without the specific written consent of Owner. The Contractor, Subcontractors of any tier, and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Shop Drawings and other submittals appropriate to and for use in the execution of their Work under the Contract Documents.

PART 5 - PERFORMANCE

5.01 CONTRACTOR CONTROL AND SUPERVISION

A. Contractor shall supervise and direct the Work, using its best skill and attention, and shall perform the Work in a skillful manner. 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, unless the Contract Documents give other specific

instructions concerning these matters. Contractor shall disclose its means and methods of construction when requested by Owner.

B. Performance of the Work shall be directly supervised by a competent superintendent who has authority to act for Contractor. The superintendent must be satisfactory to Owner and shall not be changed without the prior written consent of Owner. Owner may require Contractor to remove the superintendent from the Work or Project site, if Owner reasonable deems the superintendent incompetent, careless, or otherwise objectionable, provided Owner has first notified Contractor in writing and allowed a reasonable period for transition.

C. Contractor shall be responsible to Owner for acts and omissions of Contractor, Subcontractors, and their employees and agents.

D. Contractor shall enforce strict discipline and good order among Contractor's employees and other persons performing the Work. Contractor shall not permit employment of persons not skilled in tasks assigned to them. Contractor's employees shall at all times conduct business in a manner which assures fair, equal, and nondiscriminatory treatment of all persons. Owner may, by written notice, request Contractor to remove from the Work or Project site any employee Owner reasonably deems incompetent, careless, or otherwise objectionable.

E. Contractor shall keep on the Project site a copy of the Drawings, Specifications, addenda, reviewed Shop Drawings, and permits and permit drawings.

F. Contractor shall ensure that its owner(s) and employees, and those of its Subcontractors, comply with the Ethics in Public Service Act RCW 42.52, which, among other things, prohibits state employees from having an economic interest in any public works contract that was made by, or supervised by, that employee. Contractor shall remove, at its sole cost and expense, any of its, or its Subcontractors', employees, if they are in violation of this act.

5.02 PERMITS, FEES, AND NOTICES

A. Unless otherwise provided in the Contract Documents, Owner shall pay for and obtain all permits, and licenses required for proper execution and completion of the Work. Prior to Final Acceptance, the approved, signed permits shall be delivered to Owner.

Contractor is responsible for requesting all inspections required for proper execution and completion of the Work.

B. If allowances for permits or utility fees are called for in the Contract Documents and set forth in Contractor's bid, and the actual costs of those permits or fees differ from the allowances in the Contract Documents, the difference shall be adjusted by Change Order.

C. Contractor shall comply with and give notices required by all federal, state, and local laws, ordinances, rules, regulations, and lawful orders of public authorities applicable to performance of the Work.

5.03 PATENTS AND ROYALTIES

A. Contractor is responsible for, and shall pay, all royalties and license fees. Contractor shall defend, indemnify, and hold Owner harmless from any costs, expenses, and liabilities arising out of the infringement by Contractor of any patent, copyright, or other intellectual property right used in the Work; however, provided that Contractor gives prompt notice, Contractor shall not be responsible for such defense or indemnity when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents. If Contractor has reason to believe that use of the required design, process, or product constitutes an infringement of a patent or copyright, it shall promptly notify Owner of such potential infringement.

5.04 PREVAILING WAGES

A. Contractor shall pay the prevailing rate of wages to all workers, laborers, or mechanics employed in the performance of any part of the Work in accordance with RCW 39.12 and the rules and regulations of the Department of Labor and Industries. The schedule of prevailing wage rates for the locality or localities of the Work, is determined by the Industrial Statistician of the Department of Labor and Industries. It is the Contractor's responsibility to verify the applicable prevailing wage rate.

B. Before payment is made by Owner to Contractor for any work performed by Contractor and subcontractors whose work is included in the application for payment, Contractor shall submit, or shall have previously submitted to Owner for the Project, a Statement of Intent to Pay Prevailing Wages, approved by the Department of Labor & Industries, certifying the rate of hourly wages paid and to be paid each classification of laborers, workers, or mechanics employed upon the Work by Contractor and tis subcontractors. Such rates of hourly wages shall not be less than the prevailing wage rate for job site, Bainbridge Island, Kitsap County, Washington.

C. Prior to release of retainage, Contractor shall submit to Owner an Affidavit of Wages Paid, approved by the Department of Labor & Industries, for Contractor and every subcontractor, or any tier, that performed work on the Project.

D. Disputes regarding prevailing wage rates shall be referred for arbitration to the Director of the Department of Labor and Industries. The arbitration decision shall be final and conclusive and binding on all parties involved in the dispute as provided for by RCW 39.12.060.

E. Each Application for Payment submitted by Contractor shall state that prevailing wages have been paid in accordance with the pre-filed statement(s) of intent, as approved. Copies of the approved intent statement(s) shall be posted on the job site with the address and telephone number of the Industrial Statistician of the Department of Labor and Industries where a complaint or inquiry concerning prevailing wages may be made.

F. In compliance with chapter 296-127 WAC, Contractor shall pay to the Department of Labor and Industries the currently established fee(s) for each statement of intent and/or affidavit of wages paid submitted to the Department of Labor and Industries for certification.

G. Consistent with WAC 296-127-320, the Contractor and any subcontractor shall submit a certified copy of payroll records if requested.

5.05 HOURS OF LABOR

A. Contractor shall comply with all applicable provisions of RCW 49.28 and they are incorporated herein by reference. Pursuant to that statute, no laborer, worker, or mechanic employed by Contractor, any Subcontractor, or any other person performing or contracting to do the whole or any part of the Work, shall be permitted or required to work more than eight hours in any one calendar day, provided, that in cases of extraordinary emergency, such as danger to life or property, the hours of work may be extended, but in such cases the rate of pay for time employed in excess of eight hours of each calendar day shall be not less than one and one-half times the rate allowed for this same amount of time during eight hours' service.

B. Notwithstanding the preceding paragraph, RCW 49.28 permits a contractor or subcontractor in any public works contract subject to those provisions, to enter into an agreement with its employees in which the employees work up to ten hours in a calendar day. No such agreement may provide that the employees work ten-hour days for more than four calendar days a week. Any such agreement is subject to approval by the employees. The overtime provisions of RCW 49.28 shall not apply to the hours, up to forty hours per week, worked pursuant to any such agreement.

5.06 NONDISCRIMINATION

A. Discrimination in all phases of employment is prohibited by, among other laws and regulations, Title VII of the Civil Rights Act of 1964, the Vietnam Era Veterans Readjustment Act of 1974, sections 503 and 504 of the Vocational Rehabilitation Act of 1973, the Equal Employment Act of 1972, the Age Discrimination Act of 1967, the Americans with Disabilities Act of 1990, the Civil Rights Act of 1991, Presidential Executive Order 11246, Executive Order 11375, the Washington State Law Against Discrimination, RCW 49.60, and Gubernatorial Executive Order 85-09. These laws and regulations establish minimum requirements for affirmative action and fair employment practices which Contractor must meet.

B. During performance of the Work:

1. Contractor shall not discriminate against any employee or applicant for employment because of race, creed, color, national origin, sex, age, marital status, or the presence of any physical, sensory, or mental disability, Vietnam era veteran status, or disabled veteran status, nor commit any other unfair practices as defined in RCW 49.60.
2. Contractor shall, in all solicitations or advertisements for employees placed by or for it, state that all qualified applicants will be considered for employment, without regard to race, creed, color, national origin, sex, age, marital status, or the presence of any physical, sensory, or mental disability.
3. Contractor shall send to each labor union, employment agency, or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice advising the labor union, employment agency, or workers' representative of Contractor's obligations according to the Contract Documents and RCW 49.60.
4. Contractor shall permit access to its books, records, and accounts, and to its premises by Owner, and by the Washington State Human Rights Commission, for the purpose of investigation to ascertain compliance with this section of the Contract Documents.
5. Contractor shall include the provisions of this section in every Subcontract.

5.07 SAFETY PRECAUTIONS

A. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Work.

B. In carrying out its responsibilities according to the Contract Documents, Contractor shall protect the lives and health of employees performing the Work and other persons who may be affected by the Work; prevent damage to materials, supplies, and equipment whether on site or stored off-site; and prevent damage to other property at the site or adjacent thereto. Contractor shall comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss; shall erect and maintain all necessary safeguards for such safety and protection; and shall notify owners of adjacent property and utilities when prosecution of the Work may affect them.

C. Contractor shall maintain an accurate record of exposure data on all incidents relating to the Work resulting in death, traumatic injury, occupational disease, or damage to property, materials, supplies, or equipment. Contractor shall immediately report any such incident to Owner. Owner shall, at all times, have a right of access to all records of exposure.

D. Contractor shall provide all persons working on the Project site with information and training on hazardous chemicals in their work at the time of their initial assignment, and whenever a new hazard is introduced into their work area.

1. Information. At a minimum, Contractor shall inform persons working on the Project site of:

a. The requirements of chapter 296-62 WAC, General Occupational Health Standards;

b. Any operations in their work area where hazardous chemicals are present; and

c. The location and availability of written hazard communication programs, including the required list(s) of hazardous chemicals and material safety data sheets required by chapter 296-62 WAC.

2. Training. At a minimum, Contractor shall provide training for persons working on the Project site which includes:

a. Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

b. The physical and health hazards of the chemicals in the work area;

c. The measures such persons can take to protect themselves from these hazards, including specific procedures Contractor, or its Subcontractors, or others have implemented to protect those on the Project site from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and

d. The details of the hazard communications program developed by Contractor, or its Subcontractors, including an explanation of the labeling system and the material safety data sheet, and how employees can obtain and use the appropriate hazard information.

E. Contractor's responsibility for hazardous, toxic, or harmful substances shall include the following duties:

1. Contractor shall not keep, use, dispose, transport, generate, or sell on or about the Project site, any substances now or hereafter designated as, or which are subject to regulation as, hazardous, toxic, dangerous, or harmful by any federal, state or local law, regulation, statute or ordinance (hereinafter collectively referred to as "hazardous substances", in violation of any such law, regulation, statute, or ordinance, but in no case shall any such hazardous substance be stored more than 90 days on the Project site.

2. Contractor shall promptly notify Owner of all spills or releases of any hazardous substances which are otherwise required to be reported to any regulatory agency and pay the cost of cleanup. Contractor shall promptly notify Owner of all failures to comply with any federal, state, or local law, regulation, or ordinance; all inspections of the Project site by any regulatory entity concerning the same; all regulatory orders or fines; and all responses or interim cleanup actions taken by or proposed to be taken by any government entity or private party on the Project site.

F. All Work shall be performed with due regard for the safety of the public. Contractor shall perform the Work so as to cause a minimum of interruption of vehicular traffic or inconvenience to pedestrians. All arrangements to care for such traffic shall be Contractor's responsibilities. All expenses involved in the maintenance of traffic by way of detours shall be borne by Contractor.

G. In an emergency affecting the safety of life or the Work or of adjoining property, Contractor is permitted to act, at its discretion, to prevent such threatened loss or injury, and Contractor shall so act if so authorized or instructed.

H. Nothing provided in this section shall be construed as imposing any duty upon Owner or A/E with regard to, or as constituting any express or implied assumption of control or responsibility over, Project site safety, or over any other safety conditions relating to employees or agents of Contractor or any of its Subcontractors, or the public.

5.08 OPERATIONS, MATERIAL HANDLING, AND STORAGE AREAS

A. Contractor shall confine all operations, including storage of materials, to Owner-approved areas.

B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be provided by Contractor only with the consent of Owner and without expense to Owner. The temporary buildings and utilities shall remain the property of Contractor and shall be removed by Contractor at its expense upon completion of the Work.

C. Contractor shall use only established roadways or temporary roadways authorized by Owner. When materials are transported in prosecuting the Work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by federal, state, or local law or regulation.

D. Ownership and control of all materials or facility components to be demolished or removed from the Project site by Contractor shall immediately vest in Contractor upon severance of the component from the facility or severance of the material from the Project site. Contractor shall be responsible for compliance with all laws governing the storage and ultimate disposal. Contractor shall provide Owner with a copy of all manifests and receipts evidencing proper disposal when required by Owner or applicable law.

E. Contractor shall be responsible for the proper care and protection of its materials and equipment delivered to the Project site. Materials and equipment may be stored on the premises subject to approval of Owner. When Contractor uses any portion of the Project site as a shop, Contractor shall be responsible for any repairs, patching, or cleaning arising from such use.

F. Contractor shall protect and be responsible for any damage or loss to the Work, or to the materials or equipment until the date of Substantial Completion, and shall repair or replace without cost to Owner any damage or loss that may occur, except damages or loss caused by the acts or omissions of Owner. Contractor shall also protect and be responsible for any damage or loss to the Work, or to the materials or equipment, after the date of Substantial Completion, and shall repair or replace without cost to Owner any such damage or loss that might occur, to the extent such damages or loss are caused by the acts or omissions of Contractor, or any Subcontractor.

5.09 PRIOR NOTICE OF EXCAVATION

A. "Excavation" means an operation in which earth, rock, or other material on or below the ground is moved or otherwise displaced by any means, except the tilling of soil less than 12 inches in depth for agricultural purposes, or road ditch maintenance that does not change the original road grade or ditch flow line. Before commencing any excavation, Contractor shall provide notice of the scheduled commencement of excavation to all owners of underground facilities or utilities, through locator services.

5.10 UNFORESEEN PHYSICAL CONDITIONS

A. If Contractor encounters conditions at the site which are subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents, or unknown physical conditions of an unusual nature which 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, then Contractor shall give written notice to Owner promptly and in no event later than 7 days after the first observance of the conditions. Conditions shall not be disturbed prior to such notice.

B. If such conditions differ materially and cause a change in Contractor's cost of, or time required for, performance of any part of the Work, the Contractor may be entitled to an equitable adjustment in the Contract Time or Contract Sum, or both, provided it makes a request therefor as provided in part 7.

5.11 PROTECTION OF EXISTING STRUCTURES, EQUIPMENT, VEGETATION, UTILITIES, AND IMPROVEMENTS

A. Contractor shall protect from damage all existing structures, equipment, improvements, utilities, and vegetation: at or near the Project site; and on adjacent property of a third party, the locations of which are made known to or should be known by Contractor. Contractor shall repair any damage, including that to the property of a third party, resulting from failure to comply with the requirements of the Contract Documents or failure to exercise reasonable care in performing the Work. If Contractor fails or refuses to repair the damage promptly, Owner may have the necessary work performed and charge the cost to Contractor.

B. Contractor shall only remove trees when specifically authorized to do so, and shall protect vegetation that will remain in place.

5.12 LAYOUT OF WORK

A. Contractor shall plan and lay out the Work in advance of operations so as to coordinate all work without delay or revision.

B. Contractor shall lay out the Work from Owner-established baselines and bench marks indicated on the Drawings, and shall be responsible for all field measurements in connection with the layout. Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the Work. Contractor shall be responsible for executing the Work to the lines and grades that may be established. Contractor shall be responsible for maintaining or restoring all stakes and other marks established.

5.13 MATERIAL AND EQUIPMENT

A. All equipment, material, and articles incorporated into the Work shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in the Contract Documents. References in the Specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard quality and shall not be construed as limiting competition. Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of A/E, is equal to that named in the specifications, unless otherwise specifically provided in the Contract Documents.

B. Contractor shall do all cutting, fitting, or patching that may be required to make its several parts fit together properly, or receive or be received by work of others set forth in, or reasonably implied by, the Contract Documents. Contractor shall not endanger any work by

cutting, excavating, or otherwise altering the Work and shall not cut or alter the work of any other contractor unless approved in advance by Owner.

C. Should any of the Work be found defective, or in any way not in accordance with the Contract Documents, this work, in whatever stage of completion, may be rejected by Owner.

5.14 AVAILABILITY AND USE OF UTILITY SERVICES

A. Owner shall make all reasonable utilities available to Contractor from existing outlets and supplies, as specified in the Contract Documents. Unless otherwise provided in the Contract Documents, the utility service consumed shall be charged to or paid for by Contractor at prevailing rates charged to Owner or, where the utility is produced by Owner, at reasonable rates determined by Owner. Contractor will carefully conserve any utilities furnished.

B. Contractor shall, at its expense and in a skillful manner satisfactory to Owner, install and maintain all necessary temporary connections and distribution lines, together with appropriate protective devices, and all meters required to measure the amount of each utility used for the purpose of determining charges. Prior to the date of Final Acceptance, Contractor shall remove all temporary connections, distribution lines, meters, and associated equipment and materials.

5.15 TESTS AND INSPECTION

A. Contractor shall maintain an adequate testing and inspection program and perform such tests and inspections as are necessary or required to ensure that the Work conforms to the requirements of the Contract Documents. Contractor shall be responsible for inspection and quality surveillance of all its Work and all Work performed by any Subcontractor. Unless otherwise provided, Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. Contractor shall give Owner timely notice of when and where tests and inspections are to be made. Contractor shall maintain complete inspection records and make them available to Owner.

B. Owner may, at any reasonable time, conduct such inspections and tests as it deems necessary to ensure that the Work is in accordance with the Contract Documents. Owner shall promptly notify Contractor if an inspection or test reveals that the Work is not in accordance with the Contract Documents. Unless the subject items are expressly accepted by Owner, such Owner inspection and tests are for the sole benefit of Owner and do not:

1. Constitute or imply acceptance;
2. Relieve Contractor of responsibility for providing adequate quality control measures;
3. Relieve Contractor of responsibility for risk of loss or damage to the Work, materials, or equipment;
4. Relieve Contractor of its responsibility to comply with the requirements of the Contract Documents; or
5. Impair Owner's right to reject defective or nonconforming items, or to avail itself of any other remedy to which it may be entitled.

C. Neither observations by an inspector retained by Owner, the presence or absence of such inspector on the site, nor inspections, tests, or approvals by others, shall relieve Contractor from any requirement of the Contract Documents, nor is any such inspector authorized to change any term or condition of the Contract Documents.

D. Contractor shall promptly furnish, without additional charge, all facilities, labor, material and equipment reasonably needed for performing such safe and convenient inspections and tests

as may be required by Owner. Owner may charge Contractor any additional cost of inspection or testing when Work is not ready at the time specified by Contractor for inspection or testing, or when prior rejection makes reinspection or retest necessary. Owner shall perform its inspections and tests in a manner that will cause no undue delay in the Work.

5.16 CORRECTION OF NONCONFORMING WORK

A. If a portion of the Work is covered contrary to the requirements in the Contract Documents, it must, if required in writing by Owner, be uncovered for Owner's observation and be replaced at the Contractor's expense and without change in the Contract Time.

B. If, at any time prior to Final Completion, Owner desires to examine the Work, or any portion of it, which has been covered, Owner may request to see such Work and it shall be uncovered by Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an adjustment in the Contract Sum for the costs of uncovering and replacement, and, if completion of the Work is thereby delayed, an adjustment in the Contract Time, provided it makes a request therefor as provided in part 7. If such Work is not in accordance with the Contract Documents, the Contractor shall pay the costs of examination and reconstruction.

C. Contractor shall promptly correct Work found by Owner not to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed, or completed. Contractor shall bear all costs of correcting such nonconforming Work, including additional testing and inspections.

D. If, within one year after the date of Substantial Completion of the Work or designated portion thereof, or within one year after the date for commencement of any system warranties established under section 6.08, or within the 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, Contractor shall correct it promptly after receipt of written notice from Owner to do so. Owner shall give such notice promptly after discovery of the condition. This period of one year 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 performance of the Work. Contractor's duty to correct with respect to Work repaired or replaced shall run for one year from the date of repair or replacement. Obligations under this paragraph shall survive Final Acceptance.

E. Contractor shall remove from the Project site portions of the Work which are not in accordance with the requirements of the Contract Documents and are neither corrected by Contractor nor accepted by Owner.

F. If Contractor fails to correct nonconforming Work within a reasonable time after written notice to do so, Owner may replace, correct, or remove the nonconforming Work and charge the cost thereof to the Contractor.

G. Contractor shall bear the cost of correcting destroyed or damaged Work, whether completed or partially completed, caused by Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

H. Nothing contained in this section shall be construed to establish a period of limitation with respect to other obligations which Contractor might have according to the Contract Documents. Establishment of the time period of one year as described in paragraph 5.16D relates only to the specific obligation of Contractor to correct the Work, and has no relationship to the time within which the Contractor's obligation to comply with the Contract Documents may be sought to be enforced, including the time within which such proceedings may be commenced.

I. If Owner prefers to accept Work which is not in accordance with the requirements of the Contract Documents, Owner may do so instead of requiring its removal and correction, in which case the Contract Sum may be reduced as appropriate and equitable.

5.17 CLEAN UP

A. Contractor shall at all times keep the Project site, including hauling routes, infrastructures, utilities, and storage areas, free from accumulations of waste materials. Before completing the Work, Contractor shall remove from the premises its rubbish, tools, scaffolding, equipment, and materials. Upon completing the Work, Contractor shall leave the Project site in a clean, neat, and orderly condition satisfactory to Owner. If Contractor fails to clean up as provided herein, and after reasonable notice from Owner, Owner may do so and the cost thereof shall be charged to Contractor.

5.18 ACCESS TO WORK

A. Contractor shall provide Owner and A/E access to the Work in progress wherever located.

5.19 OTHER CONTRACTS

A. Owner may undertake or award other contracts for additional work at or near the Project site. Contractor shall reasonably cooperate with the other contractors and with Owner's employees and shall carefully adapt scheduling and perform the Work in accordance with these Contract Documents to reasonably accommodate the other work.

5.20 SUBCONTRACTORS AND SUPPLIERS

A. The Contractor shall include the language of this paragraph in each of its first tier subcontract, and shall require each of its subcontractors to include the same language of this section 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 the subcontractor meets the subcontractor responsibility criteria below. The requirements of this paragraph apply to all subcontractors regardless of tier. 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 as a contractor in compliance with chapter 18.27 RCW, which must have been in effect at the time of subcontract bid submittal;
2. Have a current Washington Unified Business Identifier (UBI) number;
3. If applicable, have Industrial Insurance (workers' compensation) coverage for the subcontractor's employees working in Washington, as required in Title 51 RCW;
4. A Washington Employment Security Department number, as required in Title 50 RCW;
5. A Washington Department of Revenue state excise tax registration number, as required in Title 82 RCW;
6. An electrical contractor license, if required by Chapter 19.28 RCW;
7. An elevator contractor license, if required by Chapter 70.87 RCW.
8. Not be disqualified from bidding any public works contract under RCW 39.06.010 or 39.12.065(3).
9. On a 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 Owner's first advertisement of the project.

B. Before submitting the first Application for Payment, Contractor shall furnish in writing to Owner the names, addresses, and telephone numbers of all Subcontractors, as well as suppliers providing materials in excess of $2,500. Contractor shall utilize Subcontractors and suppliers which are experienced and qualified, and meet the requirements of the Contract Documents, if any. Contractor shall not utilize any Subcontractor or supplier to whom the Owner has a reasonable objection, and shall obtain Owner's written consent before making any substitutions or additions.

C. All Subcontracts must be in writing. By appropriate written agreement, Contractor shall require each Subcontractor, so far as applicable to the Work to be performed by the Subcontractor, to be bound to Contractor by terms of the Contract Documents, and to assume toward Contractor all the obligations and responsibilities which Contractor assumes toward Owner in accordance with the Contract Documents. Each Subcontract shall preserve and protect the rights of Owner in accordance with the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights. Where appropriate, Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. However, nothing in this paragraph shall be construed to alter the contractual relations between Contractor and its Subcontractors with respect to insurance or bonds.

D. Contractor shall schedule, supervise, and coordinate the operations of all Subcontractors. No Subcontracting of any of the Work shall relieve Contractor from its responsibility for the performance of the Work in accordance with the Contract Documents or any other obligations of the Contract Documents.

E. Each subcontract agreement for a portion of the Work is hereby assigned by Contractor to Owner provided that:

1. The assignment is effective only after termination by Owner for cause pursuant to section 9.01 and only for those Subcontracts which Owner accepts by notifying the Subcontractor in writing; and
2. After the assignment is effective, Owner will assume all future duties and obligations toward the Subcontractor which Contractor assumed in the Subcontract.
3. The assignment is subject to the prior rights of the surety, if any, obligated under any bond provided in accordance with the Contract Documents.

5.21 WARRANTY OF CONSTRUCTION

A. In addition to any special warranties provided elsewhere in the Contract Documents, Contractor warrants that all Work conforms to the requirements of the Contract Documents and is free of any defect in equipment, material, or design furnished, or workmanship performed, by Contractor.

B. With respect to all warranties, express or implied, for Work performed or materials furnished according to the Contract Documents, Contractor shall:

1. Obtain all warranties that would be given in normal commercial practice;
2. Require all warranties to be executed, in writing, for the benefit of Owner;
3. Enforce all warranties for the benefit of Owner, if directed by Owner; and
4. Be responsible to enforce any subcontractor's, manufacturer's, or supplier's warranty should they extend beyond the period specified in the Contract Documents.

C. The obligations under this section shall survive Final Acceptance.

5.22 INDEMNIFICATION

A. Contractor shall defend, indemnify, and hold Owner and A/E harmless from and against all claims, demands, losses, damages, or costs, including but not limited to damages arising out of bodily injury or death to persons and damage to property, caused by or resulting from:
   1. The sole negligence of Contractor or any of its Subcontractors;
   2. The concurrent negligence of Contractor, or any Subcontractor, but only to the extent of the negligence of Contractor or such Subcontractor; and
   3. The use of any design, process, or equipment which constitutes an infringement of any United States patent presently issued, or violates any other proprietary interest, including copyright, trademark, and trade secret.

B. In any action against Owner and any other entity indemnified in accordance with this section, by any employee of Contractor, its Subcontractors, Sub-subcontractors, agents, or anyone directly or indirectly employed by any of them, the indemnification obligation of this section shall not be limited by a limit on the amount or type of damages, compensation, or benefits payable by or for Contractor or any Subcontractor under RCW Title 51, the Industrial Insurance Act, or any other employee benefit acts. In addition, Contractor waives immunity as to Owner and A/E only, in accordance with RCW Title 51.

PART 6 - PAYMENTS AND COMPLETION

6.01 CONTRACT SUM

A. Owner shall pay Contractor the Contract Sum for performance of the Work, in accordance with the Contract Documents.

6.02 SCHEDULE OF VALUES

A. Before submitting its first Application for Payment, Contractor shall submit to Owner for approval a breakdown allocating the total Contract Sum to each principle category of work, in such detail as requested by Owner ("Schedule of Values"). The approved Schedule of Values shall include appropriate amounts for demobilization, record drawings, O&M manuals, and any other requirements for Project closeout, and shall be used by Owner as the basis for progress payments. Payment for Work shall be made only for and in accordance with those items included in the Schedule of Values.

6.03 APPLICATION FOR PAYMENT

A. At monthly intervals at least thirty days before the 10th or 25th day of each month, unless determined otherwise by Owner, Contractor shall submit to Owner an itemized Application for Payment for Work completed in accordance with the Contract Documents and the approved Schedule of Values. Each application shall be supported by such substantiating data as Owner may require.

B. By submitting an Application for Payment, Contractor is certifying that all Subcontractors have been paid, less earned retainage in accordance with RCW 60.28.010, as their interests appeared in the last preceding certificate of payment. By submitting an Application for Payment, Contractor is recertifying that the representations set forth in section 1.03 are true and correct, to the best of Contractor's knowledge, as of the date of the Application for Payment.

C. At the time it submits an Application for Payment, Contractor shall analyze and reconcile, to the satisfaction of Owner, the actual progress of the Work with the Progress Schedule.

D. If authorized by Owner, the Application for Payment may include request for payment for material delivered to the Project site and suitably stored, or for completed preparatory work.

Payment may similarly be requested for material stored off the Project site, provided Contractor complies with or furnishes satisfactory evidence of the following:

1. The material will be placed in a warehouse that is structurally sound, dry, lighted and suitable for the materials to be stored;
2. The warehouse is located within a 10-mile radius of the Project. Other locations may be utilized, if approved in writing, by Owner;
3. Only materials for the Project are stored within the warehouse (or a secure portion of a warehouse set aside for the Project);
4. Contractor furnishes Owner a certificate of insurance extending Contractor's insurance coverage for damage, fire, and theft to cover the full value of all materials stored, or in transit;
5. The warehouse (or secure portion thereof) is continuously under lock and key, and only Contractor's authorized personnel shall have access;
6. Owner shall at all times have the right of access in company of Contractor;
7. Contractor and its surety assume total responsibility for the stored materials; and
8. Contractor furnishes to Owner certified lists of materials stored, bills of lading, invoices, and other information as may be required, and shall also furnish notice to Owner when materials are moved from storage to the Project site.

6.04 PROGRESS PAYMENTS

A. Owner shall make progress payments on the 10th or 25th of each calendar month, in the manner and within the time provided in the Contract Documents, in such amounts as Owner determines are properly due, after receipt of a properly executed Application for Payment. Owner shall notify Contractor in accordance with RCW 39.76 if the Application for Payment does not comply with the requirements of the Contract Documents.

B. Owner shall retain 5% of the amount of each progress payment until 45 days after Final Acceptance and receipt of all documents required by law or the Contract Documents, including, at Owner's request, consent of surety to release of the retainage. In accordance with RCW 60.28, Contractor may request that monies reserved be retained in a fund by Owner, deposited by Owner in a bank or savings and loan, or placed in escrow with a bank or trust company to be converted into bonds and securities to be held in escrow with interest to be paid to Contractor. Owner may permit Contractor to provide an appropriate bond in lieu of the retained funds.

C. Title to all Work and materials covered by a progress payment shall pass to Owner at the time of such payment free and clear of all liens, claims, security interests, and encumbrances. Passage of title shall not, however, relieve Contractor from any of its duties and responsibilities for the Work or materials, or waive any rights of Owner to insist on full compliance by Contractor with the Contract Documents.

D. Payments due and unpaid in accordance with the Contract Documents shall bear interest as specified in RCW 39.76.

6.05 PAYMENTS WITHHELD

A. Owner may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any payment to such extent as may be necessary to protect Owner from loss or damage for reasons including but not limited to:

1. Work not in accordance with the Contract Documents;

2. Reasonable evidence that the Work required by the Contract Documents cannot be completed for the unpaid balance of the Contract Sum;
3. Work by Owner to correct defective Work or complete the Work in accordance with section 5.16;
4. Failure to perform in accordance with the Contract Documents; or
5. Cost or liability that may occur to Owner as the result of Contractor's fault or negligent acts or omissions.

B. In any case where part or all of a payment is going to be withheld for unsatisfactory performance, Owner shall notify Contractor in accordance with RCW 39.76.

6.06 RETAINAGE AND BOND CLAIM RIGHTS

A. RCW chapters 39.08 and 60.28, concerning the rights and responsibilities of Contractor and Owner with regard to the performance and payment bonds and retainage, are made a part of the Contract Documents by reference as though fully set forth herein.

6.07 SUBSTANTIAL COMPLETION

A. Substantial Completion is the stage in the progress of the Work (or portion thereof designated and approved by Owner) when the construction is sufficiently complete, in accordance with the Contract Documents, so Owner has full and unrestricted use and benefit of the facilities (or the portion thereof designate and approved by Owner) for the use for which it is intended. All Work other than incidental corrective or punch list work shall be completed. Substantial Completion shall not have been achieved if all systems and parts are not functional, if utilities are not connected and operating normally, if all required occupancy permits have not been issued, or if the Work is not accessible by normal vehicular and pedestrian traffic routes. The date Substantial Completion is achieved shall be established in writing by Owner. Contractor may request an early date of Substantial Completion which must be approved by Change Order. Owner's occupancy of the Work or designated portion thereof does not necessarily indicate that Substantial Completion has been achieved.

6.08 PRIOR OCCUPANCY

A. Owner may, upon written notice thereof to Contractor, take possession of or use any completed or partially completed portion of the Work ("Prior Occupancy") at any time prior to Substantial Completion. Unless otherwise agreed in writing, Prior Occupancy shall not: be deemed an acceptance of any portion of the Work; accelerate the time for any payment to Contractor; prejudice any rights of Owner provided by any insurance, bond, guaranty, or the Contract Documents; relieve Contractor of the risk of loss or any of the obligations established by the Contract Documents; establish a date for termination or partial termination of the assessment of liquidated damages; or constitute a waiver of claims.

B. Notwithstanding anything in the preceding paragraph, Owner shall be responsible for loss of or damage to the Work resulting from Prior Occupancy. Contractor's one year duty to repair and any system warranties shall begin on building systems activated and used by Owner as agreed in writing by Owner and Contractor.

6.09 FINAL COMPLETION, ACCEPTANCE, AND PAYMENT

A. Final Completion shall be achieved when the Work is fully and finally complete in accordance with the Contract Documents. The date Final Completion is achieved shall be established by Owner in writing, but in no case shall constitute Final Acceptance which is a subsequent, separate, and distinct action.

B. Final Acceptance is the formal action of Owner acknowledging Final Completion. Prior to Final Acceptance, Contractor shall, in addition to all other requirements in the Contract Documents, submit to Owner a written notice of any outstanding disputes or claims between Contractor and any of its Subcontractors, including the amounts and other details thereof. Neither Final Acceptance, nor final payment, shall release Contractor or its sureties from any obligations of these Contract Documents or the Public Works Bond, or constitute a waiver of any claims by Owner arising from Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Acceptance of final payment by Contractor, or any Subcontractor, shall constitute a waiver and release to Owner of all claims by Contractor, or any such Subcontractor, for an increase in the Contract Sum or the Contract Time, and for every act or omission of Owner relating to or arising out of the Work, except for those Claims made in accordance with the procedures, including the time limits, set forth in part 8.

PART 7 - CHANGES

7.01 CHANGE IN THE WORK

A. Owner may, at any time and without notice to Contractor's surety, order additions, deletions, revisions, or other changes in the Work. These changes in the Work shall be incorporated into the Contract Documents through the execution of Change Orders. If any change in the Work ordered by Owner causes an increase or decrease in the Contract Sum or the Contract Time, an equitable adjustment shall be made as provided in section 7.02 or 7.03, respectively, and such adjustment(s) shall be incorporated into a Change Order.

B. If Owner desires to order a change in the Work, it may request a written Change Order proposal from Contractor. Contractor shall submit a Change Order proposal within 14 days of the request from Owner, or within such other period as mutually agreed. Contractor's Change Order proposal shall be full compensation for implementing the proposed change in the Work, including any adjustment in the Contract Sum or Contract Time, and including compensation for all delays in connection with such change in the Work and for any expense or inconvenience, disruption of schedule, or loss of efficiency or productivity occasioned by the change in the Work.

C. Upon receipt of the Change Order proposal, or a request for equitable adjustment in the Contract Sum or Contract Time, or both, as provided in sections 7.02 and 7.03, Owner may accept or reject the proposal, request further documentation, or negotiate acceptable terms with Contractor. Pending agreement on the terms of the Change Order, Owner may direct Contractor to proceed immediately with the Change Order Work. Contractor shall not proceed with any change in the Work until it has obtained Owner's approval. All Work done pursuant to any Owner-directed change in the Work shall be executed in accordance with the Contract Documents.

D. If Owner and Contractor reach agreement on the terms of any change in the Work, including any adjustment in the Contract Sum or Contract Time, such agreement shall be incorporated in a Change Order. The Change Order shall constitute full payment and final settlement of all claims for time and for direct, indirect, and consequential costs, including costs of delays, inconvenience, disruption of schedule, or loss of efficiency or productivity, related to any Work either covered or affected by the Change Order, or related to the events giving rise to the request for equitable adjustment.

E. If Owner and Contractor are unable to reach agreement on the terms of any change in the Work, including any adjustment in the Contract Sum or Contract Time, Contractor may at any

time in writing, request a final offer from Owner. Owner shall provide Contractor with its written response within 30 days of Contractor's request. Owner may also provide Contractor with a final offer at any time. If Contractor rejects Owner's final offer, or the parties are otherwise unable to reach agreement, Contractor's only remedy shall be to file a Claim as provided in part 8.

F. Owner may direct Contractor to proceed with a change in the Work through a written Field Authorization (also referred to as a Field Order) when the time required to price and execute a Change Order would impact the Project.

1. The Field Authorization shall describe and include the following:

a. The scope of work.

b. An agreed upon maximum not-to-exceed amount.

c. Any estimated change to the Contract Time.

d. The method of final cost determination in accordance with the requirements of Part 7 of the General Conditions.

e. The supporting cost data to be submitted in accordance with the requirements of Part 7 of the General Conditions.

f. Upon satisfactory submittal by Contractor and approval by Owner of supporting cost data, a Change Order will be executed. Owner will not make payment to Contractor for Field Authorization work until that work has been incorporated into an executed Change Order.

7.02 CHANGE IN THE CONTRACT SUM

A. General Application

1. The Contract Sum shall only be changed by a Change Order. Contractor shall include any request for a change in the Contract Sum in its Change Order proposal.

2. If the cost of Contractor's performance is changed due to the fault or negligence of Owner, or anyone for whose acts Owner is responsible, Contractor shall be entitled to make a request for an equitable adjustment in the Contract Sum in accordance with the following procedure. No change in the Contract Sum shall be allowed to the extent: Contractor's changed cost of performance is due to the fault or negligence of Contractor, or anyone for whose acts Contractor is responsible; the change is concurrently caused by Contractor and Owner; or the change is caused by an act of Force Majeure as defined in Section 3.05.

a. A request for an equitable adjustment in the Contract Sum shall be based on written notice delivered to Owner within 7 days of the occurrence of the event giving rise to the request. For purposes of this part, "occurrence" means when Contractor knew, or in its diligent prosecution of the Work should have known, of the event giving rise to the request. If Contractor believes it is entitled to an adjustment in the Contract Sum, Contractor shall immediately notify Owner and begin to keep and maintain complete, accurate, and specific daily records. Contractor shall give Owner access to any such records and, if requested shall promptly furnish copies of such records to Owner.

b. Contractor shall not be entitled to any adjustment in the Contract Sum for any occurrence of events or costs that occurred more than 7 days before Contractor's written notice to Owner. The written notice shall set forth, at a minimum, a description of: the event giving rise to the request for an equitable adjustment in the Contract Sum; the nature of the impacts to Contractor and its Subcontractors of any tier, if any; and to the extent possible

the amount of the adjustment in Contract Sum requested. Failure to properly give such written notice shall constitute a waiver of Contractor's right to an equitable adjustment.

c. Within 30 days of the occurrence of the event giving rise to the request, unless Owner agrees in writing to allow an additional period of time to ascertain more accurate data, Contractor shall supplement the written notice provided in accordance with subparagraph a. above with additional supporting data. Such additional data shall include, at a minimum: the amount of compensation requested, itemized in accordance with the procedure set forth herein; specific facts, circumstances, and analysis that confirms not only that Contractor suffered the damages claimed, but that the damages claimed were actually a result of the act, event, or condition complained of and that the Contract Documents provide entitlement to an equitable adjustment to Contractor for such act, event, or condition; and documentation sufficiently detailed to permit an informed analysis of the request by Owner. When the request for compensation relates to a delay, or other change in Contract Time, Contractor shall demonstrate the impact on the critical path, in accordance with section 7.03C. Failure to provide such additional information and documentation within the time allowed or within the format required shall constitute a waiver of Contractor's right to an equitable adjustment.

d. Pending final resolution of any request made in accordance with this paragraph, unless otherwise agreed in writing, Contractor shall proceed diligently with performance of the Work.

e. Any requests by Contractor for an equitable adjustment in the Contract Sum and in the Contract Time that arise out of the same event(s) shall be submitted together.

3. The value of any Work covered by a Change Order, or of any request for an equitable adjustment in the Contract Sum, shall be determined by one of the following methods: a. On the basis of a fixed price as determined in paragraph 7.02B. b. By application of unit prices to the quantities of the items involved as determined in paragraph 7.02C. c. On the basis of time and material as determined in paragraph 7.02D.

4. When Owner has requested Contractor to submit a Change Order proposal, Owner may direct Contractor as to which method in subparagraph 3. above to use when submitting its proposal. Otherwise, Contractor shall determine the value of the Work, or of a request for an equitable adjustment, on the basis of the fixed price method.

B. Change Order Pricing -- Fixed Price

1. When the fixed price method is used to determine the value of any Work covered by a Change Order, or of a request for an equitable adjustment in the Contract Sum, the following procedures shall apply:

a. Contractor's Change Order proposal, or request for adjustment in the Contract Sum, 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.

b. All costs shall be calculated based upon appropriate industry standard methods of calculating labor, material quantities, and equipment costs.

c. If any of Contractor's pricing assumptions are contingent upon anticipated actions of Owner, Contractor shall clearly state them in the proposal or request for an equitable adjustment.

d. The cost of any additive or deductive changes in the Work shall be calculated as set forth below, except that overhead and profit shall not be included on deductive changes in the Work. 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.

e. If the total cost of the change in the Work or request for equitable adjustment does not exceed $1,000, Contractor shall not be required to submit a breakdown if the description of the change in the Work or request for equitable adjustment is sufficiently definitive for Owner to determine fair value.

f. If the total cost of the change in the Work or request for equitable adjustment is between $1,000 and $2,500, Contractor may submit a breakdown in the following level of detail if the description of the change in the Work or if the request for equitable adjustment is sufficiently definitive to permit the Owner to determine fair value:

1) lump sum labor;
2) lump sum material;
3) lump sum equipment usage;
4) overhead and profit as set forth below; and
5) insurance and bond costs as set forth below.

2. Any request for adjustment of Contract Sum based upon the fixed price method shall include only the following items:

a. 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." 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) Worker's insurance: Direct contributions to the state of Washington for industrial insurance; medical aid; and supplemental pension, by the class and rates established by the Department of Labor and Industries.
3) Federal insurance: Direct contributions required by the Federal Insurance Compensation Act; Federal Unemployment Tax Act; and the State Unemployment Compensation Act.
4) 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.
5) 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.

b. 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.

c. 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 on the basis of actual invoice costs or if owned, from the current edition of one of the following sources:

1) Associated General Contractors - Washington State Department of Transportation (AGC WSDOT) Equipment Rental Agreement current edition as of the Contract execution date.

2) The state of Washington Utilities and Transportation Commission for trucks used on highways.

3) The National Electrical Contractors Association for equipment used on electrical work.

4) The Mechanical Contractors Association of America for equipment used on mechanical work. 5) 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 as of the Contract execution date.

d. 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) For Contractor, 3% of direct labor costs.

2) For Subcontractors, 5% of direct labor costs.

3) Expendables and consumable supplies directly associated with the change in Work must be itemized.

e. Subcontractor costs: This is defined as payments Contractor makes to Subcontractors for changed Work performed by Subcontractors of any tier. The Subcontractors' cost of Work shall be calculated and itemized in the same manner as prescribed herein for Contractor.

f. Allowance for overhead: 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 but not to the cost of any change in the Contract Time for which contractor has been compensated pursuant to the conditions set forth in Section 7.03. 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, and any other cost incidental to the change in the Work. It shall be strictly limited in all cases to a reasonable amount, mutually

acceptable, or if none can be agreed upon to an amount not to exceed the rates below:

1) For projects where the Contract Award Amount is under $3 million, the following shall apply:

a) For Contractor, for any Work actually performed by Contractor's own forces, 16% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

b) For each Subcontractor (including lower tier subcontractors), for any Work actually performed by its own forces, 16% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

c) For Contractor, for any work performed by its Subcontractor(s), 6% of the first $50,000 of the amount due each Subcontractor, and 4% of the remaining amount if any.

d) For each Subcontractor, for any Work performed by its Subcontractor(s) of any lower tier, 4% of the first $50,000 of the amount due the sub-Subcontractor, and 2% of the remaining amount if any.

e) The cost to which overhead is to be applied shall be determined in accordance with subparagraphs Section 7.02B 7a.-e.

2) For projects where the Contract Award Amount is equal to or exceeds $3 million, the following shall apply:

a) For Contractor, for any Work actually performed by Contractor's own forces, 12% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

b) For each Subcontractor (including lower tier subcontractors), for any Work actually performed by its own forces, 12% of the first $50,000 of the cost, and 4% of the remaining cost, if any.

c) For Contractor, for any Work performed by its Subcontractor(s), 4% of the first $50,000 of the amount due each Subcontractor, and 2% of the remaining amount if any.

d) For each Subcontractor, for any Work performed by its Subcontractor(s) of any lower tier, 4% of the first $50,000 of the amount due the sub-Subcontractor, and 2% of the remaining amount if any.

e) The cost to which overhead is to be applied shall be determined in accordance with subparagraphs Section 7.02B 7a.-e.

g. Allowance for profit: This is an amount to be added to the cost of any change in contract sum, but not to the cost of change in Contract Time for which contractor has been compensated pursuant to the conditions set forth in section 7.03. It shall be limited to a reasonable amount, mutually acceptable, or if none can be agreed upon, to an amount not to exceed the rates below:

1) For Contractor or Subcontractor of any tier for work performed by their forces, 6% of the cost developed in accordance with Section 7.02 b. 7a.-e.

2) For Contractor or Subcontractor of any tier for work performed by a subcontractor of a lower tier, 4% of the Subcontractor cost developed in accordance with Section 7.02 b. 7a.-h.

h. Cost of change in insurance or bond premium: 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) Public works bond: The cost of the additional premium for Contractor's bond arising directly from the changed Work.

i. The costs of any change in insurance or bond premium shall be added after overhead and allowance for profit are calculated in accordance with subparagraph f. and g. above.

C. Change Order Pricing -- Unit Prices

1. Whenever Owner authorizes Contractor to perform Work on a unit-price basis, Owner's authorization shall clearly state:

a. Scope of work to be performed;

b. Type of reimbursement including pre-agreed rates for material quantities; and

c. Cost limit of reimbursement.

2. Contractor shall:

a. Cooperate with Owner and assist in monitoring the Work being performed. As requested by Owner, Contractor shall identify workers assigned to the Change Order Work and areas in which they are working;

b. Leave access as appropriate for quantity measurement; and

c. Not exceed any cost limit(s) without Owner's prior written approval.

3. Contractor shall submit costs in accordance with paragraph 7.02B. and satisfy the following requirements:

a. Unit prices shall include reimbursement for all direct and indirect costs of the Work, including overhead and profit, and bond and insurance costs; and

b. Quantities must be supported by field measurement statements signed by Owner.

D. Change Order Pricing -- Time-and-Material Prices

1. Whenever Owner authorizes Contractor to perform Work on a time-and-material basis, Owner's authorization shall clearly state:

a. Scope of Work to be performed;

b. Type of reimbursement including pre-agreed rates, if any, for material quantities or labor; and

c. Cost limit of reimbursement.

2. Contractor shall:

a. Cooperate with Owner and assist in monitoring the Work being performed. As requested by Owner, identify workers assigned to the Change Order Work and areas in which they are working;

b. Identify on daily time sheets all labor performed in accordance with this authorization. Submit copies of daily time sheets within 2 working days for Owner's review;

c. Leave access as appropriate for quantity measurement;

d. Perform all Work in accordance with this section as efficiently as possible; and

e. Not exceed any cost limit(s) without Owner's prior written approval.

3. Contractor shall submit costs in accordance with paragraph 7.02B and additional verification supported by:

a. Labor detailed on daily time sheets; and b. Invoices for material.

7.03 CHANGE IN THE CONTRACT TIME

A. The Contract Time shall only be changed by a Change Order. Contractor shall include any request for a change in the Contract Time in its Change Order proposal.

B. If the time of Contractor's performance is changed due to an act of Force Majeure, or due to the fault or negligence of Owner or anyone for whose acts Owner is responsible, Contractor shall be entitled to make a request for an equitable adjustment in the Contract Time in accordance with the following procedure. No adjustment in the Contract Time shall be allowed to the extent Contractor's changed time of performance is due to the fault or negligence of Contractor, or anyone for whose acts Contractor is responsible.

1. A request for an equitable adjustment in the Contract Time shall be based on written notice delivered within 7 days of the occurrence of the event giving rise to the request. If Contractor believes it is entitled to adjustment of Contract Time, Contractor shall immediately notify Owner and begin to keep and maintain complete, accurate, and specific daily records. Contractor shall give Owner access to any such record and if requested, shall promptly furnish copies of such record to Owner.
2. Contractor shall not be entitled to an adjustment in the Contract Time for any events that occurred more than 7 days before Contractor's written notice to Owner. The written notice shall set forth, at a minimum, a description of: the event giving rise to the request for an equitable adjustment in the Contract Time; the nature of the impacts to Contractor and its Subcontractors of any tier, if any; and to the extent possible the amount of the adjustment in Contract Time requested. Failure to properly give such written notice shall constitute a waiver of Contractor's right to an equitable adjustment.
3. Within 30 days of the occurrence of the event giving rise to the request, unless Owner agrees in writing to allow an additional period of time to ascertain more accurate data, Contractor shall supplement the written notice provided in accordance with subparagraph 7.03B.2 with additional supporting data. Such additional data shall include, at a minimum: the amount of delay claimed, itemized in accordance with the procedure set forth herein; specific facts, circumstances, and analysis that confirms not only that Contractor suffered the delay claimed, but that the delay claimed was actually a result of the act, event, or condition complained of, and that the Contract Documents provide entitlement to an equitable adjustment in Contract Time for such act, event, or condition; and supporting documentation sufficiently detailed to permit an informed analysis of the request by Owner. Failure to provide such additional information and documentation within the time allowed or within the format required shall constitute a waiver of Contractor's right to an equitable adjustment.
4. Pending final resolution of any request in accordance with this paragraph, unless otherwise agreed in writing, Contractor shall proceed diligently with performance of the Work.

C. Any change in the Contract Time covered by a Change Order, or based on a request for an equitable adjustment in the Contract Time, shall be limited to the change in the critical path of Contractor's schedule attributable to the change of Work or event(s) giving rise to the request for equitable adjustment. Any Change Order proposal or request for an adjustment in the Contract Time shall demonstrate the impact on the critical path of the schedule. Contractor

shall be responsible for showing clearly on the Progress Schedule that the change or event: had a specific impact on the critical path, and except in case of concurrent delay, was the sole cause of such impact; and could not have been avoided by resequencing of the Work or other reasonable alternatives.

D. Contractor may request compensation for the cost of a change in Contract Time in accordance with this paragraph, 7.03D, subject to the following conditions:
   1. The change in Contract Time shall solely be caused by the fault or negligence of Owner or A/E;
   2. Compensation under this paragraph is limited to changes in Contract Time for which Contractor is not entitled to be compensated under section 7.02;
   3. Contractor shall follow the procedure set forth in paragraph 7.03B;
   4. Contractor shall establish the extent of the change in Contract Time in accordance with paragraph 7.03C; and
   5. The daily cost of any change in Contract Time shall be limited to the items below, less funds that may have been paid pursuant to a change in the Contract Sum that contributed to this change in Contract Time:
      a. cost of nonproductive field supervision or labor extended because of the delay;
      b. cost of weekly meetings or similar indirect activities extended because of the delay;
      c. cost of temporary facilities or equipment rental extended because of the delay;
      d. cost of insurance extended because of the delay;
      e. general and administrative overhead in an amount to be agreed upon, but not to exceed 3% of Contract Sum divided by the Contract Time for each day of the delay.

PART 8 - CLAIMS AND DISPUTE RESOLUTION

8.01 CLAIMS PROCEDURE

A. If the parties fail to reach agreement on the terms of any Change Order for Owner-directed Work as provided in Section 7.01, or on the resolution of any request for an equitable adjustment in the Contract Sum as provided in section 7.02 or the Contract Time as provided in section 7.03, Contractor's only remedy shall be to file a Claim with Owner as provided in this section.

B. Contractor shall file its Claim within the earlier of: 120 days from Owner's final offer in accordance with either paragraph 7.01E or the date of Final Acceptance.

C. The Claim shall be deemed to cover all changes in cost and time (including direct, indirect, impact, and consequential) to which Contractor may be entitled. It shall be fully substantiated and documented. At a minimum, the Claim shall contain the following information:
   1. A detailed factual statement of the Claim for additional compensation and time, if any, providing all necessary dates, locations, and items of Work affected by the Claim;
   2. The date on which facts arose which gave rise to the Claim
   3. The name of each employee of Owner or A/E knowledgeable about the Claim;
   4. The specific provisions of the Contract Documents which support the Claim;
   5. The identification of any documents and the substance of any oral communications that support the Claim;

6. Copies of any identified documents, other than the Contract Documents, that support the Claim;
7. If an adjustment in the Contract Time is sought: the specific days and dates for which it is sought; the specific reasons Contractor believes an extension in the Contract Time should be granted; and Contractor's analysis of its Progress Schedule to demonstrate the reason for the extension in Contract Time;
8. If an adjustment in the Contract Sum is sought, the exact amount sought and a breakdown of that amount into the categories set forth in, and in the detail required by, section 7.02; and
9. A statement certifying, under penalty of perjury, that the Claim is made in good faith, that the supporting cost and pricing data are true and accurate to the best of Contractor's knowledge and belief, that the Claim is fully supported by the accompanying data, and that the amount requested accurately reflects the adjustment in the Contract Sum or Contract Time for which Contractor believes Owner is liable.

D. After Contractor has submitted a fully documented Claim that complies with all applicable provisions of parts 7 and 8, Owner shall respond, in writing, to Contractor as follows:
1. If the Claim amount is less than $50,000, with a decision within 60 days from the date the Claim is received; or
2. If the Claim amount is $50,000 or more, with a decision within 60 days from the date the Claim is received, or with notice to Contractor of the date by which it will render its decision. Owner will then respond with a written decision in such additional time.

E. To assist in the review of Contractor's Claim, Owner may visit the Project site, or request additional information, in order to fully evaluate the issues raised by the Claim. Contractor shall proceed with performance of the Work pending final resolution of any Claim. Owner's written decision as set forth above shall be final and conclusive as to all matters set forth in the Claim, unless Contractor follows the procedure set forth in section 8.02.

F. Any Claim of the Contractor against the Owner for damages, additional compensation, or additional time, shall be conclusively deemed to have been waived by the Contractor unless timely made in accordance with the requirements of this section.

8.02 ARBITRATION

A. If Contractor disagrees with Owner's decision rendered in accordance with paragraph 8.01D, Contractor shall provide Owner with a written demand for arbitration. No demand for arbitration of any such Claim shall be made later than 30 days after the date of Owner's decision on such Claim; failure to demand arbitration within said 30-day period shall result in Owner's decision being final and binding upon Contractor and its Subcontractors.

B. Notice of the demand for arbitration shall be filed with the American Arbitration Association (AAA), with a copy provided to Owner. The parties shall negotiate or mediate under the Voluntary Construction Mediation Rules of the AAA, or mutually acceptable service, before seeking arbitration in accordance with the Construction Industry Arbitration Rules of AAA as follows:
1. Disputes involving $30,000 or less shall be conducted in accordance with the Northwest Region Expedited Commercial Arbitration Rules; or
2. Disputes over $30,000 shall be conducted in accordance with the Construction Industry Arbitration Rules of the AAA, unless the parties agree to use the expedited rules.

C. All Claims arising out of the Work shall be resolved by arbitration. The judgment upon the arbitration award may be entered, or review of the award may occur, in the superior court having jurisdiction thereof. No independent legal action relating to or arising from the Work shall be maintained.

D. Claims between Owner and Contractor, Contractor and its Subcontractors, Contractor and A/E, and Owner and A/E shall, upon demand by Owner, be submitted in the same arbitration or mediation.

E. If the parties resolve the Claim prior to arbitration judgment, the terms of the resolution shall be incorporated in a Change Order. The Change Order shall constitute full payment and final settlement of the Claim, including all claims for time and for direct, indirect, or consequential costs, including costs of delays, inconvenience, disruption of schedule, or loss of efficiency or productivity.

8.03 CLAIMS AUDITS

A. All Claims filed against Owner shall be subject to audit at any time following the filing of the Claim. Failure of Contractor, or Subcontractors of any tier, to maintain and retain sufficient records to allow Owner to verify all or a portion of the Claim or to permit Owner access to the books and records of Contractor, or Subcontractors of any tier, shall constitute a waiver of the Claim and shall bar any recovery.

B. In support of Owner audit of any Claim, Contractor shall, upon request, promptly make available to Owner the following documents:

1. Daily time sheets and supervisor's daily reports;
2. Collective bargaining agreements;
3. Insurance, welfare, and benefits records;
4. Payroll registers;
5. Earnings records;
6. Payroll tax forms;
7. Material invoices, requisitions, and delivery confirmations;
8. Material cost distribution worksheet;
9. Equipment records (list of company equipment, rates, etc.);
10. Vendors', rental agencies', Subcontractors', and agents' invoices;
11. Contracts between Contractor and each of its Subcontractors, and all lower-tier Subcontractor contracts and supplier contracts;
12. Subcontractors' and agents' payment certificates;
13. Cancelled checks (payroll and vendors);
14. Job cost report, including monthly totals;
15. Job payroll ledger;
16. Planned resource loading schedules and summaries;
17. General ledger;
18. Cash disbursements journal;
19. Financial statements for all years reflecting the operations on the Work. In addition, the Owner may require, if it deems it appropriate, additional financial statements for 3 years preceding execution of the Work;
20. Depreciation records on all company equipment whether these records are maintained by the company involved, its accountant, or others;
21. If a source other than depreciation records is used to develop costs for Contractor's internal purposes in establishing the actual cost of owning and operating equipment, all such other source documents;

22. All nonprivileged documents which relate to each and every Claim together with all documents which support the amount of any adjustment in Contract Sum or Contract Time sought by each Claim;
23. Work sheets or software used to prepare the Claim establishing the cost components for items of the Claim including but not limited to labor, benefits and insurance, materials, equipment, Subcontractors, all documents which establish the time periods, individuals involved, the hours for the individuals, and the rates for the individuals; and
24. Work sheets, software, and all other documents used by Contractor to prepare its bid.

C. The audit may be performed by employees of Owner or a representative of Owner. Contractor, and its Subcontractors, shall provide adequate facilities acceptable to Owner, for the audit during normal business hours. Contractor, and all Subcontractors, shall make a good faith effort to cooperate with Owner's auditors.

PART 9 - TERMINATION OF THE WORK

9.01 TERMINATION BY OWNER FOR CAUSE

A. Owner may, upon 7 days written notice to Contractor and to its surety, terminate (without prejudice to any right or remedy of Owner) the Work, or any part of it, for cause upon the occurrence of any one or more of the following events:
1. Contractor fails to prosecute the Work or any portion thereof with sufficient diligence to ensure Substantial Completion of the Work within the Contract Time;
2. Contractor is adjudged bankrupt, makes a general assignment for the benefit of its creditors, or a receiver is appointed on account of its insolvency;
3. Contractor fails in a material way to replace or correct Work not in conformance with the Contract Documents;
4. Contractor repeatedly fails to supply skilled workers or proper materials or equipment;
5. Contractor repeatedly fails to make prompt payment due to Subcontractors or for labor;
6. Contractor materially disregards or fails to comply with laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction; or
7. Contractor is otherwise in material breach of any provision of the Contract Documents.

B. Upon termination, Owner may at its option:
1. Take possession of the Project site and take possession of or use all materials, equipment, tools, and construction equipment and machinery thereon owned by Contractor to maintain the orderly progress of, and to finish, the Work;
2. Accept assignment of subcontracts pursuant to section 5.21; and
3. Finish the Work by whatever other reasonable method it deems expedient.

C. Owner's rights and duties upon termination are subject to the prior rights and duties of the surety, if any, obligated under any bond provided in accordance with the Contract Documents.

D. When Owner terminates the Work in accordance with this section, Contractor shall take the actions set forth in paragraph 9.02B, and shall not be entitled to receive further payment until the Work is accepted.

E. If the unpaid balance of the Contract Sum exceeds the cost of finishing the Work, including compensation for A/E's services and expenses made necessary thereby and any other extra

costs or damages incurred by Owner in completing the Work, or as a result of Contractor's actions, such excess shall be paid to Contractor. If such costs exceed the unpaid balance, Contractor shall pay the difference to Owner. These obligations for payment shall survive termination.

F. Termination of the Work in accordance with this section shall not relieve Contractor or its surety of any responsibilities for Work performed.

G. If Owner terminates Contractor for cause, and it is later determined that none of the circumstances set forth in paragraph 9.01A exist, then such termination shall be deemed a termination for convenience pursuant to section 9.02.

9.02 TERMINATION BY OWNER FOR CONVENIENCE

A. Owner may, upon written notice, terminate (without prejudice to any right or remedy of Owner) the Work, or any part of it, for the convenience of Owner.

B. Unless Owner directs otherwise, after receipt of a written notice of termination for either cause or convenience, Contractor shall promptly:

1. Stop performing Work 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 such portion of the Work as is not terminated;
3. Cancel all orders and subcontracts, upon terms acceptable to Owner, to the extent that they relate to the performance of Work terminated;
4. Assign to Owner all of the right, title, and interest of Contractor in all orders and subcontracts;
5. Take such action as may be necessary or as directed by Owner to preserve and protect the Work, Project site, and any other property related to this Project in the possession of Contractor in which Owner has an interest; and
6. Continue performance only to the extent not terminated.

C. If Owner terminates the Work or any portion thereof for convenience, Contractor shall be entitled to make a request for an equitable adjustment for its reasonable direct costs incurred prior to the effective date of the termination, plus a reasonable allowance for overhead and profit on Work performed prior to termination, plus the reasonable administrative costs of the termination, but shall not be entitled to any other costs or damages, whatsoever, provided however, the sum payable upon termination shall not exceed the Contract Sum reduced by prior payments. Contractor shall be required to make its request in accordance with the provisions of part 7.

D. If Owner terminates the Work or any portion thereof for convenience, the Contract Time shall be adjusted as determined by Owner.

PART 10 - MISCELLANEOUS PROVISIONS

10.01 GOVERNING LAW

A. The Contract Documents and the rights of the parties herein shall be governed by the laws of the state of Washington. Venue shall be in Kitsap County, unless otherwise specified.

10.02 SUCCESSORS AND ASSIGNS

A. Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to the other party hereto and to partners, successors, assigns, and legal representatives of such other party in respect to covenants, agreements, and obligations contained in the Contract Documents. Neither party shall assign the Work without written

consent of the other, except that Contractor may assign the Work for security purposes, to a bank or lending institution authorized to do business in the state of Washington. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations set forth in the Contract Documents.

10.03 MEANING OF WORDS

A. Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings. Reference to standard specifications, manuals, or codes of any technical society, organization, or association, or to the code of any governmental authority, whether such reference be specific or by implication, shall be to the latest standard specification, manual, or code in effect on the date for submission of bids, except as may be otherwise specifically stated. Wherever in these Drawings and Specifications an article, device, or piece of equipment is referred to in the singular manner, such reference shall apply to as many such articles as are shown on the drawings or required to complete the installation.

10.04 RIGHTS AND REMEDIES

A. No action or failure to act by Owner or A/E shall constitute a waiver of a right or duty afforded them under the Contract Documents, nor shall such action or failure to act constitute approval of an acquiescence in a breach therein, except as may be specifically agreed in writing.

10.05 CONTRACTOR REGISTRATION

A. Pursuant to RCW 39.06, Contractor shall be registered or licensed as required by the laws of the State of Washington, including but not limited to RCW 18.27.

10.06 TIME COMPUTATIONS

A. When computing any period of time, the day of the event from which the period of time begins shall not be counted. The last day is counted unless it falls on a weekend or legal holiday, in which event the period runs until the end of the next day that is not a weekend or holiday. When the period of time allowed is less than 7 days, intermediate Saturdays, Sundays, and legal holidays are excluded from the computation.

10.07 RECORDS RETENTION

A. The wage, payroll, and cost records of Contractor, and its Subcontractors, and all records subject to audit in accordance with section 8.03, shall be retained for a period of not less than 6 years after the date of Final Acceptance.

10.08 THIRD-PARTY AGREEMENTS

A. The Contract Documents shall not be construed to create a contractual relationship of any kind between: A/E and Contractor; Owner and any Subcontractor; or any persons other than Owner and Contractor.

10.09 ANTITRUST ASSIGNMENT

A. Owner and Contractor recognize that in actual economic practice, overcharges resulting from antitrust violations are in fact usually borne by the purchaser. Therefore, Contractor hereby assigns to Owner any and all claims for such overcharges as to goods, materials, and equipment purchased in connection with the Work performed in accordance with the Contract Documents, except as to overcharges which result from antitrust violations commencing after the Contract Sum is established and which are not passed on to Owner under a Change Order. Contractor shall put a similar clause in its Subcontracts, and require a similar clause in its sub-Subcontracts, such that all claims for such overcharges on the Work are passed to Owner by Contractor.

10.10. HEADINGS AND CAPTIONS

A. All headings and captions used in these General Conditions are only for convenience of reference and shall not be used in any way in connection with the meaning, effect, interpretation, construction, or enforcement of the General Conditions, and do not define the limit or describe the scope or intent of any provision of these General Conditions.

END OF SECTION

PART 1 – GENERAL

1.01 PREVAILING WAGE RATES

A. General

1. The Work is subject to the wage requirements of RCW 39.12 (Prevailing Wages on Public Works), RCW 49.28 (Hours of Labor), and to RCW 49.46 (Minimum Wage Act) as amended or supplemented. The Contractor, any Subcontractor, and all individuals and firms required to pay prevailing wages under WAC 296-127-010, must pay all laborers, workers, or mechanics no less than the applicable prevailing hourly wage rate and fringe benefits appropriate to the worker's classification. Higher wages and benefits may be paid at the option of the employer.
2. The Contractor is responsible for assigning the appropriate classification to all laborers, workers, or mechanics that perform any Work under this Contract, under the scope of work descriptions established by the L&I Industrial Statistician. Laborers, workers, and mechanics must be paid in full at least once each week and in lawful money of the United States. If the Contractor assigns the wrong prevailing wage classification, the Contractor is responsible for and must pay the amount of the corrected prevailing wage. The difference is not subject to an equitable adjustment or Change Order.
3. The Contractor must ensure that all Subcontractors, and all other individuals and firms as applicable, comply with all prevailing wage requirements including payroll reporting requirements and payment of prevailing wages. The Contractor is responsible for any violations of prevailing wage requirements by Subcontractors, individuals, or firms, and The Owner will take enforcement action against the Contractor to remedy any violations and achieve compliance with prevailing wage requirements

B. Applicability OF Federal Prevailing Wage Rates

1. On projects funded in whole or part from federal monies, federal wage laws and rules also apply. If the Work is subject to both the provisions of the State (RCW 39.12) and federal (Davis Bacon and Related Acts, DBRA) prevailing wage requirements, the Contractor and every Subcontractor must pay the higher prevailing wage rate for the classification.

C. Wage Rates

1. Any listing of wages and fringe benefits in the Project Manual for any classification is intended only as a guideline for the Contractor and does not necessarily reflect the most recent classification or prevailing wage rate. Prevailing wage rates will be determined by L&I and published on the first Business Day of February and the first Business Day of August of each year. All prevailing wage rates become effective 30 Days after they are published. Current prevailing wage information may be obtained online:
   Washington State Department of Labor and Industries
   https://Lni.wa.gov/licensing-permits/public-works-projects/prevailing-wage-rates
2. For projects funded in whole or part with federal monies, current federal prevailing wage information may be obtained upon request from the:
   U.S. Department of Labor
   https://www.dol.gov/whd/govcontracts/dbra.htm

3. By including wage and fringe benefit rates in the Project Manual, the Owner does not imply that the Contractor will find labor available at those rates. The Contractor must calculate any amount above the minimums that have to be paid.
4. If the Contractor employs labor in a classification not covered by WAC 296-127, the Contractor must request the Industrial Statistician at L&I determine the correct prevailing wage rate for that classification and locality. If the project is federally funded, the Contractor must request the Secretary of the U.S. Department of Labor (US DOL) determine a federal prevailing wage rate for that classification and locality in addition to requesting the State prevailing wage rates. In such case, the Director of L&I's, and if applicable the Secretary of US DOL's, decision regarding the rates is final, conclusive, and binding on all parties. If the state and federal wage rates differ, the Contractor must pay the higher wage rate.

D. Overtime
1. General
   a. Pursuant to the provisions of RCW 49.28 and WAC 296-127-022, Work performed on public works contracts will not require the payment of overtime rates for the first 2 hours worked in excess of 8 hours per Day when the employer and employee voluntarily enter into a written agreement wherein the employee will work up to 10 hours per Day in a 4-Day week to accomplish 40 hours of work. Working more than 10 hours on any Calendar Day on a public works project is prohibited except in cases of extraordinary emergency, such as danger to life or property. The Contractor must refer to the Benefits Code Key attached to the Prevailing Wage Schedule for specific overtime rates. Overtime rates must be paid for all hours worked more than 40 hours per week. This Section provides a minimum public works overtime standard, and does not supersede prevailing overtime wage rates established under RCW 39.12.
2. Written Overtime Agreement
   a. Recognizing that there may be Days when a full 10 hours of work is not available, the remainder of the forty hours may be made up on another work Day or Days within the same work week. However, work performed on Saturdays, Sundays, and Holidays is subject to the established prevailing overtime provisions for a given trade or occupation, as provided in RCW 39.12.
   b. For the purpose of this **Paragraph 1.01.D**, an agreement must:
      1) Have been authorized by employees who bargained collectively with their employers through representatives of their own choosing; or
      2) Be obtained in writing, signed, and dated by both parties;
      3) Be entered into individually with each employee;
      4) Be entered into separately for each public works project, except that an employer, at its option, may obtain an annual authorization;
      5) State the name of the public works project with specificity; and
      6) Be entered into voluntarily by the employer and employee.
   c. Each employer must retain copies of individual employee authorization agreements for 3 years from the Completion Date of the Work. Absence of an authorization record for an employee will be deemed per se evidence of lack of that employee's authorization. Such records are payroll records, subject to the requirements of WAC 296-127-320.

d. For any overtime work performed on a federally funded project per the agreements referenced above, the Contractor, Subcontractor, and all other individuals or firms required to pay prevailing wages must submit a copy of such authorization agreement for each affected employee to BI Metro Park, either in person or by mail.

1) Physical and Mailing address
Bainbridge Island Park & Recreation District
11700 Meadowmeer Cir NE
Bainbridge Island, WA 98110

1.02 PAYROLL REPORTS

A. Payroll reports for the Contractor, every Subcontractor, and all other individuals or firms required to pay prevailing wages for Work performed must be submitted weekly via an online reporting portal: http://www.LCPtracker.net. The Contractor is responsible for approving electronically the payrolls submitted by all Subcontractors. Payroll reports must contain the following information:

1. Name and residence address of each worker
2. Classification of work performed by each worker. The classification must be specific and match the classification categories listed in the applicable wage schedule
3. Total number of hours employed each Day
4. Total number of hours employed during the payroll period.
5. Straight time and overtime hourly rate of wages paid to each worker
6. Total or gross amount earned by each worker.
7. Deductions for medical insurance, FICA, federal withholding tax, and any other deductions taken.
8. Net amount paid each worker
9. Contractor's or Subcontractor's name and address
10. All Days during the pay period
11. Date of final Day of pay period
12. Whether fringe benefits were paid to each worker as part of the hourly wage rate or whether fringe benefits were paid into an approved plan, fund, or program; and the hourly rate of fringe benefits paid, if any.

B. The first payroll submitted for the Work for both the Contractor and each Subcontractor must be labeled Initial. The last payroll submitted for the Work for both the Contractor and each Subcontractor must be labeled Final. If no work is performed for the week, the Contractor must submit a certified payroll noting that no work has been performed.

1.03 ENFORCEMENT

A. The Contractor, every Subcontractor, and all other individuals or firms required to pay prevailing wages for Work performed on this Contract are subject to investigation by BIMPRD and L&I in regard to payment of the required prevailing wage to workers, laborers, and mechanics employed on the project.

B. If the investigations result in a finding that an individual or firm has violated the requirement to pay the prevailing rate of wage, the unpaid wages will constitute a lien against the Contractor's Bond and retainage. Per RCW 39.12.065 and 39.12.050, the Contractor or Subcontractor may also be subject to civil penalties and may be prohibited from bidding on any public works contract within the State of Washington for the period specified by law.

1.04 POSTING NOTICES

A. The Contractor must post in a location acceptable to L&I and in compliance with the requirements of RCW 39.12.020:
   1. One copy of the approved Statement of Intent to Pay Prevailing Wages for the Contractor, each Subcontractor regardless of tier, and any other individual or firm required to pay prevailing wages per WAC 296-127-010.
   2. A copy of the prevailing wage rates for the project.
   3. The address and telephone number of the L&I Industrial Statistician along with notice that complaints or questions about wage rates may be directed there.

1.05 PREVAILING WAGES FOR APPRENTICES

A. An apprentice is defined as a laborer, worker, or mechanic employed to perform the Work for whom an apprentice agreement is established through a Training Program that is registered and approved by the Washington State Apprenticeship and Training Council (WSATC). Per RCW 39.12.021 and RCW 49.04, apprentices must be paid the applicable prevailing hourly rate for an apprentice of that trade. If the Contractor or Subcontractor of any tier makes use of an apprentice on work also governed by federal wage rates and regulations, the Contractor must present to the Owner written evidence of registration of such employees in a program approved by the WSATC. On any project that is federally funded and where submission of payroll reports is required, such evidence must be submitted with the first payroll on which the name of the employee appears.

1.06 PREVAILING WAGE DISPUTES

A. For purposes of prevailing wage disputes the following applies:
   1. If there is a dispute regarding prevailing wages, BIMPRD and the Contractor must attempt to resolve the dispute and to receive corrected prevailing wage documents such as amended certified payrolls and other supporting documents as requested. If the Contractor does not make good faith efforts to resolve the dispute within 30 Calendar Days of receiving notification, BIMPRDD may conduct its own investigation or refer the dispute at any time thereafter to L&I and/ or US DOL as applicable. If BIMPRDD determines that it will conduct an investigation, BIMPRD will provide written notice of the investigation to the Contractor and after its investigation is complete, BIMPRD will furnish its written determination to the Contractor including the identification of any or all enforcement actions specified in **Article 1.03 of this Section**. The Contractor may appeal this determination in writing to the Director of BIMPRD. The Director will provide a written response to the Contractor regarding the appeal. Nothing in this process precludes other interested parties from filing complaints or disputes with L&I or US DOL or taking other legal action.

2. In the event that after exhausting the foregoing process, the Contractor disagrees with the Owner's final determination of a prevailing wage dispute involving a state prevailing wage rate, the matter will be referred to the Director of L&I. In such cases, the Director's decision is final, conclusive, and binding on all parties. If the dispute involves a federal prevailing wage rate, the matter will be referred to the Secretary of U.S. DOL for a decision. In such case, the Secretary's decision is final, conclusive, and binding on all parties.

B. When the Work is subject to both State and federal prevailing wage requirements, the Contractor and every Subcontractor must pay whichever rate is higher.

1.07 REQUIRED DOCUMENTS

A. Before payment is made by the Owner of any sums due under this Contract, the Contractor and each Subcontractor regardless of tier must have a Statement of Intent to Pay Prevailing Wages (form F700 029 000), approved by L&I. Wage rates listed on an approved Statement of Intent to Pay Prevailing Wages may not comply with federal prevailing wage requirements.

B. Each progress estimate submitted for payment must include an Owner-provided form listing all Subcontractors and Suppliers, who performed Work on the project during that pay period, including but not limited to, Subcontractor Name, UBI Number, Intent Number and Affidavit Number as applicable, along with a statement completed and signed by an authorized representative of the Contractor certifying the prevailing wages have been paid per RCW 39.12.040.

C. Upon Physical Completion and before final progress payment and funds retained under RCW Chapter 60.28 can be released to the Contractor, the Contractor and each Subcontractor regardless of tier must have an Affidavit of Wages Paid (form L700 007 000) approved by L&I.

D. The Contractor or Subcontractor, as applicable, is responsible for payment of fees for each Statement of Intent to Pay Prevailing Wages and Affidavit of Wages Paid and must submit all forms directly to L&I for approval. The cost of these fees is included in the Bid Item prices that comprise this Contract. Intent and Affidavit forms may be obtained from L&I at the following website:

https://www.lni.wa.gov/licensing-permits/public-works-projects/contractors-employers/

1.08 AUDITS

A. Payroll, wage, and cost records must be retained, and may be audited or inspected.

PART 2 – PRODUCTS - NOT USED.

PART 3 – EXECUTION - NOT USED.

END OF SECTION

1.01 GENERAL

A. These Unique Project Conditions form a part of, and are incorporated in the Contract.

1.02 TIME CRITICAL WORK/RESTRICTIONS AND CONSTRUCTION SCHEDULE

A. A limited Scope of Work as defined in the Phase 1 Contract Documents are preparation for work scope planned in Phase 2. Contractor will coordinate with the Owner and Architect during Phase I to determine best methods for associated work that is to occur for Phase 2.

B. ***The current market conditions for specific electrical and mechanical equipment require unusually long lead times. Two critical path items, a new HVAC system, and new electrical panels are included as major scope of work for Phase 1 improvements. Due to these being critical path items, the Contractor is to have both electrical and mechanical submittals ready for review by the A/E Team as soon as possible after contract award. A critical path schedule is to be coordinated with Owner upon Notice-To-Proceed.***

C. The Nakata Pool will be in-operation during the construction period for Ray Williamson Pool. Due to user privacy requirements at the Nakata Pool, the Contractor is to separate the Ray Williamson Pool work from Nakata Pool with a physical barrier that also provides visual blockage of the Nakata Pool. No videos or photographs are permitted of the Nakata Pool or its premises and its users at any time, and the Contractor and **all** of his personnel are restricted to the Ray Williamson Pool project site, unless escorted or given permission to enter the Nakata Pool site. Any on-site facilities and restrooms will be provided by the General Contractor in the designated staging area provided on the Ray Williamson Pool side.

D. All construction site access is to occur from Madison Avenue N entry to the Aquatics Center parking lot. Note that on-going road construction not related to the Scope of Work will be present during the construction period.

E. Contractor shall coordinate with Bainbridge Island Metro Parks Project Manager for construction key cores for access to the project site.

F. The Contractor shall phase the construction schedule and delivery of materials in a manner to limit the impact on the remaining areas of Bainbridge Aquatics Center and its occupants, and surrounding areas in operation.

G. Contractor is to maintain pedestrian service, vehicle, and fire department access to Bainbridge Aquatics Center. The Contractor shall prevent interruptions of any kind to the building occupants and its operations.

H. Contractor is to provide temporary dust enclosure to isolate the project work.

I. Contractor is to maintain Nakata Pool free from construction dust and debris.

1.03 RETAINAGE AND BOND CLAIM RIGHTS

A. Chapters 39.08 RCW and 60.28 RCW incorporated by reference: Chapters 39.08 RCW and 60.28 RCW, concerning the rights and responsibilities of Contractor and Owner with regard to the performance and payment bonds and retainage, are made a part of the Contract Documents by reference as though fully set forth herein. See General and Supplemental Conditions for Washington State Facility Construction.

1.04 PRODUCT SUBSTITUTIONS

A. Product substitutions are discussed in the General Conditions. Due to the complexity of many of the systems required in Ray Williamson Pool, construction components, and the compressed construction schedule, no substitution requests will be considered unless received at least seven (7) calendar days prior to the bid date. Acceptable substitutions will be noted at the end of each published addendum. Only substitutions listed in the published addendum will be allowed. No substitution will be considered if it is not accompanied by the Substitution Request Form that is included in Section 01 63 00. The Owner, Architect and consulting engineers retain the sole discretionary authority on the acceptance/rejection of substitution requests.

1.05 SECURITY AND BADGING

A. All of the Contractor's and Subcontractor's personnel shall have legible ID badges representing their company displayed while working on the project site at all times.

B. Construction of the Ray Williamson Pool will be completely separated from the in-operation Nakata Pool. At no time will the contractor or his subcontractors utilize or walk through Nakata Pool without approval from the Owner.

C. The General Contractor shall submit a written list of ALL personnel working on the jobsite to BIMPRD prior to Start of Work. Should there be any personnel changes during the course of construction, the new personnel names are to be submitted to the Owner prior to their start of work on the project site.

1.06 CONTRACTOR PARKING AND TRAFFIC COMPLIANCE

A. The project site is located in the Bainbridge Island High School property. This building is in-operation daily, including evenings, with public using the adjacent pool.
   1. Contractor may park within Aquatics Center property. Construction vehicles for Ray Williamson Pool Renovation project will utilize the designated parking and staging areas demarcated by the Owner.
   2. No construction vehicles will be allowed to park outside of the designated parking area. If Contractor vehicles exceed the designated area, the Contractor is required to develop a transportation plan to manage construction parking operations.
   3. Contractor shall at all times observe the designated speed limits indicated on the Aquatics Center property site.

1.07 COORDINATION OF LOW VOLTAGE SYSTEM WORK – NOT USED

1.08 LOCK OUT/TAG OUT POLICY

A. In compliance with WAC 296-24-11001 through 296-24-11011 and 296-24-119, anytime equipment is to be inspected, serviced, repaired, altered, installed, or any other maintenance performed where any possibility of unexpected energization or start-up of the equipment, or release of stored energy could cause harm, that equipment shall have all sources of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or any other source of energy including gravity locked out and tagged out. When it is not possible to Lock Out the energy source the source shall be Tagged Out. In addition, all equipment must be at "zero energy state" before servicing or maintenance work is performed.

1.09 UNDERGROUND/EXISTING UTILITIES

A. Contractor shall verify location of all underground and existing utilities. Contractor shall take extreme care and necessary precautions to work around and protect power and communication services on site.

1.10 SCHEDULE OF VALUES

A. A minimum of 2% of the total contract value will be allocated to “project closeout”. This will be a single scheduled value. Refer to Section 01 00 01.

1.11 PERMITS AND LICENSING

A. Owner is responsible for paying the permit review and intake fee for the building permit (includes mechanical review). All other permits will be the responsibility of the Contractor to obtain.

B. All contractors working on site will be required to have a current City of Bainbridge Island business license.

1.12 CONTINUITY OF BUILDING AND UTILITY SERVICES AND SHUTDOWNS

A. Shutdowns: Utilities shutdowns shall be scheduled for weekends, holidays or at night when the shutdown affects the use of the operational portion of the building. The actual time and date will be coordinated with and approved by the Owner at least 72 hours in advance. The Contractor shall reconnect utilities at the end of utilities shutdown period.

B. Costs: Pay all costs associated with utilities shutdowns. No extra payment will be made for overdue work, schedule changes, or failure to complete utilities connections within authorized shutdown periods.

1.13 DISRUPTIVE WORK

A. Contractor to coordinate all operations with the Bainbridge Island Metro Parks Project Manager, including site access, materials storage and staging, interruption of electrical and mechanical services, and timing of noisy and/or disruptive operations.

B. All shutdowns will be scheduled in advance at a time agreeable to the Bainbridge Island Metro Parks Project Manager.

1.14 REGULATED MATERIALS

A. Asbestos and lead-free materials must be used in the construction of this project.

B. Reference Section 01 11 00 Summary of Hazardous Materials Work and the Hazardous Materials Survey Report.

END OF SECTION

DIVISION 01

General Requirements

PART 1 - GENERAL

1.01 DEFINITIONS

A. Title of Project:	**Ray Williamson Pool Improvements, Phase 1**
B. Owner/ Contracting Agency:	Bainbridge Island Metro Park & Recreation District 11700 Meadowmeer Cir NE Bainbridge Island, WA 98110 Telephone: (206) 565-5658 Contact: Matthew Keough
C. Architect:	Stemper Architecture Collaborative 4000 Delridge Way, SW, Suite 200 Seattle, WA 98106 Telephone: (206) 624-2777 Contact: Melody Leung / Lalo Bello
D. Structural Engineer:	MLA Engineering 1424 4th Ave Unit 815 Seattle, WA 98101 Telephone: (206)264-2727 Contact: Michael Leonard
E. Mechanical Engineer:	The Greenbusch Group Engineers 1900 W Nickerson St, Suite #201 Seattle, WA 98119 Telephone: (206) 644-1369 Contact: Jack Burgess
F. Electrical Engineer:	TFWB Engineers 1200 Westlake Ave N Seattle, WA 98109 Telephone: (206) 285-7228 Contact: Aprille Balangue/ Rocxy Juan

1.02 REQUIREMENTS INCLUDED

A. Work Covered by Contract Documents

B. Contractor's Use of Premises

C. Excessive Noise

D. Related Work By Owner or Others

G. Existing Utilities

H. Contractor Identification

I. Scheduling

J. Use of Site

1.03 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Make particular reference to the following Division One sections:
   1. Section 01 11 00 – Summary of Hazardous Materials Work
   2. Section 01 50 00 – Construction Facilities and Temporary Controls

B. All capitalized terms not defined herein shall have the meaning given them in the General Conditions.

1.04 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work shall be the providing of all supplies, tools, equipment, scaffolding, shoring, transportation, utilities, services, superintendence, and labor, including hazardous materials abatement and architectural, structural, mechanical, and electrical improvements, and the furnishing of all materials, items, and accessories needed for the total construction of the project in strict conformance with the Contract Documents.

B. The intent of the Contract Documents is that the Contractor will produce a complete project with all materials and equipment in place and all systems operative.

C. The pool renovation work will encompass work at Bainbridge Aquatics Center Ray Williamson Pool and will include but not be limited to the following:
   1. Replacement of low slope roof
   2. Replacement of storefront window and door system at office 101
   3. Replacement of clerestory and skylight windows
   4. Replacement of swing out doors
   5. Adaptive reuse and rehabilitation of the Locker Rooms (Men's and Women's)
   6. Repair and coating of exterior/interior brick
   7. Replacement of existing heating and ventilation system

8. Refurbishing and recoating the existing fire sprinkler piping
9. Replacement of main electrical panels
10. Replacing existing lighting with LED fixtures and lighting control upgrades
11. Racking loose low voltage and communications cabling
12. Cleaning corroded equipment and accessory items – glue-lam metal bases

1.05 (Not Used)

1.06 CONTRACTOR'S USE OF PREMISES

A. The Contractor's exterior work limits and staging areas are indicated on the Drawings. Interior work limits and staging areas will be as defined in the Contract Documents.

B. Contractor shall limit its use of premises for Work and for storage to allow for:
   1. Owner occupancy
   2. Public use
   3. Coordinated use of premises under direction of Owner.
   4. Full responsibility for protection and safekeeping of products under this Contract stored at site.
   5. Moving stored products, under Contractor's control, which interfere with operations of Owner or separate Contractor.
   6. Obtaining and paying for use of additional storage or work areas needed for operations.

C. Construction Operations:
   1. Do not unreasonably encumber Site with materials or equipment.
   2. Do not load structure with weight that will endanger structure.
   3. Coordinate activities to assure minimum disruption to adjoining residents, fire district and community activities.

D. Existing Utilities:
   1. General: The Contractor shall be responsible for determining the location of existing utilities (whether shown or not) that would be impacted by the Work. At Contractor’s expense, immediately repair and restore operation of utilities damaged during construction; conform to owner’s repair requirements.
   2. All building utility systems, including heating, pneumatic controls water, sewers, telephone and electrical systems shall remain in operation during the construction period.
   3. The existing electrical and fire alarm system will remain in service for the duration of the contract at Nakata Pool. Refer to Section 01 50 00 for information regarding use of the electrical system during construction.

E. Delivery, Storage and Handling:
   1. Refer to the drawings for locations of contractor’s mobilization and storage areas.
   2. Contractor shall receive all materials and not rely on any Bainbridge Island Aquatics personnel at this site.

F. Cleaning:

1. Following construction, clean all areas associated with and impacted by construction, and restore to original condition. Contractor should take pictures / video of all work areas prior to commencing activities.

1.07 EXCESSIVE NOISE

A. Minimize noise during working hours. Notify Owner at least 24 hours prior to any necessary excessive noise. Comply with Owner's instructions and the City of Bainbridge Island Noise Ordinance.

1.08 RELATED WORK BY OWNER OR OTHERS

A. NIC & FOIO Items: Items designated on the Drawings and/or described in the Specifications as “NIC” (Not in Contract) or “FOIO” (Furnished by Owner and Installed by Owner) are not included in the Contract.

B. Contractor’s Responsibilities:
   1. Designate delivery date for each portion of the Work in the Progress Schedule.
   2. Storage of products if requested.
   3. Coordinate installation with the Progress Schedule.
   4. Provide all preparatory work necessary for proper installation including blocking and backing and finish work including caulking, grouting, furring, and painting adjacent surfaces as required for NIC or FOIO equipment.

1.09 NOT USED

1.10 CONTRACTOR DESIGNED ELEMENTS

A. Where work of this Contract requires Contractor design, Contractor shall comply with following requirements.
   1. Submit Shop Drawings and calculations to Architect for review.
   2. Submit Shop Drawings and calculations to for City of Bainbridge Island approval and permits.
   3. All Shop Drawings and calculations shall be stamped by a registered architect or engineer licensed in State of Washington.

1.11 EXISTING UTILITIES

A. Utilities of record are shown on the Drawings insofar as possible to do so. These, however, are shown for convenience only and the Owner and Architect assume no responsibility for improper locations or failure to show utility location on the Drawings. The Contractor is responsible for determining the location of all existing utilities (whether shown or not) prior to commencing work. At Contractor's expense, immediately repair and restore operation of any utilities damaged during construction; conform to owner’s repair requirements.

1.12 CONTRACTOR IDENTIFICATION

A. All Contractor and Subcontractor personnel shall, at all times on the project site, wear

Contractor provided identification that is easily identified from no less than ten (10) feet away. Such identification shall be acceptable to the Owner (Example identification: colored hard hats, colored tee-shirts, identification badges of acceptable size.)

1.13 SCHEDULING

A. In accordance with the General Conditions, Contractor shall coordinate and conduct its Work in such a manner as to cause minimum interference to the school program. The Work shall be considered subordinate to regular school functions which may continue throughout the Work schedule.

B. Contractor may work any shift during regular business hours clearly shown in an approved Work Schedule. The Work Schedule shall clearly define any hours outside the normal working hours of Monday through Friday from 7:30 a.m. to 4:00 p.m. Contractor may request additional work hours not shown on the approved Work Schedule by notifying the Owner two (2) working days in advance of the requested hours.

C. If it is determined the work will not be completed by the Substantial Completion Date, contractor shall be required to take actions as required in Section 00 72 00.

D. Except for an emergency, Contractor shall provide forty-eight (48) hours' advance notice of his intent to work nights, weekends or holidays, or anytime outside the usual working hours. In no case will the Contractor do any such work without first notifying the Owner to permit arrangements for proper inspection.

E. The Contractor shall reimburse the additional cost to the Owner for staff coverage and/or inspection work on weekends or recognized holidays.

1.14 USE OF SITE

A. Contractor shall confine all operations in the performance of the Work (including, but not limited to offices, storage, assembly, vehicle and equipment parking, ingress, egress, and movement of Materials, equipment and workers) to such areas and during such time periods as are permitted by law, ordinances, or permits, specified in the Contract or designated by Owner. Unless otherwise directed by Owner, Contractor shall deliver to (or provide for delivery to) the site of the Work, and unload and store all materials, equipment and other items to be installed, used, consumed or incorporated in the Work or otherwise used in connection with this contract. Contractor shall coordinate with Owner in determining set-up areas, see Section 00 72 00. Contractor shall be responsible for moving items which may be necessary to proceed with work. If items need to be moved elsewhere from the room they are located, Contractor shall coordinate with Owner. **Contractor shall use all necessary means to protect existing paved and landscaped surfaces from damage when using vehicles to transport material in and around the project site.**
   1. Contractor is required to provide restroom and hand-washing facilities for employees and sub-contractors. Contractor use of restroom facilities is prohibited.

B. Owner will occupy premises during entire construction period for conduct of normal operations. Cooperate with Owner in scheduling operations to minimize conflict and to

facilitate Owner's usage on the basis of the completion dates on the indicated schedule and based on the Owner's occupancy of areas designated below:

1. Aquatics staff will generally operate throughout the project schedule per their working hours. Coordinate with Owner for exact hours.
2. Routine and/or periodic maintenance activity.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

PART 1 – GENERAL

1.01 DESCRIPTION

A. Materials or materials needing special handling or disposal, that may be potentially impacted by the project or that could be encountered during construction, have been identified below. The purpose of this section is to identify all of these materials in one section and refer the reader to subsequent sections as necessary.

1.02 RELATED WORK

A. Work performed under this specification section is governed by related specification sections, including, but not limited to, the following:
   1. Division 2: Existing Conditions, Section 02 82 00, Asbestos Abatement.
   2. Division 2: Existing Conditions, Section 02 83 00, Lead-Related Activities.

1.03 ASBESTOS-CONTAINING MATERIALS

A. Asbestos-related work is included in this contract. See items below.

B. The Contractor shall refer to the attached Hazardous Materials Survey Report. This document lists suspect asbestos-containing materials (ACM) sampled and analyzed for asbestos content, or presumed, at the areas of the buildings included in the Work. The Contractor shall ensure that copies of this information are made available to and retained on the project site by all subcontractors.

C. The Contractor shall be aware that suspect-ACM may exist in inaccessible locations of the spaces included in the Work. The Contractor shall proceed with caution during all phases of the Work. Should any suspect-ACM not indicated in the Hazardous Materials Survey Report be encountered, the Contractor shall immediately notify the Owner's Representative.

D. The Contractor is advised that, should additional suspect ACM not included in the Hazardous Materials Survey Report be encountered, the Owner may elect to include the abatement of such materials in the Work at a mutually agreed upon price. Work impacting such materials is not to occur prior to the Contractor receiving explicit written authorization from the Owner, and any Work performed without such approval is performed at the Contractor's own risk and expense.

E. The disturbance or impact of ACM may cause asbestos fibers to be released into the building's atmosphere, thereby creating a potential health hazard to building occupants. Contractor is to apprise all workers, supervisory personnel, subcontractors and consultants who will be at the jobsite of the seriousness of this potential hazard and of proper Work procedures that must be followed, should it occur.

F. Should the disturbance or impact of ACM occur, or additional ACM not included in the Hazardous Materials Survey Report be encountered, the Contractor shall immediately notify the Owner's Representative.

G. Where in the performance of the Work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified ACM, Contractor shall take appropriate continuous measures, as necessary, to protect all building occupants from the potential hazard of exposure to airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with applicable local, state and federal regulations.

H. Contractor to verify the scope of Work prior to commencing work and shall coordinate all Work with Owner and Prime Contractor.

I. Contractor shall coordinate with Owner, other trades, furnish all labor, materials, equipment, services and insurance (specifically covering the handling and transportation of asbestos-containing materials) that is specified, shown, or reasonably implied in accordance with the requirements of applicable regulations, including, but not limited to: 40 CFR Part 61, NESHAPS; 40 CFR Part 763, AHERA; WAC 296-62 and 296-65; and Puget Sound Clean Air Agency – Regulation III, Article 4: Asbestos Control Standards.

J. Contractor shall furnish all labor, materials, equipment, services and insurance (specifically covering the handling and transportation of ACM) that is specified, shown, or reasonably implied for activities related to asbestos-containing materials as identified below:
   1. Remove and dispose of approximately 210 square feet of asbestos-containing tank insulation associated with hot water tank in basement mechanical room.
   2. Remove and dispose of approximately 50 EA of asbestos-containing exposed hard mudded fitting insulation associated with non-ACM fiberglass straight-run insulation in mechanical rooms.
   3. Remove and dispose of an estimated 50 EA of asbestos-containing concealed hard mudded fitting insulation associated with non-ACM fiberglass straight-run insulation located in wall and ceiling cavities throughout.

1.04 LEAD-CONTAINING PAINT

A. Lead-containing items: The Owner has conducted a survey of lead-containing items in the areas to be impacted by the Work. Survey samples and results are included in the Hazardous Materials Survey Report.

B. Consider all items similar to those testing positive for lead to be lead-containing. Consider any painted coatings that have not been tested to be lead-containing.

C. The Contractor shall comply with all applicable regulations, laws and ordinances concerning removal, remodeling, cutting, handling, storage, disposal, monitoring and protection against exposure or environmental pollution. Work related to lead-containing paint and lead-containing components within this contract is the responsibility of the General Contractor, in addition to all affected Sub-Contractors, and shall be performed in accordance with Section 02 83 00 and all applicable local, state and federal regulations, including but not limited to WAC 296-155-176, Lead in Construction.

1.05 Polychlorinated Biphenyls (PCBs)

A. The Owner has conducted a survey of representative light fixture ballasts to be impacted by the project. The majority of all fluorescent light fixture ballasts have been retro-fitted with newer, non-suspect-PCB ballasts. The potential exists for older PCB-containing ballasts to exist that may be impacted by the Work. Caution should be exercised to ensure older PCB-ballasts are properly handled, containerized and disposed of, should they be encountered.

B. All employers of personnel performing work related to PCB-containing light ballasts are to submit the following information related to all tasks to be performed by their personnel:
   1. Work Plan: Provide a detailed description of the means and methods to be employed regarding PCB-containing light ballasts, including: personal protective equipment and work area protection to be implemented during the work, decontamination procedures, access restriction procedures and controlled areas, clean-up procedures, and employee exposure assessment(s).
   2. Disposal/Recycling Information: Prior to commencing work, provide the name, address and phone number of the proposed end-point facility to receive fluorescent light tubes removed from the project site. Submit to the Environmental Consultant all waste manifests and disposal/recycling receipts following removal operations.

C. Contractor shall furnish all labor, materials, equipment, services and insurance that is specified, shown, or reasonably implied for the removal, packaging, transport and disposal of up to 20 PCB-containing light fixture ballasts from various locations throughout.

D. The Owner has conducted a survey of representative caulking/sealants for the presence of PCBs. Impact of materials containing less than 50 ppm PCBs requires construction activities to be performed in accordance with Washington State Department of Labor and Industries regulations, including but not limited to, WAC 296-62, 296-155 and 296-841. Workers impacting PCBs should be provided the proper personal protective equipment and use proper work methods to limit occupational and environmental exposure to PCBs until an initial exposure assessment has been conducted.

1.06 Mercury

A. Fluorescent light tubes and thermostat bulbs are known to contain regulated concentrations of mercury and require special handling and disposal/recycling at a facility permitted to accept such material. Remove light tubes only as specified elsewhere. The contractor should follow any and all applicable regulations to prevent breakage to any tubes encountered during demolition or renovation activities.

B. Prevent breakage to any tubes or thermostat bulbs encountered during demolition or renovation activities.

C. All employers of personnel performing the work related to fluorescent light tubes are to submit the following information related to all tasks to be performed by their personnel:
   1. Work Plan: Provide a detailed description of the work impacting light tubes to be performed, including personal protective equipment and engineering controls to be implemented during the work, decontamination procedures, access restriction

procedures and controlled areas, debris clean-up procedures, exposure assessments and any related air monitoring.

2. Disposal/Recycling Information: Prior to commencing work, provide the name, address and phone number of the proposed end-point facility to receive fluorescent light tubes removed from the project site. Submit to the Environmental Consultant all waste manifests and disposal/recycling receipts following removal operations.

D. Contractor shall furnish all labor, materials, equipment, services and insurance that is specified, shown, or reasonably implied for the removal, packaging, transport and recycling/disposal of up to 100 four-foot and 50 eight-foot mercury-containing fluorescent light tubes from various locations throughout.

1.07 EXISTING CONDITIONS

A. The Environmental Consultant and Owner make no representation, warranty, or guarantee the conditions indicated by the test reports or inspection summary are representative of those conditions existing throughout the area, or that unforeseen developments may not occur, or that materials other than, or in proportions different from those indicated, may not exist.

B. Contractor is advised that the locations of all ACMs may not be clearly known, and that care should be taken to prevent impact of ACMs located in concealed and inaccessible locations.

1.08 WORK NOT COVERED BY CONTRACT DOCUMENTS

A. Not Used.

1.09 OWNER RULES

A. The Contractor shall abide by all facility rules and regulations.

1.10 CLEAN UP

A. Ensure that all areas are visibly clean at completion of Work. Refer to other Sections for information on cleaning requirements.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

Hazardous Materials Survey Report

Bainbridge Aquatic Center Renovation – Ray Williamson Pool Building Renovation
8521 Madison Ave N
Bainbridge Island, Washington

Prepared for:
Bainbridge Island Metro Park and Recreation District
11700 NE Meadowmeer Circle NE
Bainbridge Island, WA 98110

April 23, 2024
PBS Project No. 41924.000

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1 INTRODUCTION

1.1 Project Background

PBS Engineering and Environmental LLC (PBS) performed a hazardous materials survey of the Ray Willaimson Pool at the Bainbridge Island Aquatic Center located in Bainbridge Island, WA in conjunction with the planned renovation of the structure. One intent of this investigation is to ensure that Bainbridge Island Metro Park and Recreation District is in compliance with applicable regulatory requirements that a "good faith inspection" for asbestos-containing materials (ACMs) be performed prior to renovation activities.

At the request of the Bainbridge Island Metro Park and Recreation District all accessible building areas associated with the project were inspected for the presence of ACMs, lead-containing paint (LCP), mercury-containing fluorescent lamps, PCB-containing materials, and metals in masonry components.

1.2 Building Description

The Ray Williamson pool is a single-story masonry building with a concrete foundation built originally as an outdoor pool in 1970. A roof structure was added to the pool in 1977. The interior consists of the pool and pool deck area, locker rooms, and offices. The interior generally consists of concrete masonry unit (CMU) and gypsum wallboard walls, 2'x4' lay-in ceiling tile, wood deck, and gypsum wallboard ceilings, and carpet, ceramic tile, epoxy, and concrete flooring. Interior windows and doors are metal framed. The exterior consists of brick walls with metal framed window and doors. Heating and cooling is provided by a forced air HVAC system with uninsulated duct work. The roof area over the offices and locker rooms is flat with a built-up roof system.

The pitched section of roof was not included in this investigation.

1.3 Survey Process

All accessible areas were inspected by AHERA Certified Building Inspector Ryan Hunter (Cert. No. IRO-24-7254B, Exp. 3/05/2025) on March 28th and April 2nd, 2024. PBS endeavored to inspect all accessible areas within our scope of work. Inaccessible areas consist of those requiring selective demolition, fall protection, or confined space entry protocols in order to gain access.

When observed, suspect asbestos materials were sampled. All samples were assigned a unique identification number and transmitted for analysis to NVL Laboratories (NVLAP #102063-0) under chain-of-custody protocols. Samples were analyzed according to EPA Method 600R-93/116 using Polarized Light Microscopy (PLM), which has a reliable limit of quantification of 1% asbestos by volume. Information regarding the type and location of sampled materials can be found on the attached PLM Sample Inventory.

Suspect ACMs may exist in inaccessible areas. PBS endeavored to determine the presence and estimate the condition of suspect materials in all inaccessible areas included in the scope of work. While PBS has endeavored to identify the ACMs that may be found in concealed locations, additional unidentified ACMs may exist which may include waterproofing membrane, internal gaskets, insulation on buried pipe mechanical systems, caulking and sealants of HVAC equipment and construction adhesives and wall mastics.

2 FINDINGS

2.1 Asbestos-Containing Materials (ACMs)

Asbestos materials are defined by 40 CFR Part 763 AHERA as containing greater than 1% asbestos content. The following materials were determined to contain greater than 1% asbestos.

- **Tank Insulation – Hot Water Tank in Basement Mechanical Room – Approx. 210 Square Feet**

- **Exposed Hard Mudded Fitting Insulation associated with non-ACM Fiberglass Straight-run Insulation – Mechanical Rooms – Approx. 45 EA**
- **Concealed Hard Mudded Fitting Insulation associated with non-ACM fiberglass Straight-run Insulation – Wall and Ceiling Cavities – Estimated 50 EA**

The following materials were sampled and found **NOT** to contain detectable concentrations of asbestos.

- Fiberglass and plaster coating in pool
- Gypsum wallboard and joint compound
- Yellow carpet mastic
- Epoxy Flooring
- White 2'x4' lay-in ceiling tiles
- White 1" ceramic tile and grout
- Orange and green ceramic tile and grout
- Grout at metal window frame and concrete flooring
- Groat at concrete wall base and concrete flooring
- Interior brick and mortar
- Exterior brick and mortar
- Mortar associated with CMU
- Caulking at wall panels in showers
- Brown interior door frame caulk
- Brown interior window frame caulk
- Black interior window putty
- Black exterior window putty
- Exterior window frame caulk at rough opening and brick
- Exterior window frame caulk at metal and wood beam
- Exterior window frame caulk at frame and metal base
- Exterior window frame caulk at frame and metal column
- Gray caulk at roof exhaust
- Black felt paper behind wood siding
- Black asphaltic material in roof drain
- Parapet roofing at flat roofs
- Roofing at lobby windows
- Built-up Roofing on flat roofs

Refer to Appendix A for a complete listing of representative bulk sampling and associated laboratory analysis.

2.2 Lead-Containing Components

A total of eight (8) representative paint coatings were sampled throughout the structure for lead content. The samples were assigned unique identification numbers and transmitted to NVL Laboratories (AIHA IH #101861) in Seattle, WA under chain-of-custody protocols for analysis using Flame Atomic Absorption. The following describes specific testing that was conducted.

One (1) of the eight (8) samples collected was found to contain lead above detectable limits.

- **Blue paint** – on metal door frame at filter room (0.014% lead)

Samples determined **NOT** to contain lead above detectable limits include:

- White paint – on gypsum wallboard wall in Tutor Office #6
- White paint – on CMU wall at Pool deck west wall

- Blue paint – on brick wall at Pool Deck south wall
- White paint – on brick wall in Lobby Room #9
- Blue paint – on metal door frame at Lobby Room #9
- White paint – on metal support of spring board
- Brown paint – on exterior metal roof flashing

Refer to Appendix B for a complete listing of paint chip sampling and associated laboratory analysis.

2.3 Mercury-Containing Components

All fluorescent light tubes are presumed to contain mercury. PBS counted the number of fluorescent tubes in the areas to be impacted for the purposes of mercury vapor recovery prior to demolition activities.

- Approximately 100 four-foot fluorescent light tubes and 50 eight-foot light tubes were identified as part of this survey.

2.4 PCB-Containing Components

PBS used a Phillips electronic ballast checker to inspect all fluorescent light fixture ballasts throughout the building. Magnetic ballasts are presumed to contain PCB's while electronic ballasts do not contain PCB's. Light fixture ballasts inspected were observed to be electronic and magnetic. Approximately two (2) magnetic ballasts were observed in the rooftop mechanical rooms. Magnetic ballasts should be presumed to contain PCBs and properly removed, stored, transported and disposed of in accordance with Washington Administrative Code (WAC) 173-303 Dangerous Waste Regulations and 40 CFR Part 761 Subpart D. PBS recommends all light ballasts be inspected prior to disposal.

Four (4) representative caulking/sealant samples were collected and analyzed for the presence of PCBs. The samples were assigned a unique identification number and transmitted to NVL Laboratories in Seattle, Washington under chain-of-custody protocols for analysis. The samples were analyzed by EPA Method 8082.

The following material was sampled and determined to contain PCBs less than 50 ppm:

- Exterior window frame caulk at rough opening and brick wall at Lobby Entrance – 1.6 ppm

The following materials were sampled for PCB content and found **NOT** to contain PCBs:

- Interior door frame caulk at pool deck at east entrance
- Exterior window frame caulk at metal column and metal frame at east elevation
- Exterior door frame caulk at rough opening and brick at east elevation

Refer to Appendix C for locations and laboratory results of PCB samples.

2.5 Metals in Masonry Components

PBS collected a representative sample of the masonry mortar and analyzed the sample for the presence of the following regulated metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. One (1) suspect masonry mortar sample was collected and delivered to Fremont Analytical for analysis by EPA Method 6020/7471 for regulated metals.

The laboratory results indicated the presence of arsenic, barium, cadmium, chromium, lead, and silver. Impact to these materials requires compliance with applicable WAC regulations including but not limited to, 296-155, which includes development and implementation of a compliance plan, exposure assessments, and waste stream characterization by the contractor prior to demolition activities.

Based on concentrations of the regulated metals found, PBS does not anticipate the masonry mortar to be considered a dangerous waste for disposal purposes. However, this does not alleviate the Contractor's requirement to characterize the actual final waste streams generated during demolition activities.

See Appendix D for sample inventory, laboratory data and chain of custody information.

3 RECOMMENDATIONS

3.1 ACMs

PBS recommends that all ACMs that may be impacted by the planned renovatoin be removed prior to construction activities, or impacted, only by a qualified Washington State licensed asbestos abatement contractor according to applicable local, state and federal regulations.

The possibility exist that suspect ACM may be present at concealed locations in wall and ceiling cavities, within HVAC equipment and potentially in other select concealed areas. These may include, but are not limited to waterproofing membrane, vapor barriers, internal gasketing, mastics, caulking, and sealants on HVAC equipment, construction adhesives, electrical insulators, below grade pipe covering and insulation.

In the event that suspect ACMs not included in this report are encountered during construction, contractors should stop work immediately and inform the Owner promptly for confirmation testing. All untested materials should be presumed asbestos-containing or tested for asbestos content prior to impact.

3.2 Lead-Containing Components

Detectible levels of lead were identified in representative painted coatings sampled as part of this investigation.

Impact of painted surfaces with detectable concentrations of lead requires construction activities to be performed according to Washington Labor and Industries regulations for Lead in Construction (WAC 296-62 and 296-155). Workers impacting LCP should be provided the proper personal protective equipment and use proper work methods to limit occupational and environmental exposure to lead until an initial exposure assessment has been conducted.

Painted coatings may exist in inaccessible areas of the work area or in secondary coatings. Any previously unidentified painted coatings should be considered lead containing until sampled and proven otherwise. All waste shall be handled in accordance with WAC 173-303.

3.3 Mercury-Containing Components

PBS recommends that all fluorescent lamps be carefully handled and recycled in accordance with applicable regulations prior to demolition. Breakage of lamps should be avoided to prevent potential exposures to mercury. Washington Department of Safety and Health requires specific training, handling, engineering controls and disposal practices when performing this work.

3.4 PCB-Containing Components

PBS recommends all light ballasts be inspected prior to disposal. Magnetic ballasts should be presumed to contain PCBs and properly removed, stored, transported and disposed of in accordance with Washington Administrative Code (WAC) 173-303 Dangerous Waste Regulations and 40 CFR Part 761 Subpart D. Electronic ballasts do not contain PCB's and can be disposed of as general debris in compliance with applicable codes and endpoint facility requirements.

Impact of materials containing less than 50 ppm PCBs requires construction activities to be performed in accordance with Washington Labor and Industries regulations (WAC 296-62, 296-155, and 296-841). Workers impacting PCBs should be provided the proper personal protective equipment and use proper work methods to limit occupational and environmental exposure to PCBs until an initial exposure assessment has been conducted.

3.5 Metals in Masonry Components

Representative masonry mortar from the project site was sampled and found to contain regulated metals (i.e. arsenic, barium, cadmium, chromium, lead, and silver) by laboratory analysis.

Impact of masonry mortar with detectable concentrations of regulated metals requires construction activities to be performed according to Washington Labor and Industries regulations (WAC 296-62 and 296-155). Workers impacting regulated metals should be provided the proper personal protective equipment and use proper work methods to limit occupational and environmental exposures until an initial exposure assessment has been conducted. Additionally, this may include development and implementation of a metals-compliance plan, control of wastewater discharge/capture, and waste stream characterization.

Report prepared by:

Ryan Hunter
Project Manager / AHERA Building Inspector
Cert. # IRO-24-7254B, expiration 3/05/2025

APPENDIX A

PLM Bulk Sampling Information

PLM Bulk Sample Inventory
PLM Bulk Sample Laboratory Data Sheets
PLM Bulk Sample Chain-of-Custody Documentation

PLM ASBESTOS SAMPLE INVENTORY

PBS Sample	Material Type	Sample Location	Lab Description	Lab Result	Lab
41924.000-001	Fiberglass Coating	Pool Wall Deep End East	Layer 1: White brittle fibrous material with white coating material	NAD	NVL
	Plaster		Layer 2: White brittle tile	NAD	
			Layer 3: Gray cementitious material	NAD	
41924.000-002	Fiberglass Coating	Pool Wall Deep End South	Layer 1: White brittle fibrous material with white coating material	NAD	NVL
	Plaster		Layer 2: White brittle tile	NAD	
			Layer 3: Gray cementitious material	NAD	
41924.000-003	Fiberglass Coating	Pool Wall Shallow End West	Layer 1: White brittle fibrous material with white coating material	NAD	NVL
	Plaster		Layer 2: White brittle tile	NAD	
			Layer 3: Gray cementitious material	NAD	
41924.000-004	Fiberglass Coating	Pool Wall Shallow End North	Layer 1: White brittle fibrous material with white coating material	NAD	NVL
	Plaster		Layer 2: White brittle tile	NAD	
			Layer 3: Gray cementitious material	NAD	
41924.000-005	Fiberglass Coating	Pool Cove North	Layer 1: White brittle fibrous material with white coating material	NAD	NVL
	Plaster		Layer 2: White brittle tile	NAD	
			Layer 3: Gray cementitious material	NAD	
41924.000-006	Fiberglass Coating	Pool Cove South	Layer 1: White brittle fibrous material with white coating material	NAD	NVL
	Plaster		Layer 2: White brittle tile	NAD	
			Layer 3: Gray cementitious material	NAD	
41924.000-007	Fiberglass Coating	Pool Deep End Floor	Layer 1: White brittle fibrous material with white coating material	NAD	NVL
	Plaster		Layer 2: White brittle tile	NAD	
			Layer 3: Gray cementitious material	NAD	

PLM ASBESTOS SAMPLE INVENTORY

PBS Sample	Material Type	Sample Location	Lab Description	Lab Result	Lab
41924.000-008	Fiberglass Coating	Pool Shallow End Floor	Layer 1: White brittle fibrous material with white coating material	NAD	NVL
	Plaster		Layer 2: White brittle tile	NAD	
			Layer 3: Gray cementitious material	NAD	
41924.000-009	Joint compound	Northeast Storage	Layer 1: Off-white compacted powdery material with paint	NAD	NVL
	Gypsum wallboard		Layer 2: Beige chalky material with paper	NAD	
41924.000-010	Joint compound	Filter Room	Layer 1: White compacted powdery material with paint	NAD	NVL
	Gypsum wallboard		Layer 2: White chalky material with paper	NAD	
41924.000-011	Joint compound	Boy's Locker Room Ceiling	Layer 1: White compacted powdery material with paint	NAD	NVL
	Gypsum wallboard		Layer 2: Beige chalky material with paper	NAD	
41924.000-012	Yellow carpet mastic	Lobby	Layer 1: Yellow brittle mastic	NAD	NVL
41924.000-013	Epoxy floor	Stairs to Boy's Locker Room	Layer 1: Brown-red thin brittle material with paint	NAD	NVL
41924.000-014	Epoxy floor	Girl's Locker Room	Layer 1: Brown-red thin brittle material with paint	NAD	NVL
41924.000-015	White 2' x 4' lay-in ceiling tile	Pool Area	Layer 1: Off-white fibrous material with white paint	NAD	NVL
41924.000-016	White 1" ceramic tile	Pool Deck at Pool Edge	Layer 1: White ceramic tile	NAD	NVL
	Grout		Layer 2: White brittle material	NAD	
			Layer 3: Red crumbly material	NAD	
41924.000-017	Orange ceramic tile	Boy's Locker Room Wall	Layer 1: Orange brittle tile material	NAD	NVL
41924.000-018	Green ceramic tile	Girl's Locker Room Wall	Layer 1: Green brittle tile material	NAD	NVL
	Grout		Layer 2: Gray cementitious material	NAD	
41924.000-019	Grout at window frame and concrete	Pool Deck East Interior	Layer 1: Gray cementitious material	NAD	NVL
41924.000-020	Grout at Concrete wall base and slab	Pool Deck East Interior	Layer 1: Gray cementitious material with debris	NAD	NVL
41924.000-021	Red brick	Boy's Locker Room Wall	Layer 1: Brown-red brittle tile	NAD	NVL
	Mortar		Layer 2: Gray cementitious material	NAD	

PLM ASBESTOS SAMPLE INVENTORY

PBS Sample	Material Type	Sample Location	Lab Description	Lab Result	Lab
41924.000-022	Mortar associated with CMU	Boy's Locker Room Wall	Layer 1: White brittle material with paint	NAD	NVL
41924.000-023	Wall panel caulking	Boy's Locker Room Shower Wall	Layer 1: White hard rubbery material	NAD	NVL
41924.000-024	Hard mudded pipe fitting	Mechanical Basement	Layer 1: White flaky fibrous material with white interwoven fibrous material and paint	**3% Amosite**	NVL
41924.000-025	Hard mudded pipe fitting	Mechanical Basement	Layer 1: White flaky fibrous material	**2% Amosite**	NVL
41924.000-026	Hard mudded pipe fitting	Filter Room	Layer 1: White flaky fibrous material	**2% Amosite**	NVL
41924.000-027	Tank insulation	Mechanical Basement	Layer 1: White flaky fibrous material with white fibrous mesh and paint	**2% Amosite**	NVL
41924.000-028	Tank insulation	Mechanical Basement	Layer 1: White flaky fibrous material with white fibrous mesh and paint	**3% Amosite**	NVL
41924.000-029	Tank insulation	Mechanical Basement	Layer 1: White flaky fibrous material with white fibrous mesh and paint	**2% Amosite**	NVL
41924.000-030	Brown interior door frame caulk	Lobby	Layer 1: Black soft sticky material with paint	NAD	NVL
41924.000-031	Brown interior door frame caulk	Pool Deck East Interior	Layer 1: Black soft sticky material with paint	NAD	NVL
41924.000-032	Brown interior door frame caulk	Pool Deck West Interior	Layer 1: Black soft elastic material	NAD	NVL
41924.000-033	Brown interior door frame caulk	Filter Room to Pool	Layer 1: Black soft elastic material	NAD	NVL
41924.000-034	Brown interior window frame caulk	Lobby	Layer 1: Black soft crumbly material	NAD	NVL
41924.000-035	Brown interior window frame caulk	Pool Deck West Interior	Layer 1: Black soft rubbery material	NAD	NVL
41924.000-036	Black interior window putty	Lobby Clerestory Windows	Layer 1: Black sticky material	NAD	NVL
41924.000-037	Exterior brick Mortar	East Elevation	Layer 1: Brown hard brittle material Layer 2: Gray sandy material with debris	NAD NAD	NVL

PLM ASBESTOS SAMPLE INVENTORY

PBS Sample	Material Type	Sample Location	Lab Description	Lab Result	Lab
41924.000-038	Black exterior window putty patch	Roof Pool Windows	Layer 1: Black soft material with debris	NAD	NVL
41924.000-039	Black exterior window putty	Roof Pool Windows	Layer 1: Black soft/elastic material with debris	NAD	NVL
41924.000-040	Exterior window frame caulk at rough opening and brick	East Elevation North	Layer 1: Dark gray brittle material with debris	NAD	NVL
41924.000-041	Exterior window frame caulk at metal and wood beam	East Elevation Central	Layer 1: Gray soft material with debris	NAD	NVL
41924.000-042	Exterior window frame caulk at frame and metal base	East Elevation	Layer 1: Black soft/elastic material with debris	NAD	NVL
41924.000-043	Exterior window frame caulk at rough opening and brick	East Elevation South Side	Layer 1: Gray brittle material with debris	NAD	NVL
41924.000-044	Exterior window frame caulk at metal column and frame	South Elevation	Layer 1: Dark gray soft material with debris Layer 2: Clear soft/elastic material with debris	NAD NAD	NVL
41924.000-045	Exterior window frame caulk at metal and brick	South Elevation	Layer 1: Dark gray soft material with debris	NAD	NVL
41924.000-046	Exterior window frame caulk at frame and wood siding	Pool Roof Windows	Layer 1: Brown soft/elastic material with paint & debris Layer 2: Black thin brittle material with debris	NAD NAD	NVL
41924.000-047	Exterior window frame caulk at wood frame and metal	Roof Lobby Windows	Layer 1: Brown soft material with debris	NAD	NVL
41924.000-048	Gray caulk at roof exhaust	Roof East Side	Layer 1: Gray soft material with paint & debris	NAD	NVL
41924.000-049	Exterior window frame caulk at rough opening and brick	East Elevation	Layer 1: Black brittle material with debris	NAD	NVL
41924.000-050	Exterior window frame caulk at rough opening and brick	South Elevation	Layer 1: Black brittle material with debris	NAD	NVL
41924.000-051	Black felt paper behind wood siding	Roof Mech Room East	Layer 1: Brown asphaltic fibrous material	NAD	NVL

PLM ASBESTOS SAMPLE INVENTORY

PBS Sample	Material Type	Sample Location	Lab Description	Lab Result	Lab
41924.000-052	Black felt paper behind wood siding	Roof Mech Room West	Layer 1: Brown asphaltic fibrous material	NAD	NVL
41924.000-053	Black asphaltic material in roof drain	Roof Center Drain	Layer 1: Black asphaltic material with debris	NAD	NVL
			Layer 2: Black asphaltic fibrous built-up material with debris	NAD	
41924.000-054	Parapet roofing	West Side	Layer 1: Silver paint with debris	NAD	NVL
			Layer 2: Multi-layered black asphaltic material with debris	NAD	
41924.000-055	Roofing at lobby windows	Roof South Windows	Layer 1: Silver paint with debris	NAD	NVL
			Layer 2: Black asphaltic fibrous built-up material with debris	NAD	
			Layer 3: Black thin crumbly material (on wood) with debris	NAD	
			Layer 4: Tan compressed fibrous material	NAD	
41924.000-056	Built-up roofing	Office Roof West Side	Layer 1: Silver paint	NAD	NVL
			Layer 2: Black asphaltic fibrous built-up material	NAD	
			Layer 3: Multi-layered black asphaltic material	NAD	
			Layer 4: Tan foamy material	NAD	
			Layer 5: Multi-layered black asphaltic material	NAD	
41924.000-057	Built-up roofing	Office Roof East Side	Layer 1: Silver paint	NAD	NVL
			Layer 3: Tan foamy material	NAD	
			Layer 4: Multi-layered black asphaltic material	NAD	

April 2, 2024

Ryan Hunter
PBS Environmental - Seattle
214 E Galer St. Suite. 300
Seattle, WA 98102

RE: Bulk Asbestos Fiber Analysis; NVL Batch # 2405662.00

Client Project: 41924.000
Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Dear Mr. Hunter,

Enclosed please find test results for the 36 sample(s) submitted to our laboratory for analysis on 4/1/2024.

Examination of these samples was conducted for the presence of identifiable asbestos fibers using polarized light microscopy (PLM) with dispersion staining in accordance with **U. S. EPA 40 CFR Appendix E to Subpart E of Part 763**, Interim Method for the Determination of Asbestos in Bulk Insulation Samples and **EPA 600/R-93/116**, Method for the Determination of Asbestos in Bulk Building Materials.

For samples containing more than one separable layer of materials, the report will include findings for each layer (labeled Layer 1 and Layer 2, etc. for each individual layer). The asbestos concentration in the sample is determined by calibrated visual estimation.

For those samples with asbestos concentrations between 1 and 10 percent based on visual estimation, the EPA recommends a procedure known as point counting (NESHAPS, 40 CFR Part 61). Point counting is a statistically more accurate means of quantification for samples with low concentrations of asbestos.

The detection limit for the calibrated visual estimation is <1%, 400 point counts is 0.25% and 1000 point counts is 0.1%

Samples are archived for two weeks following analysis. Samples that are not retrieved by the client are discarded after two weeks.

Thank you for using our laboratory services. Please do not hesitate to call if there is anything further we can assist you with.

Sincerely,

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

NVLAP
Testing
Lab Code: 102063-0

Enc.: Sample Results

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405662.00
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 36
Samples Analyzed: 36
Method: EPA/600/R-93/116

Lab ID: 24034909 **Client Sample #: 41924.000-001**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 3	**Description:** White brittle fibrous material with white coating material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Fine particles, Paint	Glass fibers	32%	**None Detected ND**
Layer 2 of 3	**Description:** White brittle tile			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Mineral grains, Fine particles	None Detected	ND	**None Detected ND**
Layer 3 of 3	**Description:** Gray cementitious material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Cement/Binder, Fine grains, Cementitious particles	None Detected	ND	**None Detected ND**

Lab ID: 24034910 **Client Sample #: 41924.000-002**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 3	**Description:** White brittle fibrous material with white coating material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Fine particles, Paint	Glass fibers	36%	**None Detected ND**
Layer 2 of 3	**Description:** White brittle tile			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Mineral grains, Fine particles	None Detected	ND	**None Detected ND**
Layer 3 of 3	**Description:** Gray cementitious material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Cement/Binder, Fine grains, Cementitious particles	None Detected	ND	**None Detected ND**

Lab ID: 24034911 **Client Sample #: 41924.000-003**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Sampled by: Client
Analyzed by: Akane Yoshikawa **Date:** 04/02/2024
Reviewed by: Kunga Woser **Date:** 04/02/2024

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405662.00
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 36
Samples Analyzed: 36
Method: EPA/600/R-93/116

Layer 1 of 3	**Description:** White brittle fibrous material with white coating material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Fine particles, Paint	Glass fibers	42%	**None Detected ND**
Layer 2 of 3	**Description:** White brittle tile			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Mineral grains, Fine particles	None Detected	ND	**None Detected ND**
Layer 3 of 3	**Description:** Gray cementitious material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Cement/Binder, Fine grains, Cementitious particles	None Detected	ND	**None Detected ND**

Lab ID: 24034912 **Client Sample #: 41924.000-004**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 3	**Description:** White brittle fibrous material with white coating material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Fine particles, Paint	Glass fibers	37%	**None Detected ND**
Layer 2 of 3	**Description:** White brittle tile			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Mineral grains, Fine particles	None Detected	ND	**None Detected ND**
Layer 3 of 3	**Description:** Gray cementitious material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Cement/Binder, Fine grains, Cementitious particles	None Detected	ND	**None Detected ND**

Lab ID: 24034913 **Client Sample #: 41924.000-005**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 3	**Description:** White brittle fibrous material with white coating material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Fine particles, Paint	Glass fibers	44%	**None Detected ND**

Sampled by: Client
Analyzed by: Akane Yoshikawa **Date:** 04/02/2024
Reviewed by: Kunga Woser **Date:** 04/02/2024

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405662.00
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 36
Samples Analyzed: 36
Method: EPA/600/R-93/116

Layer 2 of 3	**Description:** White brittle tile			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Mineral grains, Fine particles	None Detected	ND	**None Detected ND**
Layer 3 of 3	**Description:** Gray cementitious material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Cement/Binder, Fine grains, Cementitious particles	None Detected	ND	**None Detected ND**

Lab ID: 24034914 **Client Sample #: 41924.000-006**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 3	**Description:** White brittle fibrous material with white coating material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Fine particles, Paint	Glass fibers	46%	**None Detected ND**
Layer 2 of 3	**Description:** White brittle tile			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Mineral grains, Fine particles	None Detected	ND	**None Detected ND**
Layer 3 of 3	**Description:** Gray cementitious material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Cement/Binder, Fine grains, Cementitious particles	None Detected	ND	**None Detected ND**

Lab ID: 24034915 **Client Sample #: 41924.000-007**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 3	**Description:** White brittle fibrous material with white coating material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Fine particles, Paint	Glass fibers	41%	**None Detected ND**
Layer 2 of 3	**Description:** White brittle tile			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Mineral grains, Fine particles	None Detected	ND	**None Detected ND**

Sampled by: Client
Analyzed by: Akane Yoshikawa **Date:** 04/02/2024
Reviewed by: Kunga Woser **Date:** 04/02/2024

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405662.00
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 36
Samples Analyzed: 36
Method: EPA/600/R-93/116

Layer 3 of 3 **Description:** Gray cementitious material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Cement/Binder, Fine grains, Cementitious particles	None Detected ND	**None Detected ND**

Lab ID: 24034916 **Client Sample #: 41924.000-008**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 3 **Description:** White brittle fibrous material with white coating material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles, Paint	Glass fibers 41%	**None Detected ND**

Layer 2 of 3 **Description:** White brittle tile

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Mineral grains, Fine particles	None Detected ND	**None Detected ND**

Layer 3 of 3 **Description:** Gray cementitious material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Cement/Binder, Fine grains, Cementitious particles	None Detected ND	**None Detected ND**

Lab ID: 24034917 **Client Sample #: 41924.000-009**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 2 **Description:** Off-white compacted powdery material with paint

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine grains, Fine particles	Cellulose 3%	**None Detected ND**
Paint		

Layer 2 of 2 **Description:** Beige chalky material with paper

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Gypsum/Binder, Fine grains, Calcareous particles	Cellulose 18%	**None Detected ND**

Lab ID: 24034918 **Client Sample #: 41924.000-010**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Sampled by: Client
Analyzed by: Akane Yoshikawa **Date:** 04/02/2024
Reviewed by: Kunga Woser **Date:** 04/02/2024

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405662.00
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 36
Samples Analyzed: 36
Method: EPA/600/R-93/116

Layer 1 of 2 **Description:** White compacted powdery material with paint

Non-Fibrous Materials:	Other Fibrous Materials:	%	**Asbestos Type: %**
Binder/Filler, Fine grains, Fine particles	None Detected	ND	**None Detected ND**
Paint			

Layer 2 of 2 **Description:** White chalky material with paper

Non-Fibrous Materials:	Other Fibrous Materials:	%	**Asbestos Type: %**
Gypsum/Binder, Fine grains, Calcareous particles	Cellulose	16%	**None Detected ND**
	Glass fibers	4%	

Lab ID: 24034919 **Client Sample #: 41924.000-011**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 2 **Description:** White compacted powdery material with paint

Non-Fibrous Materials:	Other Fibrous Materials:	%	**Asbestos Type: %**
Binder/Filler, Fine grains, Fine particles	Cellulose	2%	**None Detected ND**
Paint			

Layer 2 of 2 **Description:** Beige chalky material with paper

Non-Fibrous Materials:	Other Fibrous Materials:	%	**Asbestos Type: %**
Gypsum/Binder, Fine grains, Calcareous particles	Cellulose	15%	**None Detected ND**
	Glass fibers	3%	

Lab ID: 24034920 **Client Sample #: 41924.000-012**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** Yellow brittle mastic

Non-Fibrous Materials:	Other Fibrous Materials:	%	**Asbestos Type: %**
Mastic, Fine particles	None Detected	ND	**None Detected ND**

Sampled by: Client
Analyzed by: Akane Yoshikawa **Date:** 04/02/2024
Reviewed by: Kunga Woser **Date:** 04/02/2024

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

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Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405662.00
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 36
Samples Analyzed: 36
Method: EPA/600/R-93/116

Lab ID: 24034921 **Client Sample #: 41924.000-013**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** Brown-red thin brittle material with paint

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles, Paint	None Detected ND	**None Detected ND**

Lab ID: 24034922 **Client Sample #: 41924.000-014**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** Brown-red thin brittle material with paint

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles, Paint	None Detected ND	**None Detected ND**

Lab ID: 24034923 **Client Sample #: 41924.000-015**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** Off-white fibrous material with white paint

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Perlite, Fine particles	Cellulose 38%	**None Detected ND**
Paint		

Lab ID: 24034924 **Client Sample #: 41924.000-016**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 3 **Description:** White ceramic tile

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Ceramic/Binder, Fine particles	None Detected ND	**None Detected ND**

Layer 2 of 3 **Description:** White brittle material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine grains, Fine particles	None Detected ND	**None Detected ND**

Sampled by: Client
Analyzed by: Akane Yoshikawa **Date:** 04/02/2024
Reviewed by: Kunga Woser **Date:** 04/02/2024

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405662.00
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 36
Samples Analyzed: 36
Method: EPA/600/R-93/116

Layer 3 of 3	**Description:** Red crumbly material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Fine particles, Paint/Binder	None Detected	ND	**None Detected ND**

Lab ID: 24034925 **Client Sample #: 41924.000-017**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1	**Description:** Orange brittle tile material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Mineral grains, Fine particles	None Detected	ND	**None Detected ND**

Lab ID: 24034926 **Client Sample #: 41924.000-018**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 2	**Description:** Green brittle tile material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Mineral grains, Fine particles	None Detected	ND	**None Detected ND**
Layer 2 of 2	**Description:** Gray cementitious material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Cement/Binder, Fine grains, Cementitious particles	None Detected	ND	**None Detected ND**

Lab ID: 24034927 **Client Sample #: 41924.000-019**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1	**Description:** Gray cementitious material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Cement/Binder, Fine grains, Cementitious particles	None Detected	ND	**None Detected ND**

Lab ID: 24034928 **Client Sample #: 41924.000-020**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Sampled by: Client
Analyzed by: Akane Yoshikawa **Date:** 04/02/2024
Reviewed by: Kunga Woser **Date:** 04/02/2024

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

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Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405662.00
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 36
Samples Analyzed: 36
Method: EPA/600/R-93/116

Layer 1 of 1 **Description:** Gray cementitious material with debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Cement/Binder, Fine grains, Cementitious particles	None Detected ND	**None Detected ND**
Debris		

Lab ID: 24034929 **Client Sample #: 41924.000-021**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 2 **Description:** Brown-red brittle tile

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Mineral grains, Fine grains	None Detected ND	**None Detected ND**

Layer 2 of 2 **Description:** Gray cementitious material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Cement/Binder, Fine grains, Cementitious particles	None Detected ND	**None Detected ND**

Lab ID: 24034930 **Client Sample #: 41924.000-022**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** White brittle material with paint

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Mineral grains, Fine particles	None Detected ND	**None Detected ND**
Paint		

Lab ID: 24034931 **Client Sample #: 41924.000-023**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** White hard rubbery material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles	None Detected ND	**None Detected ND**

Sampled by: Client
Analyzed by: Akane Yoshikawa **Date:** 04/02/2024
Reviewed by: Kunga Woser **Date:** 04/02/2024

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

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Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405662.00
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 36
Samples Analyzed: 36
Method: EPA/600/R-93/116

Lab ID: 24034932 **Client Sample #: 41924.000-024**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson
Layer 1 of 1 **Description:** White flaky fibrous material with white interwoven fibrous material and paint

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles, Paint	Glass fibers 34%	**Amosite 3%**
	Cellulose 16%	

Lab ID: 24034933 **Client Sample #: 41924.000-025**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson
Layer 1 of 1 **Description:** White flaky fibrous material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles	Glass fibers 44%	**Amosite 2%**
	Cellulose 2%	

Lab ID: 24034934 **Client Sample #: 41924.000-026**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson
Layer 1 of 1 **Description:** White flaky fibrous material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles	Glass fibers 39%	**Amosite 2%**

Lab ID: 24034935 **Client Sample #: 41924.000-027**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson
Layer 1 of 1 **Description:** White flaky fibrous material with white fibrous mesh and paint

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles, Paint	Glass fibers 37%	**Amosite 2%**
	Cellulose 19%	

Sampled by: Client
Analyzed by: Akane Yoshikawa **Date:** 04/02/2024
Reviewed by: Kunga Woser **Date:** 04/02/2024

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

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Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405662.00
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 36
Samples Analyzed: 36
Method: EPA/600/R-93/116

Lab ID: 24034936 **Client Sample #: 41924.000-028**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** White flaky fibrous material with white fibrous mesh and paint

Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
Binder/Filler, Fine particles, Paint	Glass fibers	34%	**Amosite 3%**
	Cellulose	17%	

Lab ID: 24034937 **Client Sample #: 41924.000-029**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** White flaky fibrous material with white fibrous mesh and paint

Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
Binder/Filler, Fine particles, Paint	Glass fibers	29%	**Amosite 2%**
	Cellulose	16%	

Lab ID: 24034938 **Client Sample #: 41924.000-030**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** Black soft sticky material with paint

Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
Binder/Filler, Fine particles, Paint	None Detected	ND	**None Detected ND**

Lab ID: 24034939 **Client Sample #: 41924.000-031**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** Black soft sticky material with paint

Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
Binder/Filler, Fine particles, Paint	None Detected	ND	**None Detected ND**

Lab ID: 24034940 **Client Sample #: 41924.000-032**
Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Sampled by: Client
Analyzed by: Akane Yoshikawa **Date:** 04/02/2024
Reviewed by: Kunga Woser **Date:** 04/02/2024

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

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Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405662.00
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 36
Samples Analyzed: 36
Method: EPA/600/R-93/116

Layer 1 of 1 **Description:** Black soft elastic material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles	None Detected ND	**None Detected ND**

Lab ID: 24034941 **Client Sample #: 41924.000-033**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** Black soft elastic material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles	Cellulose <1%	**None Detected ND**

Lab ID: 24034942 **Client Sample #: 41924.000-034**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** Black soft crumbly material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles	None Detected ND	**None Detected ND**

Lab ID: 24034943 **Client Sample #: 41924.000-035**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** Black soft rubbery material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles	None Detected ND	**None Detected ND**

Lab ID: 24034944 **Client Sample #: 41924.000-036**

Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Layer 1 of 1 **Description:** Black sticky material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine particles	Cellulose 6%	**None Detected ND**

Sampled by: Client
Analyzed by: Akane Yoshikawa **Date:** 04/02/2024
Reviewed by: Kunga Woser **Date:** 04/02/2024

Kunga Woser

Kunga Woser, Supervisor Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

ASBESTOS LABORATORY SERVICES

Company	PBS Environmental - Seattle	**NVL Batch Number**	**2405662.00**
Address	214 E Galer St. Suite. 300 Seattle, WA 98102	**TAT** 2 Days **Rush TAT**	**AH** No
Project Manager	Mr. Ryan Hunter	**Due Date** 4/3/2024	**Time** 8:20 AM
Phone	(206) 233-9639	**Email**	ryan.hunter@pbsusa.com
Cell	(484) 269-2138	**Fax**	(866) 727-0140

Project Name/Number: 41924.000 **Project Location:** Bainbridge Aquatic Center Renovation - Ray Williamson

Subcategory PLM Bulk

Item Code ASB-02 EPA 600/R-93-116 Asbestos by PLM <bulk>

Total Number of Samples 36 Rush Samples

	Lab ID	Sample ID	Description	A/R
1	24034909	41924.000-001		A
2	24034910	41924.000-002		A
3	24034911	41924.000-003		A
4	24034912	41924.000-004		A
5	24034913	41924.000-005		A
6	24034914	41924.000-006		A
7	24034915	41924.000-007		A
8	24034916	41924.000-008		A
9	24034917	41924.000-009	Composite	A
10	24034918	41924.000-010	Composite	A
11	24034919	41924.000-011	Composite	A
12	24034920	41924.000-012		A
13	24034921	41924.000-013		A
14	24034922	41924.000-014		A
15	24034923	41924.000-015		A
16	24034924	41924.000-016		A
17	24034925	41924.000-017		A
18	24034926	41924.000-018		A

	Print Name	Signature	Company	Date	Time
Sampled by	Client				
Relinquished by	Client				

Office Use Only	Print Name	Signature	Company	Date	Time
Received by	Kelly AuVu		NVL	4/1/24	820
Analyzed by	Akane Yoshikawa		NVL	4/2/24	
Results Called by					
☐ **Faxed** ☐ **Emailed**					

Special Instructions:

Date: 4/1/2024
Time: 9:41 AM
Entered By: Kelly AuVu

ASBESTOS LABORATORY SERVICES

Company	PBS Environmental - Seattle	**NVL Batch Number**	**2405662.00**
Address	214 E Galer St. Suite. 300 Seattle, WA 98102	**TAT** 2 Days	**AH** No
		Rush TAT	
Project Manager	Mr. Ryan Hunter	**Due Date** 4/3/2024	**Time** 8:20 AM
Phone	(206) 233-9639	**Email**	ryan.hunter@pbsusa.com
Cell	(484) 269-2138	**Fax**	(866) 727-0140

Project Name/Number: 41924.000 **Project Location:** Bainbridge Aquatic Center Renovation - Ray Williamson

Subcategory PLM Bulk

Item Code ASB-02 EPA 600/R-93-116 Asbestos by PLM <bulk>

Total Number of Samples 36 Rush Samples

	Lab ID	Sample ID	Description	A/R
19	24034927	41924.000-019		A
20	24034928	41924.000-020		A
21	24034929	41924.000-021		A
22	24034930	41924.000-022		A
23	24034931	41924.000-023		A
24	24034932	41924.000-024		A
25	24034933	41924.000-025		A
26	24034934	41924.000-026		A
27	24034935	41924.000-027		A
28	24034936	41924.000-028		A
29	24034937	41924.000-029		A
30	24034938	41924.000-030		A
31	24034939	41924.000-031		A
32	24034940	41924.000-032		A
33	24034941	41924.000-033		A
34	24034942	41924.000-034		A
35	24034943	41924.000-035		A
36	24034944	41924.000-036		A

	Print Name	Signature	Company	Date	Time
Sampled by	Client				
Relinquished by	Client				

Office Use Only	Print Name	Signature	Company	Date	Time
Received by	Kelly AuVu		NVL	4/1/24	820
Analyzed by	Akane Yoshikawa		NVL	4/2/24	
Results Called by					
☐ **Faxed** ☐ **Emailed**					

Special Instructions:

Date: 4/1/2024
Time: 9:41 AM
Entered By: Kelly AuVu

PBS
AN APEX COMPANY

LABORATORY C 2405662

Project: Bainbrige Aquatic Center Renovation – Ray Williamson **Project #:** 41924.000 Page 1 of 2

Analysis requested: PLM **Date:** 03/29/2024

Relinq'd by/Signature: Ryan Hunter / Ryan HO **Date/Time:** 03/29 noon

Received by/Signature: Kennedy O Nun **Date/Time:** 4/1/24 820

Email ALL INVOICES to: seattleap@pbsusa.com

E-mail results to:

- ☐ Willem Mager
- ☐ Gregg Middaugh
- ☐ Mark Hiley
- ☐ Ryan Hunter
- ☐ Janet Murphy
- ☐ Ferman Fletcher
- ☐ Claire Tsai
- ☐ Toan Nguyen
- ☐ Peter Stensland
- ☐ Cameron Budnick
- ☐ Nick San
- ☐ Katie King
- ☐ Kameron DeMonnin
- ☐ _____

TURN AROUND TIME:

- ☐ 1 Hour
- ☐ 2 Hours
- ☐ 4 Hours
- ☐ 24 Hours
- ☒ 48 Hours
- ☐ 3-5 Days
- ☐ Other_____

NOTE: ***Composite if positive

SAMPLE DATA FORM

Sample #	Material	Location	Lab
41924.000-001	Fiberglass and Plaster Finish	Pool Wall Deep End East	NVL
41924.000-002	Fiberglass and Plaster Finish	Pool Wall Deep End South	
41924.000-003	Fiberglass and Plaster Finish	Pool Wall Shallow End West	
41924.000-004	Fiberglass and Plaster Finish	Pool Wall Shallow End North	
41924.000-005	Fiberglass and Plaster Finish	Pool Cove North	
41924.000-006	Fiberglass and Plaster Finish	Pool Cove South	
41924.000-007	Fiberglass and Plaster Finish	Pool Deep End Floor	
41924.000-008	Fiberglass and Plaster Finish	Pool Shallow End Floor	
41924.000-009	Joint Compound*** / Gypsum Wallboard	Northeast Storage	
41924.000-010	Joint Compound*** / Gypsum Wallboard	Filter Room	
41924.000-011	Joint Compound*** / Gypsum Wallboard	Boy's Locker Room Ceiling	
41924.000-012	Yellow Carpet Mastic	Lobby	
41924.000-013	Epoxy Floor	Stairs to Boy's Locker Room	
41924.000-014	Epoxy Floor	Girl's Locker Room	
41924.000-015	White 2' x 4' Lay-in Ceiling Tile	Pool Area	
41924.000-016	White 1" Ceramic Tile and Grout	Pool Deck at Pool Edge	
41924.000-017	Orange Ceramic Tile and Grout	Boy's Locker Room Wall	
41924.000-018	Green Ceramic Tile and Grout	Girl's Locker Room Wall	

214 EAST GALER STREET, SUITE 300, SEATTLE, WA 98102 ▪ 206.233.9639 MAIN ▪ 866.727.0140 FAX ▪ PBSUSA.COM

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LABORATORY CI 2405662

Project: Bainbrige Aquatic Center Renovation – Ray Williamson **Project #:** 41924.000 Page **2** of **2**

SAMPLE DATA FORM			
Sample #	**Material**	**Location**	**Lab**
41924.000-019	Grout at Window Frame and Concrete	Pool Deck East Interior	NVL
41924.000-020	Grout at Concrete Wall Base and Slab	Pool Deck East Interior	
41924.000-021	Mortar a/w Red Brick	Boy's Locker Room Wall	
41924.000-022	Mortar a/w CMU	Boy's Locker Room Wall	
41924.000-023	Wall Panel	Boy's Locker Room Shower Wall	
41924.000-024	Hard Mudded Pipe Fitting	Mechanical Basement	
41924.000-025	Hard Mudded Pipe Fitting	Mechanical Basement	
41924.000-026	Hard Mudded Pipe Fitting	Filter Room	
41924.000-027	Tank Insulation	Mechanical Basement	
41924.000-028	Tank Insulation	Mechanical Basement	
41924.000-029	Tank Insulation	Mechanical Basement	
41924.000-030	Brown Interior Door Frame Caulk	Lobby	
41924.000-031	Brown Interior Door Frame Caulk	Pool Deck East Interior	
41924.000-032	Brown Interior Door Frame Caulk	Pool Deck West Interior	
41924.000-033	Brown Interior Door Frame Caulk	Filter Room to Pool	
41924.000-034	Brown Interior Window Frame Caulk	Lobby	
41924.000-035	Brown Interior Window Frame Caulk	Pool Deck West Interior	
41924.000-036	Black Interior Window Putty	Lobby Clerestory Windows	

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April 5, 2024

Ryan Hunter
PBS Environmental - Seattle
214 E Galer St. Suite. 300
Seattle, WA 98102

RE: Bulk Asbestos Fiber Analysis; NVL Batch # 2405938.00

Client Project: 41924.000
Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Dear Mr. Hunter,

Enclosed please find test results for the 21 sample(s) submitted to our laboratory for analysis on 4/3/2024.

Examination of these samples was conducted for the presence of identifiable asbestos fibers using polarized light microscopy (PLM) with dispersion staining in accordance with **U. S. EPA 40 CFR Appendix E to Subpart E of Part 763**, Interim Method for the Determination of Asbestos in Bulk Insulation Samples and **EPA 600/R-93/116**, Method for the Determination of Asbestos in Bulk Building Materials.

For samples containing more than one separable layer of materials, the report will include findings for each layer (labeled Layer 1 and Layer 2, etc. for each individual layer). The asbestos concentration in the sample is determined by calibrated visual estimation.

For those samples with asbestos concentrations between 1 and 10 percent based on visual estimation, the EPA recommends a procedure known as point counting (NESHAPS, 40 CFR Part 61). Point counting is a statistically more accurate means of quantification for samples with low concentrations of asbestos.

The detection limit for the calibrated visual estimation is <1%, 400 point counts is 0.25% and 1000 point counts is 0.1%

Samples are archived for two weeks following analysis. Samples that are not retrieved by the client are discarded after two weeks.

Thank you for using our laboratory services. Please do not hesitate to call if there is anything further we can assist you with.

Sincerely,

Hilary Crumley, Manager Asbestos Laboratory

NVLAP Testing
Lab Code: 102063-0

Enc.: Sample Results

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405938.00
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 21
Samples Analyzed: 21
Method: EPA/600/R-93/116

Lab ID: 24037544 **Client Sample #: 41924.000-037**
Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 2 **Description:** Brown hard brittle material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Mineral grains, Debris	None Detected ND	**None Detected ND**
Insect parts		

Layer 2 of 2 **Description:** Gray sandy material with debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Fine grains, Mineral grains	Cellulose 2%	**None Detected ND**
Debris		

Lab ID: 24037545 **Client Sample #: 41924.000-038**
Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 1 **Description:** Black soft material with debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Debris	Polyethylene fibers 4%	**None Detected ND**

Lab ID: 24037546 **Client Sample #: 41924.000-039**
Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 1 **Description:** Black soft/elastic material with debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Debris	Cellulose <1%	**None Detected ND**

Lab ID: 24037547 **Client Sample #: 41924.000-040**
Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Sampled by: Client
Analyzed by: Kunga Woser **Date:** 04/05/2024
Reviewed by: Hilary Crumley **Date:** 04/05/2024

Hilary Crumley, Manager Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405938.00
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 21
Samples Analyzed: 21
Method: EPA/600/R-93/116

Layer 1 of 1 **Description:** Dark gray brittle material with debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Debris	Cellulose <1%	**None Detected ND**

Lab ID: 24037548 **Client Sample #: 41924.000-041**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 1 **Description:** Gray soft material with debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Debris	None Detected ND	**None Detected ND**

Lab ID: 24037549 **Client Sample #: 41924.000-042**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 1 **Description:** Black soft/elastic material with debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Debris	None Detected ND	**None Detected ND**

Lab ID: 24037550 **Client Sample #: 41924.000-043**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 1 **Description:** Gray brittle material with debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Debris	Cellulose <1%	**None Detected ND**

Lab ID: 24037551 **Client Sample #: 41924.000-044**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 2 **Description:** Dark gray soft material with debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Debris	Cellulose 2%	**None Detected ND**

Sampled by: Client
Analyzed by: Kunga Woser **Date:** 04/05/2024
Reviewed by: Hilary Crumley **Date:** 04/05/2024

Hilary Crumley, Manager Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405938.00
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 21
Samples Analyzed: 21
Method: EPA/600/R-93/116

Layer 2 of 2	**Description:** Clear soft/elastic material with debris			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Debris	Cellulose	2%	**None Detected ND**

Lab ID: 24037552 **Client Sample #: 41924.000-045**
Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 1	**Description:** Dark gray soft material with debris			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Debris	Cellulose	<1%	**None Detected ND**

Lab ID: 24037553 **Client Sample #: 41924.000-046**
Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 2	**Description:** Brown soft/elastic material with paint & debris			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Paint, Debris	None Detected	ND	**None Detected ND**
Layer 2 of 2	**Description:** Black thin brittle material with debris			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Debris	None Detected	ND	**None Detected ND**

Lab ID: 24037554 **Client Sample #: 41924.000-047**
Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 1	**Description:** Brown soft material with debris			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Debris	Cellulose	2%	**None Detected ND**

Lab ID: 24037555 **Client Sample #: 41924.000-048**
Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Sampled by: Client
Analyzed by: Kunga Woser **Date:** 04/05/2024
Reviewed by: Hilary Crumley **Date:** 04/05/2024

Hilary Crumley, Manager Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405938.00
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 21
Samples Analyzed: 21
Method: EPA/600/R-93/116

Layer 1 of 1 **Description:** Gray soft material with paint & debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Paint, Debris	Cellulose 2%	**None Detected ND**

Lab ID: 24037556 **Client Sample #: 41924.000-049**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 1 **Description:** Black brittle material wtih debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Debris	Cellulose 3%	**None Detected ND**

Lab ID: 24037557 **Client Sample #: 41924.000-050**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 1 **Description:** Black brittle material wtih debris

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Binder/Filler, Debris	Cellulose <1%	**None Detected ND**

Lab ID: 24037558 **Client Sample #: 41924.000-051**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 1 **Description:** Brown asphaltic fibrous material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Asphalt/Binder, Asphaltic Particles	Cellulose 41%	**None Detected ND**

Lab ID: 24037559 **Client Sample #: 41924.000-052**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 1 **Description:** Brown asphaltic fibrous material

Non-Fibrous Materials:	Other Fibrous Materials:%	**Asbestos Type: %**
Asphalt/Binder, Asphaltic Particles	Cellulose 44%	**None Detected ND**

Lab ID: 24037560 **Client Sample #: 41924.000-053**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Sampled by: Client
Analyzed by: Kunga Woser **Date:** 04/05/2024
Reviewed by: Hilary Crumley **Date:** 04/05/2024

Hilary Crumley, Manager Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: Mr. Ryan Hunter
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405938.00
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 21
Samples Analyzed: 21
Method: EPA/600/R-93/116

Layer 1 of 2	**Description:** Black asphaltic material with debris				
	Non-Fibrous Materials:	Other Fibrous Materials:	%	**Asbestos Type: %**	
	Asphalt/Binder, Asphaltic Particles, Debris	Synthetic fibers	3%	**None Detected ND**	
Layer 2 of 2	**Description:** Black asphaltic fibrous built-up material with debris				
	Non-Fibrous Materials:	Other Fibrous Materials:	%	**Asbestos Type: %**	
	Asphalt/Binder, Asphaltic Particles, Debris	Synthetic fibers	9%	**None Detected ND**	
		Glass fibers	5%		

Lab ID: 24037561 **Client Sample #: 41924.000-054**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 2	**Description:** Silver paint with debris				
	Non-Fibrous Materials:	Other Fibrous Materials:	%	**Asbestos Type: %**	
	Metallic paint, Debris	Wollastonite	4%	**None Detected ND**	
Layer 2 of 2	**Description:** Multi-layered black asphaltic material with debris				
	Non-Fibrous Materials:	Other Fibrous Materials:	%	**Asbestos Type: %**	
	Asphalt/Binder, Asphaltic Particles, Debris	Glass fibers	11%	**None Detected ND**	
		Synthetic fibers	6%		

Lab ID: 24037562 **Client Sample #: 41924.000-055**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 4	**Description:** Silver paint with debris				
	Non-Fibrous Materials:	Other Fibrous Materials:	%	**Asbestos Type: %**	
	Metallic paint, Debris	Wollastonite	3%	**None Detected ND**	
Layer 2 of 4	**Description:** Black asphaltic fibrous built-up material with debris				
	Non-Fibrous Materials:	Other Fibrous Materials:	%	**Asbestos Type: %**	
	Asphalt/Binder, Asphaltic Particles, Debris	Synthetic fibers	6%	**None Detected ND**	

Sampled by: Client
Analyzed by: Kunga Woser **Date:** 04/05/2024
Reviewed by: Hilary Crumley **Date:** 04/05/2024

Hilary Crumley, Manager Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405938.00
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 21
Samples Analyzed: 21
Method: EPA/600/R-93/116

			Glass fibers 5%	
Layer 3 of 4	**Description:** Black thin crumbly material (on wood) with debris			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Fine particles, Debris	Cellulose 6%		**None Detected ND**
	Organic debris			
Layer 4 of 4	**Description:** Tan compressed fibrous material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Binder/Filler, Wood flakes	Cellulose 85%		**None Detected ND**

Lab ID: 24037563 **Client Sample #: 41924.000-056**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Comments: Unsure of correct layer sequence.

Layer 1 of 5	**Description:** Silver paint			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Metallic paint	Wollastonite 4%		**None Detected ND**
Layer 2 of 5	**Description:** Black asphaltic fibrous built-up material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Asphalt/Binder, Asphaltic Particles	Synthetic fibers 9%		**None Detected ND**
		Glass fibers 5%		
Layer 3 of 5	**Description:** Multi-layered black asphaltic material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Asphalt/Binder, Asphaltic Particles	Glass fibers 11%		**None Detected ND**
Layer 4 of 5	**Description:** Tan foamy material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Foamy material	None Detected ND		**None Detected ND**

Sampled by: Client
Analyzed by: Kunga Woser **Date:** 04/05/2024
Reviewed by: Hilary Crumley **Date:** 04/05/2024

Hilary Crumley, Manager Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

Bulk Asbestos Fibers Analysis

By Polarized Light Microscopy

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405938.00
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 21
Samples Analyzed: 21
Method: EPA/600/R-93/116

Layer 5 of 5	**Description:** Multi-layered black asphaltic material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Asphalt/Binder, Asphaltic Particles	Glass fibers	14%	**None Detected ND**

Lab ID: 24037564 **Client Sample #: 41924.000-057**

Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Layer 1 of 4	**Description:** Silver paint			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Metallic paint	Wollastonite	3%	**None Detected ND**
Layer 2 of 4	**Description:** Multi-layered black asphaltic material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Asphalt/Binder, Asphaltic Particles	Glass fibers	12%	**None Detected ND**
		Synthetic fibers	5%	
Layer 3 of 4	**Description:** Tan foamy material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Foamy material	None Detected	ND	**None Detected ND**
Layer 4 of 4	**Description:** Multi-layered black asphaltic material			
	Non-Fibrous Materials:	Other Fibrous Materials:%		**Asbestos Type: %**
	Asphalt/Binder, Asphaltic Particles	Glass fibers	15%	**None Detected ND**

Sampled by: Client
Analyzed by: Kunga Woser **Date:** 04/05/2024
Reviewed by: Hilary Crumley **Date:** 04/05/2024

Hilary Crumley, Manager Asbestos Laboratory

Note: If samples are not homogeneous, then subsamples of the components were analyzed separately. All bulk samples are analyzed using both EPA 600/R-93/116 and EPA 40 CFR Appendix E to Subpart E of Part 763 with the following measurement uncertainties for the reported % Asbestos (1%=0-3%, 5%=1-9%, 10%=5-15%, 20%=10-30%, 50%=40-60%). This report relates only to the items tested. If sample was not collected by NVL personnel, then the accuracy of the results is limited by the methodology and acuity of the sample collector. This report shall not be reproduced except in full, without written approval of NVL Laboratories, Inc. It shall not be used to claim product endorsement by NVLAP or any other agency of the US Government

ASBESTOS LABORATORY SERVICES

Company	PBS Environmental - Seattle	**NVL Batch Number**	**2405938.00**
Address	214 E Galer St. Suite. 300 Seattle, WA 98102	**TAT** 2 Days	**AH** No
		Rush TAT	
Project Manager	Mr. Ryan Hunter	**Due Date** 4/5/2024	**Time** 5:00 PM
Phone	(206) 233-9639	**Email**	ryan.hunter@pbsusa.com
Cell	(484) 269-2138	**Fax**	(866) 727-0140

Project Name/Number: 41924.000 **Project Location:** Bainbridge Aquatic Center Renovation-Ray Williamson

Subcategory PLM Bulk

Item Code ASB-02 EPA 600/R-93-116 Asbestos by PLM <bulk>

Total Number of Samples 21 Rush Samples

	Lab ID	Sample ID	Description	A/R
1	24037544	41924.000-037		A
2	24037545	41924.000-038		A
3	24037546	41924.000-039		A
4	24037547	41924.000-040		A
5	24037548	41924.000-041		A
6	24037549	41924.000-042		A
7	24037550	41924.000-043		A
8	24037551	41924.000-044		A
9	24037552	41924.000-045		A
10	24037553	41924.000-046		A
11	24037554	41924.000-047		A
12	24037555	41924.000-048		A
13	24037556	41924.000-049		A
14	24037557	41924.000-050		A
15	24037558	41924.000-051		A
16	24037559	41924.000-052		A
17	24037560	41924.000-053		A
18	24037561	41924.000-054		A

	Print Name	Signature	Company	Date	Time
Sampled by	Client				
Relinquished by	Client				

Office Use Only	Print Name	Signature	Company	Date	Time
Received by	Rachelle Miller		NVL	4/3/24	1700
Analyzed by	Kunga Woser		NVL	4/5/24	
Results Called by					
☐ **Faxed** ☐ **Emailed**					

Special Instructions:

Date: 4/3/2024
Time: 5:09 PM
Entered By: Rachelle Miller

ASBESTOS LABORATORY SERVICES

Company	PBS Environmental - Seattle	**NVL Batch Number**	**2405938.00**
Address	214 E Galer St. Suite. 300 Seattle, WA 98102	**TAT** 2 Days	**AH** No
		Rush TAT	
Project Manager	Mr. Ryan Hunter	**Due Date** 4/5/2024	**Time** 5:00 PM
Phone	(206) 233-9639	**Email**	ryan.hunter@pbsusa.com
Cell	(484) 269-2138	**Fax**	(866) 727-0140

Project Name/Number: 41924.000 **Project Location:** Bainbridge Aquatic Center Renovation-Ray Williamson

Subcategory PLM Bulk

Item Code ASB-02 EPA 600/R-93-116 Asbestos by PLM <bulk>

Total Number of Samples 21 Rush Samples

	Lab ID	Sample ID	Description	A/R
19	24037562	41924.000-055		A
20	24037563	41924.000-056		A
21	24037564	41924.000-057		A

	Print Name	Signature	Company	Date	Time
Sampled by	Client				
Relinquished by	Client				

Office Use Only	Print Name	Signature	Company	Date	Time
Received by	Rachelle Miller		NVL	4/3/24	1700
Analyzed by	Kunga Woser		NVL	4/5/24	
Results Called by					
☐ **Faxed** ☐ **Emailed**					

Special Instructions:

Date: 4/3/2024
Time: 5:09 PM
Entered By: Rachelle Miller

PBS
AN APEX COMPANY

LABORATORY CH 2405938

Project: Bainbridge Aquatic Center Renovation – Ray Williamson **Project #:** 41924.000

Analysis requested: PLM **Date:** 04/03/2024

Relinq'd by/Signature: Ryan Hunter / Ryan Hu **Date/Time:** 04/03/2024

Received by/Signature: Rachelle Miller MLR **Date/Time:** 4/3/24 @ 1700

Email ALL INVOICES to: seattleap@pbsusa.com

E-mail results to:

- ☐ Willem Mager
- ☐ Gregg Middaugh
- ☐ Mark Hiley
- ☒ Ryan Hunter
- ☐ Janet Murphy
- ☐ Ferman Fletcher
- ☐ Claire Tsai
- ☐ Toan Nguyen
- ☐ Peter Stensland
- ☐ Cameron Budnick
- ☐ Nick San
- ☐ Katie King
- ☐ Kameron DeMonnin
- ☐ _____

TURN AROUND TIME:

- ☐ 1 Hour
- ☐ 2 Hours
- ☐ 4 Hours
- ☐ 24 Hours
- ☒ 48 Hours
- ☐ 3-5 Days
- ☐ Other_____

NOTE: ***Composite if positive

SAMPLE DATA FORM

Sample #	Material	Location	Lab
41924.000-037	Exterior Brick and Mortar	East Elevation	NVL
41924.000-038	Black Exterior Window Putty Patch	Roof Pool Windows	
41924.000-039	Black Exterior Window Putty	Roof Pool Windows	
41924.000-040	Exterior Window Frame Caulk at Rough Opening & Brick	East Elevation North	
41924.000-041	Exterior Window Frame Caulk at Metal and Wood Beam	East Elevation Central	
41924.000-042	Exterior Window Frame Caulk at Frame and Metal Base	East Elevation	
41924.000-043	Exterior Window Frame Caulk at Rough Opening and Brick	East Elevation South Side	
41924.000-044	Exterior Window Frame Caulk at Metal Column and Frame	South Elevation	
41924.000-045	Exterior Window Frame Caulk at Metal and Brick	South Elevation	
41924.000-046	Exterior Window Frame Caulk at Frame and Wood Siding	Pool Roof Windows	
41924.000-047	Exterior Window Frame Caulk at Wood Frame and Metal	Roof Lobby Windows	
41924.000-048	Gray Caulk at Roof Exhaust	Roof East Side	
41924.000-049	Exterior Door Frame Caulk at Rough Opening and Brick	East Elevation	
41924.000-050	Exterior Door Frame Caulk at Rough Opening and Brick	South Elevation	
41924.000-051	Black Felt Paper Behind Wood Siding	Roof Mech Room East	
41924.000-052	Black Felt Paper Behind Wood Siding	Roof Mech Room West	
41924.000-053	Black Asphaltic Material in Roof Drain	Roof Center Drain	
41924.000-054	Parapet Roofing	West Side	

214 EAST GALER STREET, SUITE 300, SEATTLE, WA 98102 ▪ 206.233.9639 MAIN ▪ 866.727.0140 FAX ▪ PBSUSA.COM

PBS
AN APEX COMPANY

LABORATORY CHAI 2405938

Project: Bainbridge Aquatic Center Renovation – Ray Williamson **Project #:** 41924.000

SAMPLE DATA FORM			
Sample #	**Material**	**Location**	**Lab**
41924.000-055	Roughing at Lobby Windows	Roof South Windows	NVL
41924.000-056	Built-up Roofing	Office Roof West Side	↓
41924.000-057	Built-up Roofing	Office Roof East Side	↓

APPENDIX B

AA Lead Paint Chip Sampling Information

AA Lead Paint Chip Sample Inventory
AA Lead Paint Chip Laboratory Data Sheets
AA Lead Paint Chip Chain-of-Custody Documentation

AA LEAD PAINT CHIP SAMPLE INVENTORY

PBS Sample #	Paint Color / Component or Substrate	Sample Location	Results (mg/kg)	Results (%)	Lab
41924.000-Pb01	White / Gypsum Wallboard / Wall	Tutor Office 6	<48	<0.0048	NVL
41924.000-Pb02	White / Concrete Masonry Unit / Wall	Pool Deck West	<49	<0.0049	NVL
41924.000-Pb03	Blue / Brick / Wall	Pool at Control Office 7	<53	<0.0053	NVL
41924.000-Pb04	White / Brick / Wall	Lobby Room 9	<46	<0.0046	NVL
41924.000-Pb05	Blue / Wood / Frame	Lobby Door	<110	<0.011	NVL
41924.000-Pb06	Blue / Metal / Frame	Filter Room Door	140	0.014	NVL
41924.000-Pb07	White / Metal / Support	Spring Board	<49	<0.0049	NVL
41924.000-Pb08	Brown / Metal / Flashing	Parapet Cap at Roof	<130	<0.013	NVL

mg/kg = Milligrams per kilogram
< = Less than the Limit of Detection

April 2, 2024

Ryan Hunter
PBS Environmental - Seattle
214 E Galer St. Suite. 300
Seattle, WA 98102

NVL Batch # 2405649.00

RE: Total Metal Analysis
Method: EPA 7000B Lead by FAA <paint>
Item Code: FAA-02

Client Project: 41924.000
Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Dear Mr. Hunter,

NVL Labs received 7 sample(s) for the said project on 4/1/2024. Preparation of these samples was conducted following protocol outlined in EPA 3051/7000B , unless stated otherwise. Analysis of these samples was performed using analytical instruments in accordance with EPA 7000B Lead by FAA <paint>. The results are usually expressed in mg/Kg and percentage (%). Test results are not blank corrected.

For recent regulation updates pertaining to current regulatory levels or permissible exposure levels, please call your local regulatory agencies for more detail.

At NVL Labs all analyses are performed under strict guidelines of the Quality Assurance Program. This report is considered highly confidential and will not be released without your approval. Samples are archived after two weeks from the analysis date. Please feel free to contact us at 206-547-0100, in case you have any questions or concerns.

Sincerely,

Nick Ly, Technical Manager

Enc.: Sample results

Analysis Report

Total Lead (Pb)

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation - Ray Williamson

Batch #: 2405649.00
Matrix: Paint
Method: EPA 3051/7000B
Client Project #: 41924.000
Date Received: 4/1/2024
Samples Received: 7
Samples Analyzed: 7

Lab ID	Client Sample #	Sample Weight (g)	RL in mg/Kg	Results in mg/Kg	Results in percent
24034794	41924.000-Pb01	0.2067	48	< 48	<0.0048
24034795	41924.000-Pb02	0.2048	49	< 49	<0.0049
24034796	41924.000-Pb03	0.1875	53	< 53	<0.0053
24034797	41924.000-Pb04	0.2155	46	< 46	<0.0046
24034798	41924.000-Pb05	0.0931	110	< 110	<0.011
24034799	41924.000-Pb06	0.1601	62	140	0.014
24034800	41924.000-Pb07	0.2061	49	< 49	<0.0049

Sampled by: Client
Analyzed by: Yasuyuki Hida
Reviewed by: Nick Ly

Date Analyzed: 04/01/2024
Date Issued: 04/02/2024

Nick Ly, Technical Manager

mg/ Kg =Milligrams per kilogram
Percent = Milligrams per kilogram / 10000
Note : Method QC results are acceptable unless stated otherwise.
Unless otherwise indicated, the condition of all samples was acceptable at time of receipt.

RL = Reporting Limit
'<' = Below the reporting Limit

Bench Run No: 2024-0401-06
FAA-02

LEAD LABORATORY SERVICES

Company	PBS Environmental - Seattle	**NVL Batch Number**	**2405649.00**
Address	214 E Galer St. Suite. 300 Seattle, WA 98102	**TAT** 2 Days **AH** No **Rush TAT**	
Project Manager	Mr. Ryan Hunter	**Due Date** 4/3/2024 **Time**	8:00 AM
Phone	(206) 233-9639	**Email**	ryan.hunter@pbsusa.com
Cell	(484) 269-2138	**Fax**	(866) 727-0140

Project Name/Number: 41924.000 **Project Location:** Bainbridge Aquatic Center Renovation - Ray Williamson

Subcategory Flame AA (FAA)

Item Code FAA-02 EPA 7000B Lead by FAA <paint>

Total Number of Samples 7 Rush Samples

	Lab ID	Sample ID	Description	A/R
1	24034794	41924.000-Pb01		A
2	24034795	41924.000-Pb02		A
3	24034796	41924.000-Pb03		A
4	24034797	41924.000-Pb04		A
5	24034798	41924.000-Pb05		A
6	24034799	41924.000-Pb06		A
7	24034800	41924.000-Pb07		A

	Print Name	Signature	Company	Date	Time
Sampled by	Client				
Relinquished by	Drop Box				

Office Use Only	Print Name	Signature	Company	Date	Time
Received by	Rachelle Miller		NVL	4/1/24	800
Analyzed by	Yasuyuki Hida		NVL	4/1/24	
Results Called by					
☐ **Faxed** ☐ **Emailed**					

Special Instructions:

Date: 4/1/2024
Time: 8:48 AM
Entered By: Kelly AuVu

PBS
AN APEX COMPANY

LABORATORY C 2405649

Project: Bainbrige Aquatic Center Renovation – Ray Williamson **Project #:** 41924.000 Page **1** of **1**

Analysis requested: FAA – Total Lead Paint Chip Analysis **Date:** 03/29/2024

Relinq'd by/Signature: Ryan Hunter / [signature] **Date/Time:** 03/29/2024

Received by/Signature: [signature] **Date/Time:** 3-22 4-1-24 820

Email ALL INVOICES to: seattleap@pbsusa.com

E-mail results to:

- ☐ Willem Mager
- ☐ Gregg Middaugh
- ☐ Mark Hiley
- ☒ Ryan Hunter
- ☐ Janet Murphy
- ☐ Ferman Fletcher
- ☐ Claire Tsai
- ☐ Toan Nguyen
- ☐ Peter Stensland
- ☐ Cameron Budnick
- ☐ Nick San
- ☐ Katie King
- ☐ Kameron DeMonnin
- ☐ _____

TURN AROUND TIME:

- ☐ 1 Hour
- ☐ 2 Hours
- ☐ 4 Hours
- ☐ 24 Hours
- ☒ 48 Hours
- ☐ 3-5 Days
- ☐ Other_____

NOTE: ***Composite if positive

SAMPLE DATA FORM

Sample #	Material	Location	Lab
41924.000-Pb01	White / GWB / Wall	Tutor	NVL
41924.000-Pb02	White / CMU / Wall	Pool Deck West	
41924.000-Pb03	Blue / Brick / Wall	Pool at Control	
41924.000-Pb04	White / Brick / Wall	Lobby	
41924.000-Pb05	Blue / Wood / Frame	Lobby Door	
41924.000-Pb06	Blue / Metal / Frame	Filter Room Door	
41924.000-Pb07	White / Metal / Support	Spring Board	

April 4, 2024

Ryan Hunter
PBS Environmental - Seattle
214 E Galer St. Suite. 300
Seattle, WA 98102

NVL Batch # 2405939.00

RE: Total Metal Analysis
Method: EPA 7000B Lead by FAA <paint>
Item Code: FAA-02

Client Project: 41924.000
Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Dear Mr. Hunter,

NVL Labs received 1 sample(s) for the said project on 4/3/2024. Preparation of these samples was conducted following protocol outlined in EPA 3051/7000B , unless stated otherwise. Analysis of these samples was performed using analytical instruments in accordance with EPA 7000B Lead by FAA <paint>. The results are usually expressed in mg/Kg and percentage (%). Test results are not blank corrected.

For recent regulation updates pertaining to current regulatory levels or permissible exposure levels, please call your local regulatory agencies for more detail.

At NVL Labs all analyses are performed under strict guidelines of the Quality Assurance Program. This report is considered highly confidential and will not be released without your approval. Samples are archived after two weeks from the analysis date. Please feel free to contact us at 206-547-0100, in case you have any questions or concerns.

Sincerely,

Nick Ly, Technical Manager

Enc.: Sample results

Analysis Report

Total Lead (Pb)

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405939.00
Matrix: Paint
Method: EPA 3051/7000B
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 1
Samples Analyzed: 1

Lab ID	Client Sample #	Sample Weight (g)	RL in mg/Kg	Results in mg/Kg	Results in percent
24037565	41924.000-Pb08	0.0399	130	< 130	< 0.013

Comments: Small sample size (<0.05g)

Sampled by: Client
Analyzed by: Yasuyuki Hida
Reviewed by: Nick Ly
Date Analyzed: 04/04/2024
Date Issued: 04/04/2024

Nick Ly, Technical Manager

mg/ Kg =Milligrams per kilogram
Percent = Milligrams per kilogram / 10000
RL = Reporting Limit
'<' = Below the reporting Limit
Note : Method QC results are acceptable unless stated otherwise.
Unless otherwise indicated, the condition of all samples was acceptable at time of receipt.

Bench Run No: 2024-0404-01
FAA-02

LEAD LABORATORY SERVICES

Company	PBS Environmental - Seattle	**NVL Batch Number**	**2405939.00**
Address	214 E Galer St. Suite. 300 Seattle, WA 98102	**TAT** 2 Days **AH** No **Rush TAT**	
Project Manager	Mr. Ryan Hunter	**Due Date** 4/5/2024 **Time** 5:00 PM	
Phone	(206) 233-9639	**Email**	ryan.hunter@pbsusa.com
Cell	(484) 269-2138	**Fax**	(866) 727-0140

Project Name/Number: 41924.000 **Project Location:** Bainbridge Aquatic Center Renovation-Ray Williamson

Subcategory Flame AA (FAA)

Item Code FAA-02 EPA 7000B Lead by FAA <paint>

Total Number of Samples 1 Rush Samples

	Lab ID	Sample ID	Description	A/R
1	24037565	41924.000-Pb08		A

	Print Name	Signature	Company	Date	Time
Sampled by	Client				
Relinquished by	Client				

Office Use Only	Print Name	Signature	Company	Date	Time
Received by	Rachelle Miller		NVL	4/3/24	1700
Analyzed by	Yasuyuki Hida		NVL	4/4/24	
Results Called by					
☐ **Faxed** ☐ **Emailed**					

Special Instructions:

Date: 4/3/2024
Time: 5:16 PM
Entered By: Rachelle Miller

PBS
AN APEX COMPANY

LABORATORY CH 2405939

Project: Bainbrige Aquatic Center Renovation – Ray Williamson **Project #:** 41924.000 Page 1 of 1

Analysis requested: FAA – Total Lead Paint Chip Analysis **Date:** 04/03/2024

Relinq'd by/Signature: Ryan Hunter / **Date/Time:** 04/03/2024

Received by/Signature: Rachelle Miller NVL **Date/Time:** 4/3/24 @ 1700

Email ALL INVOICES to: seattleap@pbsusa.com

E-mail results to:

- ☐ Willem Mager
- ☐ Gregg Middaugh
- ☐ Mark Hiley
- ☒ Ryan Hunter
- ☐ Janet Murphy
- ☐ Ferman Fletcher
- ☐ Claire Tsai
- ☐ Toan Nguyen
- ☐ Peter Stensland
- ☐ Cameron Budnick
- ☐ Nick San
- ☐ Katie King
- ☐ Kameron DeMonnin
- ☐ _____

TURN AROUND TIME:

- ☐ 1 Hour
- ☐ 2 Hours
- ☐ 4 Hours
- ☐ 24 Hours
- ☒ 48 Hours
- ☐ 3-5 Days
- ☐ Other_____

NOTE: ***Composite if positive

SAMPLE DATA FORM

Sample #	Material	Location	Lab
41924.000-Pb08	Brown / Metal / Flashing	Parapet Cap	NVL

APPENDIX C

PCB Sampling Information

PCB Sample Inventory

PCB Laboratory Data Sheets

PCB Chain-of-Custody Documentation

PCB SAMPLE INVENTORY

PBS Sample #	Material	Sample Location	Analyte	Lab Results (mg/kg)	Lab
41924.000-PCB01	Interior Door Frame Caulk	East Interior	Aroclor-1016	<1.2	NVL
			Aroclor-1221	<1.2	
			Aroclor-1232	<1.2	
			Aroclor-1242	<1.2	
			Aroclor-1248	<1.2	
			Aroclor-1254	<1.2	
			Aroclor-1260	<1.2	
			PCB, Total	<1.2	
41924.000-PCB02	Exterior Window Frame Caulk @ Rough Opening and Brick	East Elevation - South	Aroclor-1016	<1.1	NVL
			Aroclor-1221	<1.1	
			Aroclor-1232	<1.1	
			Aroclor-1242	<1.1	
			Aroclor-1248	<1.1	
			Aroclor-1254	1.6	
			Aroclor-1260	<1.1	
			PCB, Total	1.6	
41924.000-PCB03	Exterior Window Frame Caulk at Metal Column and Frame	South Elevation	Aroclor-1016	<19	NVL
			Aroclor-1221	<19	
			Aroclor-1232	<19	
			Aroclor-1242	<19	
			Aroclor-1248	<19	
			Aroclor-1254	<19	
			Aroclor-1260	<19	
			PCB, Total	<19	

mg/kg = Milligrams per kilogram
< = Less than the Limit of Detection

PCB SAMPLE INVENTORY

PBS Sample #	Material	Sample Location	Analyte	Lab Results (mg/kg)	Lab
41924.000-PCB04	Exterior Door Frame Caulk at Rough Opening and Brick	East Elevation	Aroclor-1016	<0.76	NVL
			Aroclor-1221	<0.76	
			Aroclor-1232	<0.76	
			Aroclor-1242	<0.76	
			Aroclor-1248	<0.76	
			Aroclor-1254	<0.76	
			Aroclor-1260	<0.76	
			PCB, Total	<0.76	

mg/kg = Milligrams per kilogram
< = Less than the Limit of Detection

April 10, 2024

Ryan Hunter
PBS Environmental - Seattle
214 E Galer St. Suite. 300
Seattle, WA 98102

NVL Batch # 2405942.00

RE: Organics PCB
Method: 8082 PCB Aroclors <Bulk>
Item Code: ORG-05

Client Project: 41924.000
Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Dear Mr. Hunter,

Enclosed please find test results for samples submitted to our laboratory for analysis. Preparation and analysis of these samples were conducted in accordance with published industry standards and methods specified on the attached analytical report.

The content of this package consists of the following:

-Case Narrative & Definition of Data Qualifiers
-Analytical Test Results
-Applicable QC Summary
-Client Chain-of-Custody (CoC)
-NVL Receiving Record

The report is considered highly confidential and will not be released without your approval. Samples are archived for two weeks following analysis. Samples that are not retrieved by the client will be discarded after two weeks.

Thank you for using our laboratory services. If you need further assistance, please contact us at 206-547-0100 or 1-888-NVLLABS.

Sincerely,

Nick Ly, Technical Manager

Enc.: Sample results

NVL Batch # 2405942.00

Case Narrative:

The following summarizes samples received on date as shown on the accompanied Chain of custody by NVL Laboratories, Inc. from PBS Environmental - Seattle for Project Number 41924.000. Samples were logged in for PCB analysis per client request using both customer sample ID's and laboratory assigned ID's as listed on the Chain-of-Custody (CoC). All samples as received were processed and analyzed within specified turnaround time without any abnormalities and deviations that may affect the analytical results. All quality control requirements were acceptable unless stated otherwise. The conditions of all samples were acceptable at time of receipt and all samples submitted with this batch were analyzed unless stated otherwise on the CoC.

Test Results are reported in milligrams per kilogram (mg/kg) for PCB samples as shown on the analytical reports.

NVL Batch # 2405942.00

Definition Appendix

Terms

% Rec	Percent recovery.
<	Below Reporting Limit(RL) or Limit of Quantitation(LoQ) of the instrument.
B	Blank contamination. The recorded results is associated with a contaminated blank.
DF	Dilution Factor
J	The reported concentration is an estimated value because something may be present in the sample that interfered with the analysis.
J1	The reported concentration is an estimated value because the laboratory control sample (LCS) is out of control limits.
J2	The reported concentration is an estimated value because the percent recovery for matrix spike is out of control limits.
J3	The reported concentration is an estimated value because the relative percent difference(RPD) for duplicate analysis is out of control limits.
J4	Percent recovery is outside of established control limits.
LCS	Laboratory Control Sample.
LFS	Laboratory Fortified Spike
Limits	The upper and lower control limits for spike recoveries.
LN	Quality control sample is outside of control limits. This analyte was not detected in the sample.
LOQ	Limit of quantitation(same as RL)
mg/kg	Milligrams per kilogram.
ND	Analyte not detected or below the reporting limit of the instrument or methodology

Definition Appendix

Terms

PPM	Parts per Million.
QC Batch Group	Quality Control Batch Group. The entity that links analytical results and supporting quality control results.
R	The data are not reliable due to possible contamination or loss of material during preparation or analysis. Re-sampling and reanalysis are necessary for verification.
RL	Reporting Limit. The minimum concentration that can be quantified under routine operating conditions.
RPD	Relative Percent Difference. The relative difference between duplicate results(matrix spike, blank spike, or samples duplicate) expressed as a percentage.
RPD Limit	The maximum RPD allowed for a set of duplicate measurements(see RPD).
SSMI	Surrogate has matrix interference.
Spike Conc	The measured concentration, in sample basis units, of a spiked sample.
SURR-ND	Surrogate was not detected due to matrix interference or dilution.
ug/m³	Micrograms per cubic meter.
ug/100cm^2	Micrograms per hundred square centimeter.

Analysis Report

Polychlorinated Biphenyls by Gas Chromatography

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405942.00
Matrix: Bulk
Analysis Method: EPA 8082
Preparation Method: EPA 3546
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 4
Samples Analyzed: 4

Sample Number **41924.000-PCB01**
Lab Sample ID 24037590
Initial Sample Size 1.7351 gm
Matrix Bulk
Units of Result mg/Kg

Analyte	RL	Final Result	Analysis Date
Aroclor-1016	1.2	< 1.2	4/4/2024
Aroclor-1221	1.2	< 1.2	4/4/2024
Aroclor-1232	1.2	< 1.2	4/4/2024
Aroclor-1242	1.2	< 1.2	4/4/2024
Aroclor-1248	1.2	< 1.2	4/4/2024
Aroclor-1254	1.2	< 1.2	4/4/2024
Aroclor-1260	1.2	< 1.2	4/4/2024
PCBs, Total	**1.2**	**< 1.2**	

Analysis Report

Polychlorinated Biphenyls by Gas Chromatography

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405942.00
Matrix: Bulk
Analysis Method: EPA 8082
Preparation Method: EPA 3546
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 4
Samples Analyzed: 4

Sample Number **41924.000-PCB02**
Lab Sample ID 24037591
Initial Sample Size 1.8076 gm
Matrix Bulk
Units of Result mg/Kg

Analyte	RL	Final Result	Analysis Date
Aroclor-1016	1.1	< 1.1	4/4/2024
Aroclor-1221	1.1	< 1.1	4/4/2024
Aroclor-1232	1.1	< 1.1	4/4/2024
Aroclor-1242	1.1	< 1.1	4/4/2024
Aroclor-1248	1.1	< 1.1	4/4/2024
Aroclor-1254	1.1	1.6	4/4/2024
Aroclor-1260	1.1	< 1.1	4/4/2024
PCBs, Total	**1.1**	**1.6**	

Analysis Report

Polychlorinated Biphenyls by Gas Chromatography

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405942.00
Matrix: Bulk
Analysis Method: EPA 8082
Preparation Method: EPA 3546
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 4
Samples Analyzed: 4

Sample Number **41924.000-PCB03**
Lab Sample ID 24037592
Initial Sample Size 2.0884 gm
Matrix Bulk
Units of Result mg/Kg

Analyte	RL	Final Result	Analysis Date
Aroclor-1016	19	< 19	4/4/2024
Aroclor-1221	19	< 19	4/4/2024
Aroclor-1232	19	< 19	4/4/2024
Aroclor-1242	19	< 19	4/4/2024
Aroclor-1248	19	< 19	4/4/2024
Aroclor-1254	19	< 19	4/4/2024
Aroclor-1260	19	< 19	4/4/2024
PCBs, Total	**19**	**< 19**	

Comments: ***Reporting limit raised due to dilution (matrix interference).***

Analysis Report

Polychlorinated Biphenyls by Gas Chromatography

Client: PBS Environmental - Seattle
Address: 214 E Galer St. Suite. 300
Seattle, WA 98102

Attention: **Mr. Ryan Hunter**
Project Location: Bainbridge Aquatic Center Renovation-Ray Williamson

Batch #: 2405942.00
Matrix: Bulk
Analysis Method: EPA 8082
Preparation Method: EPA 3546
Client Project #: 41924.000
Date Received: 4/3/2024
Samples Received: 4
Samples Analyzed: 4

Sample Number **41924.000-PCB04**
Lab Sample ID 24037593
Initial Sample Size 1.3207 gm
Matrix Bulk
Units of Result mg/Kg

Analyte	RL	Final Result	Analysis Date
Aroclor-1016	0.76	< 0.76	4/4/2024
Aroclor-1221	0.76	< 0.76	4/4/2024
Aroclor-1232	0.76	< 0.76	4/4/2024
Aroclor-1242	0.76	< 0.76	4/4/2024
Aroclor-1248	0.76	< 0.76	4/4/2024
Aroclor-1254	0.76	< 0.76	4/4/2024
Aroclor-1260	0.76	< 0.76	4/4/2024
PCBs, Total	**0.76**	**< 0.76**	

Quality Control Results

Client Project #: 41924.000

Batch #: 2405942.00
Project Manager: Mr. Ryan Hunter

Preparation Method: EPA 3546
Preparation Date: 4/4/2024

Analysis Method: EPA 8082
Analysis Description: Polychlorinated Biphenyls by Gas Chromatography

Blank: 2405942

Analyte	Blank Results	Units	DF	RL	Control Limit	Qualifiers
Aroclor-1016	ND	mg/Kg	1	1.00	1.00	
Aroclor-1221	ND	mg/Kg	1	1.00	1.00	
Aroclor-1232	ND	mg/Kg	1	1.00	1.00	
Aroclor-1242	ND	mg/Kg	1	1.00	1.00	
Aroclor-1248	ND	mg/Kg	1	1.00	1.00	
Aroclor-1254	ND	mg/Kg	1	1.00	1.00	
Aroclor-1260	ND	mg/Kg	1	1.00	1.00	
PCBs, Total	**ND**	**mg/Kg**	**1**			
Surrogates:				% Rec		
Tetrachloro-m-xylene			1	87	40-140	
Decachlorobiphenyl			1	110	40-140	

Lab Control Sample: LCS 1254-2405942

Analyte	Blank Spike Results	Units	DF	Spike Conc	% Rec	Limits	Qualifiers
Aroclor-1254	17	mg/Kg	1	20.00	85	40-140	
Surrogates:							
Tetrachloro-m-xylene			1		92	40-140	
Decachlorobiphenyl			1		110	40-140	

Lab Control Sample: LCS 1016+1260-2405942
Lab Control Sample Duplicate: LCS Dup 1016+1260

Analyte	Blank Spike Results	Units	DF	Spike Conc	% Rec	Limits	RPD %	RPD Limit	Qualifiers
Aroclor-1016	15	mg/Kg	1	20.00	75	40-140			
	15			20.00	75	40-140	5	50%	
Aroclor-1260	18	mg/Kg	1	20.00	90	40-140			
	18			20.00	90	40-140	2	50%	
Surrogates:									
Tetrachloro-m-xylene			1		92	40-140			
					81	40-140			
Decachlorobiphenyl			1		130	40-140			
					110	40-140			

* Recovery outside of control limits

Bench Run No: 2024-0403-5

ORG-05

Surrogate Recovery Summary Report

Client PBS Environmental - Seattle **Batch #** 2405942.00

Project 41924.000

Customer Sample ID	Lab Sample ID	Analyte	Recovery	Limits
41924.000-PCB01	24037590	Decachlorobiphenyl	110%	40-140
41924.000-PCB01	24037590	Tetrachloro-m-xylene	95%	40-140
41924.000-PCB02	24037591	Decachlorobiphenyl	95%	40-140
41924.000-PCB02	24037591	Tetrachloro-m-xylene	75%	40-140
41924.000-PCB03	24037592	Decachlorobiphenyl	100%	40-140
41924.000-PCB03	24037592	Tetrachloro-m-xylene	68%	40-140
41924.000-PCB04	24037593	Decachlorobiphenyl	95%	40-140
41924.000-PCB04	24037593	Tetrachloro-m-xylene	82%	40-140

*Recovery outside of the limits

NVL Batch # 2405942.00

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Sample	Analyzed	Analyte	Target	Solution Conc	Unit	% Rec	Limits
ICV-1016	4/3/2024	Aroclor-1016	5.0	4.83	ug/mL	97	85-115
ICV-1254	4/3/2024	Aroclor-1254	5.0	5.04	ug/mL	101	85-115
ICV-1260	4/3/2024	Aroclor-1260	5.0	5.38	ug/mL	108	85-115
CCV1-1016	4/3/2024	Aroclor-1016	5.0	4.80	ug/mL	96	80-120
CCV1-1254	4/3/2024	Aroclor-1254	5.0	4.46	ug/mL	89	80-120
CCV1-1260	4/3/2024	Aroclor-1260	5.0	4.52	ug/mL	90	80-120
CCV2-1016	4/3/2024	Aroclor-1016	5.0	5.38	ug/mL	108	80-120
CCV2-1254	4/3/2024	Aroclor-1254	5.0	5.16	ug/mL	103	80-120
CCV2-1260	4/3/2024	Aroclor-1260	5.0	5.24	ug/mL	105	80-120
CCV3-1016	4/3/2024	Aroclor-1016	5.0	5.27	ug/mL	105	80-120
CCV3-1254	4/3/2024	Aroclor-1254	5.0	4.96	ug/mL	99	80-120
CCV3-1260	4/3/2024	Aroclor-1260	5.0	5.15	ug/mL	103	80-120
CCV4-1016	4/3/2024	Aroclor-1016	5.0	5.52	ug/mL	110	80-120
CCV4-1254	4/3/2024	Aroclor-1254	5.0	5.14	ug/mL	103	80-120
CCV4-1260	4/3/2024	Aroclor-1260	5.0	5.22	ug/mL	104	80-120

% Rec - Percent recovery

* Percent recovery not within control limits

Bench Run No: 2024-0403-5

ORG-05

ORGANICS LABORATORY SERVICES

Company	PBS Environmental - Seattle	**NVL Batch Number**	**2405942.00**
Address	214 E Galer St. Suite. 300 Seattle, WA 98102	**TAT** 5 Days **AH** No **Rush TAT**	
Project Manager	Mr. Ryan Hunter	**Due Date** 4/10/2024 **Time** 5:00 PM	
Phone	(206) 233-9639	**Email**	ryan.hunter@pbsusa.com
Cell	(484) 269-2138	**Fax**	(866) 727-0140

Project Name/Number: 41924.000 **Project Location:** Bainbridge Aquatic Center Renovation-Ray Williamson

Subcategory Quantitative analysis

Item Code ORG-05 8082 PCB Aroclors <Bulk>

Total Number of Samples 4 Rush Samples

	Lab ID	Sample ID	Description	A/R
1	24037590	41924.000-PCB01		A
2	24037591	41924.000-PCB02		A
3	24037592	41924.000-PCB03		A
4	24037593	41924.000-PCB04		A

	Print Name	Signature	Company	Date	Time
Sampled by	Client				
Relinquished by	Client				

Office Use Only	Print Name	Signature	Company	Date	Time
Received by	Rachelle Miller		NVL	4/3/24	1700
Analyzed by	Evelyn Ahulu		NVL	4/4/24	
Results Called by					
☐ **Faxed** ☐ **Emailed**					

Special Instructions:

Date: 4/3/2024
Time: 5:26 PM
Entered By: Rachelle Miller

PBS
AN APEX COMPANY

LABORATORY C 2405942

Project: Bainbrige Aquatic Center Renovation – Ray Williamson **Project #:** 41924.000 Page 1 of 1

Analysis requested: EPA 8082 – PCB Bulk **Date:** 04/03/2024

Relinq'd by/Signature: Ryan Hunter / **Date/Time:** 04/03/2024

Received by/Signature: Rachelle Miller MM **Date/Time:** 4/3/24 @ 1700

Email ALL INVOICES to: seattleap@pbsusa.com

E-mail results to:

- ☐ Willem Mager
- ☐ Gregg Middaugh
- ☐ Mark Hiley
- ☒ Ryan Hunter
- ☐ Janet Murphy
- ☐ Ferman Fletcher
- ☐ Claire Tsai
- ☐ Toan Nguyen
- ☐ Peter Stensland
- ☐ Cameron Budnick
- ☐ Nick San
- ☐ Katie King
- ☐ Kameron DeMonnin
- ☐ _____

TURN AROUND TIME:

- ☐ 1 Hour
- ☐ 2 Hours
- ☐ 4 Hours
- ☐ 24 Hours
- ☐ 48 Hours
- ☒ 5 Day
- ☐ Other_____

SAMPLE DATA FORM

Sample #	Material	Location	Lab
41924.000-PCB01	Interior Door Frame Caulk	East Interior	NVL
41924.000-PCB02	Exterior Window Frame Caulk @ Rough Opening and Brick	East Elevation - South	↓
41924.000-PCB03	Exterior Window Frame Caulk at Metal Column and Frame	South Elevation	↓
41924.000-PCB04	Exterior Rood Frame Caulk at Rough Opening and Brick	East Elevation	↓

APPENDIX D

Metals in Masonry Components Sampling Information

RCRA 8 Sample Inventory

RCRA 8 Laboratory Data Sheets

RCRA 8 Chain-of-Custody Documentation

RCRA SAMPLE INVENTORY

PBS Sample #	Material	Sample Location	Analyte	Lab Results (mg/kg)	Lab
41924.000-RCRA01	Mortar associated with Brick	East Elevation	Arsenic	47.5	FA
			Barium	91.1	
			Cadmium	0.0427	
			Chromium	15.8	
			Lead	6.33	
			Mercury	ND	
			Selenium	ND	
			Silver	0.0222	

mg/kg = Milligrams per kilogram
< = Less than the Limit of Detection

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

PBS Engineering & Environmental
Ryan Hunter
214 E Galer St. Suite 300
Seattle, WA 98102

RE: Bainbridge Aquatic Center Renovation - Ray Williamson
Work Order Number: 2404100

April 11, 2024

Attention Ryan Hunter:

Fremont Analytical, Inc, an Alliance Technical Group company, received 1 sample(s) on 4/4/2024 for the analyses presented in the following report.

Total Metals by EPA Method 6020

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed according to our accredited Quality Assurance program. Please contact the laboratory if you should have any questions about the results.

Please note, while the appearance of our logo and branding will update, our commitment to accuracy, speed, and customer service remain values celebrated and shared by Alliance Technical Group. Thank you for the opportunity to serve you.

Sincerely,

Brianna Barnes
Project Manager

Date: *04/11/2024*

CLIENT: PBS Engineering & Environmental
Project: Bainbridge Aquatic Center Renovation - Ray
Work Order: 2404100

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2404100-001	41924.000-RCRA01	04/04/2024 12:00 AM	04/04/2024 8:23 AM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2404100**
Date: **4/11/2024**

CLIENT: PBS Engineering & Environmental
Project: Bainbridge Aquatic Center Renovation - Ray Williamson

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2404100**
Date Reported: **4/11/2024**

Client: PBS Engineering & Environmental
Collection Date: 4/4/2024
Project: Bainbridge Aquatic Center Renovation - Ray Williamson
Lab ID: 2404100-001
Matrix:
Client Sample ID: 41924.000-RCRA01

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Metals by EPA Method 6020				Batch ID: 43525		Analyst: ME
Arsenic	47.5	0.252		mg/Kg	1	4/10/2024 2:51:00 PM
Barium	91.1	0.504		mg/Kg	1	4/10/2024 2:51:00 PM
Cadmium	0.0427	0.0202		mg/Kg	1	4/10/2024 2:51:00 PM
Chromium	15.8	0.252		mg/Kg	1	4/10/2024 2:51:00 PM
Lead	6.33	1.01		mg/Kg	1	4/10/2024 2:51:00 PM
Mercury	ND	0.202		mg/Kg	1	4/10/2024 2:51:00 PM
Selenium	ND	1.01		mg/Kg	1	4/10/2024 2:51:00 PM
Silver	0.0222	0.0202		mg/Kg	1	4/10/2024 2:51:00 PM

Work Order: 2404100
CLIENT: PBS Engineering & Environmental
Project: Bainbridge Aquatic Center Renovation - Ray

QC SUMMARY REPORT

Total Metals by EPA Method 6020

Sample ID: **MB-43525**	SampType: **MBLK**	Units: **mg/Kg**	Prep Date: **4/10/2024**	RunNo: **90893**
Client ID: **MBLKS**	Batch ID: **43525**		Analysis Date: **4/10/2024**	SeqNo: **1895282**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	ND	0.258									
Barium	ND	0.517									
Cadmium	ND	0.0207									
Chromium	ND	0.258									
Lead	ND	1.03									
Mercury	ND	0.207									
Selenium	ND	1.03									
Silver	ND	0.0207									

Sample ID: **LCS-43525**	SampType: **LCS**	Units: **mg/Kg**	Prep Date: **4/10/2024**	RunNo: **90893**
Client ID: **LCSS**	Batch ID: **43525**		Analysis Date: **4/10/2024**	SeqNo: **1895283**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	39.5	0.244	39.06	0	101	80	120				
Barium	39.0	0.488	39.06	0	99.9	80	120				
Cadmium	2.03	0.0195	1.953	0	104	80	120				
Chromium	41.6	0.244	39.06	0	106	80	120				
Lead	20.7	0.977	19.53	0	106	80	120				
Mercury	1.00	0.195	0.9766	0	103	80	120				
Selenium	4.04	0.977	3.906	0	103	80	120				
Silver	2.00	0.0195	1.953	0	102	80	120				

Sample ID: **2404135-001AMS**	SampType: **MS**	Units: **mg/Kg-dry**	Prep Date: **4/10/2024**	RunNo: **90893**
Client ID: **BATCH**	Batch ID: **43525**		Analysis Date: **4/10/2024**	SeqNo: **1895286**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	62.7	0.342	54.74	5.464	105	75	125				
Barium	156	0.684	54.74	86.49	127	75	125				S
Cadmium	4.12	0.0274	2.737	1.099	110	75	125				
Chromium	81.8	0.342	54.74	20.36	112	75	125				
Lead	224	1.37	27.37	168.9	201	75	125				ES

Work Order: 2404100
CLIENT: PBS Engineering & Environmental
Project: Bainbridge Aquatic Center Renovation - Ray

QC SUMMARY REPORT

Total Metals by EPA Method 6020

Sample ID: **2404135-001AMS** SampType: **MS** Units: **mg/Kg-dry** Prep Date: **4/10/2024** RunNo: **90893**
Client ID: **BATCH** Batch ID: **43525** Analysis Date: **4/10/2024** SeqNo: **1895286**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Mercury	1.82	0.274	1.368	0.2384	115	75	125				
Selenium	6.24	1.37	5.474	0.5060	105	75	125				
Silver	3.20	0.0274	2.737	0.2368	108	75	125				

NOTES:
S - Spiked amount was low relative to sample concentration. Outlying spike recoveries may be expected.

Sample ID: **2404135-001AMSD** SampType: **MSD** Units: **mg/Kg-dry** Prep Date: **4/10/2024** RunNo: **90893**
Client ID: **BATCH** Batch ID: **43525** Analysis Date: **4/10/2024** SeqNo: **1895287**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Arsenic	58.2	0.314	50.17	5.464	105	75	125	62.71	7.54	20	
Barium	159	0.627	50.17	86.49	145	75	125	156.1	2.13	20	S
Cadmium	3.91	0.0251	2.509	1.099	112	75	125	4.122	5.24	20	
Chromium	72.9	0.314	50.17	20.36	105	75	125	81.76	11.4	20	
Lead	215	1.25	25.09	168.9	183	75	125	224.0	4.20	20	ES
Mercury	1.63	0.251	1.254	0.2384	111	75	125	1.816	10.6	20	
Selenium	5.84	1.25	5.017	0.5060	106	75	125	6.237	6.53	20	
Silver	2.93	0.0251	2.509	0.2368	107	75	125	3.205	8.88	20	

NOTES:
S - Spiked amount was low relative to sample concentration. Outlying spike recoveries may be expected.

Fremont Analytical
An Alliance Technical Group Company

Sample Log-In Check List

Client Name:	PBS	Work Order Number:	2404100
Logged by:	Morgan Wilson	Date Received:	4/4/2024 8:24:00 AM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☐	No ☑	NA ☐
		Unknown prior to receipt.		
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all hold times (except field parameters, pH e.g.) able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

17. Additional remarks:

Item Information

Item #	Temp °C
Sample	17.9

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

2404100

PBS
AN APEX COMPANY

LABORATORY CHAIN OF CUSTODY

Project: Bainbridge Aquatic Center Renovation – Ray Williamson **Project #:** 41924.000 Page 1 of 1

Analysis requested: EPA 6020 – RCRA 8 Metals **Date:** ~~04/03/2024~~ 04/04/2024

Relinq'd by/Signature: Ryan Hunter / **Date/Time:**

Received by/Signature: **Date/Time:** 4/4 8:23AM

Email ALL INVOICES to: seattleap@pbsusa.com

E-mail results to:

- ☐ Willem Mager
- ☐ Gregg Middaugh
- ☐ Mark Hiley
- ☒ Ryan Hunter
- ☐ Janet Murphy
- ☐ Ferman Fletcher
- ☐ Claire Tsai
- ☐ Toan Nguyen
- ☐ Peter Stensland
- ☐ Cameron Budnick
- ☐ Nick San
- ☐ Katie King
- ☐ Kameron DeMonnin
- ☐ _____

TURN AROUND TIME:

- ☐ 1 Hour
- ☐ 2 Hours
- ☐ 4 Hours
- ☐ 24 Hours
- ☐ 48 Hours
- ☒ 5 Day
- ☐ Other_____

SAMPLE DATA FORM

Sample #	Material	Location	Lab
41924.000-RCRA01	Mortar Associated with Brick	East Elevation	FA

APPENDIX E

Certification

THIS IS TO CERTIFY THAT

RYAN HUNTER

HAS SUCCESSFULLY COMPLETED THE TRAINING COURSE

for

ONLINE AHERA ASBESTOS INSPECTOR REFRESHER

In accordance with TSCA Title II, Part 763, Subpart E, Appendix C of 40 CFR

Course Date: 03/05/2024

Course Location: Online

Certificate: IRO-24-7254B

For verification of the authenticity of this certificate contact:
PBS Engineering and Environmental Inc.
4412 S Corbett Avenue
Portland, OR 97239
503.248.1939

CCB #SRA0615 4-Hr Training

4-Hour Online AHERA Inspector Refresher Training; AHERA is the Asbestos Hazard Emergency Response Act enacting Title II of Toxic Substance Control Act (TSCA)

Expiration Date: 03/05/2025

Andy Fridley, Instructor

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes administrative and procedural requirements for Measurement and Payment, including unit priced items.

B. **Related Sections:** Related requirements may be found in, but not limited to, the following sections:
Section 01 11 00 - Summary of Work
Section 01 26 00 - Modification Procedures and Change Orders
Section 01 45 00 - Quality Control

1.02 DEFINITIONS

A. **As-Bid Unit Prices:** These are amounts proposed by Bidders, and included on the Bid Form, as prices per unit of measurement for materials or services added to, or deducted from, the Contract based on an estimated quantity provided by the Owner on the Bid Form.
1. Unit Pricing may pertain to a base Bid Item(s), Optional Bid Item(s), and/or potential Change Orders to the awarded Contract, as prescribed by the Contract Documents.
2. Any unit pricing provided for potential Change Order item(s) will not be included in the Awarded Contract Price, but must be utilized for related Change Orders that may be issued after Contract Award. Unit-priced Change Order items are subject to the variation in quantity limitations described in Paragraph 1.03.E below.

B. **Proposed Unit Prices:** During the course of Work, the Owner may request the Contractor to propose unit pricing for an unanticipated item(s) of repetitive Work that may be difficult to quantify in advance of execution. If accepted by the Owner , the Proposed Unit Price will be utilized for Change Orders involving that element of additional Work.
1. At the time of the first Change Order involving the Proposed Unit Price item, the Owner will establish a base quantity for the item. The amount of the Modification Proposal (MP) for the item will be the product of the Proposed (and accepted) Unit Price and the base quantity established by the Owner .
2. Subsequent Change Orders involving the Proposed (and accepted) Unit Price item will continue to utilize the Proposed (and accepted) Unit Price, subject to the variation in quantity limitations described in Paragraph 1.03.E below.

1.03 PROCEDURES:

A. **Bid Evaluation and Contract Award:**
1. **Bid Evaluation:** The low responsive Bid is based on the sum of all applicable lump sum amounts (wherein the Owner's estimated quantity equals one, by definition) plus the extended (product of bid amount times quantity) for each applicable unit-priced item, as detailed below:
a. Lump Sum Base Bid amount(s);
b. Lump Sum Bid Trench Safety System;
c. Unit Priced Item(s) in Base Bid Item;
d. Each Optional Lump Sum Bid Item included in the Contract Award;

e. Each Optional unit-priced Bid item included in the Contract Award;
f. Each lump sum bid potential Change order item;
g. Each unit-priced bid for a potential Change Order item.

2. **Contract Award:** The Awarded Contract Price is based on all items included in subsection A.2 above except for items f and g, plus applicable taxes.

B. **Measurement and Payment:**
1. For lump sum bid item payment procedures, refer to Section 01 29 73.
2. Refer to individual specification sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those sections.
3. Unit priced items must be separately identified and reimbursed in the Schedule of Value and Pay Estimate forms, in accordance with Section 01 29 73 and applicable Contract requirements.

C. Unit Pricing must incorporate all costs necessary for materials, equipment, tools, labor, delivery, disposal, installation, insurance, overhead, profit, and taxes, as applicable.

D. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this work measured, at the Owner's expense, by an independent surveyor acceptable to the Contractor.

E. **Variations in Quantity:**
1. The Unit Price of any unit-price item may be renegotiated upon request by either the Contractor or the Owner in the event of either of the following scenarios:
a. The actual quantity exceeds 125% of the estimated or base quantity determined by the Owner at the time the Unit Price was accepted.
b. The actual quantity is less than 75% of the estimated or base quantity determined by the Owner at the time the Unit Price was accepted.
c. If the Unit Price is renegotiated based on either of the above scenarios, the renegotiated Unit Price shall apply to the entire quantity for that item. If partial payment has been made, the price differential must be accounted for as part of the Reconciliation process described in Paragraph 1.03.E below.
2. If an estimated or base quantity for any Unit-Priced item equals zero (0), does not exist, or was not provided by the Owner, then the associated Unit Pricing is null and void. In such case, Unit Pricing must be renegotiated with a non-zero quantity provided by the Owner, or that body of Work negotiated as a Modification Proposal on a lump sum basis.

F. **Reconciliation of Unit-Priced Work Upon Completion:** The Owner will only pay for unit-priced Work based on the product of the actual quantity of Work done and the final-negotiated Unit Price for that Work. Prior to issuing final payment on the Contract, a final Change Order must be issued to adjust the Contract Price upward or downward to account for any discrepancies in quantity or negotiations in unit-pricing that may have occurred during the life of the Contract.

G. **Unit Price Schedule**: Paragraph 3.01 below provides a description of the unit-priced items included in the Bid Form. Specification sections referenced in the Schedule contain requirements pertaining to each unit-priced item.

PART 2 - PRODUCTS: *(Not Used)*

PART 3 - EXECUTION

3.01 UNIT PRICE SCHEDULE: n/a

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. It is the intent of the Owner to award a Contract for Base Bid construction of the project as shown on the Drawings and specified herein. Based on budgetary considerations, however, the optional Bid Items listed in this Section will be considered by the Owner for incorporation in the Contract.
   1. Optional Bid Items may be designated as Additive, Alternate, Deductive, or Deductive Alternate items.
   2. Each Optional Bid Item will be assigned a different identifying number by the Owner.
   3. Optional Bid Items are identified by their numbers in the relevant Drawings and Specification sections. All information contained on the Drawings and other Contract Documents must be considered part of the Base Bid unless specifically identified as an Optional Bid Item.
   4. The Owner has sole discretion to include or exclude Optional Bid Items from the Contract.
   5. The numbers assigned to Optional Bid Items are for identification purposes, and not intended to convey priority nor order of preference. For purposes of Bid Award, the Owner may select Optional Bid Items in any order the Owner desires, at the Owner's sole discretion.
   6. The Bid price of each Optional Bid Item chosen by the Owner for inclusion in the Contract Award will be added to (or deducted from, if deductive) the Base Bid price in determination of the low responsive Bidder.
   7. In some cases, the Owner may decide to proceed with the Award of Contract while deferring the decision to include one or more Optional Bid Items into the Work. Reasons for deferring the decision may include seeking additional funding to cover the cost of an Optional Bid Item where the existing budget is insufficient, waiting for completion of demolition to confirm no unforeseen existing conditions will impact the existing Project budget, or other such practical reason. The Contractor must honor the price Bid for Optional Bid Items for at least 90 calendar days after Notice to Proceed. In the event the Owner decides to incorporate an Optional Bid Item after that time, the Contractor has the option to honor the price Bid or submit a revised Modification Proposal for the Optional Bid Item. In either case, such Work may then be added to the Contract as a Change Order item.
      a. The Owner will not incorporate any Optional Bid Item after Award of Contract which would have changed the determination of the lowest responsive Bidder at time of Contract Award.

1.02 RELATED SECTIONS:

A. Section 01 11 00 - Summary of Work

1.03 BASE BID:

A. The work to be accomplished by this Contract is that work described in the Drawings and Specifications (including all Addenda) with the exception of Optional Bid Items, as clearly delineated by the Contract Documents.

1.04 OPTIONAL BID ITEMS: (Not Used)

PART 2 - PRODUCTS: (Not Used)

PART 3 – EXECUTION

3.01 GENERAL REQUIREMENTS:

A. All general conditions and technical specification references that apply to the rest of the project also apply to the work in this section.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The Contractor must furnish and install all products specified herein. Substitutions will be considered only after the Award of Contract. The Owner will review the substitution request as stated in this Section. Samples of the required forms for submitting substitution requests are attached to the end of this section.

1.02 RELATED SECTIONS:

A. Coordinate related requirements specified in other parts of the Project Manual.

1.03 PRODUCTS:

A. Where specified only by reference standards and/or performance criteria, select any product meeting the standards and/or criteria, by any Manufacturer.

B. Where specified by naming one or more products, whether or not indicating "or approved equal" after specified listing, the Contractor may submit any request for another product substitution on a form provided by the Owner.

C. Occasionally, certain products or items will not be considered for substitution or may be designated as sole source items. In such case, these items will be clearly indicated as “sole source” and/or “no substitution” within the applicable specification subsection. Otherwise the Contractor may request substitution as described elsewhere in this section.

1.04 SUBSTITUTIONS:

A. During bidding, the Architect will consider written requests for substitutions only when received on the form provided following this section. No substitution requests will be considered unless received at least seven (7) calendar days prior to the bid date. Requests for substitutions after the bid date will be only considered if in conformance to specified section 01 25 00.

B. In connection with the use of any substitute item approved by the Owner and Architect, it shall be the Contractor's responsibility to see that such items meet all space requirements, and that any alterations to connecting items necessitated by use of the alternate items are properly made, at no increase in cost to the Owner.

C. Specific reference in the specifications to any article, device, product, materials, form or type of construction, etc., by name, make or catalog number, shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

D. In making request for substitution, Bidder/Contractor represents:
1. He has personally investigated proposed product or method, and determined that it is equal or superior in all respects to that specified.

2. He will provide the same guarantee for substitution as for product or method specified.
3. He will coordinate installation of accepted substitution into Work, making such changes as may be required for Work to be complete in all respects at no additional cost to Owner.

4. He waives all claims for additional costs or time extensions related to substitution which consequently becomes apparent.
5. He will reimburse Owner and Architect for review or redesign services associated with the substitution and re-approval by authorities.

A. In order to allow the fullest competition, consistent with the Owner's interests, the Architect will give consideration, prior to submission of proposals, to requests for approval of products and materials competitive with and similar to those specified by proprietary name.

B. To be considered and in order to facilitate review of requests for approval of substitutions for specified products or materials, all such requests shall be made in writing on the form included as a part of this section.

C. Should any proposed product substitution require any redesign work by the Architect or the Architect’s consultants to accommodate the substitute product, costs for such redesign work shall be included in the Bid amount and shall be paid to the Design Consultant at the Design Consultant's usual rates for the time expended in the required redesign work.

D. Substitutions will not be considered when they are indicated or implied on shop drawings or product data submittals, if they have not been previously approved.

E. Substitution submittal procedure:
1. All substitution requests shall be accompanied with the Substitution Request Form, completely filled out. Substitution Request Forms are bound in the specifications following Section 01 25 00. Limit each request form to one proposed substitution.
2. Submit a substitution request form and supporting data.
3. Clearly indicate with red arrows on the supporting data the proposed substitution and accessories.
4. Substitution requests may be emailed, mailed or faxed. Email is preferred.

F. Substitution Review Procedure: Because of the number of substitution requests typically received before bidding and the coordination required to review these, the following procedures will apply:
1. Substitution requests received after the time specified in paragraph 1.05 A. will not be reviewed nor listed on addenda.
2. Substitution requests will be evaluated and the request form will be annotated in the column marked "For Use by Architect". It will then be retained in the A/E's file.
3. The Substitution Request Form and submitted data will <u>not</u> be returned to the submitter. These forms are for the A/E's in-house use only.
4. Only approved substitutions will be listed on addenda. All proposed substitutions not listed on addenda shall be considered by the submitter and the Contractor as a non-acceptable substitution and shall not be used.

1.04 ARCHITECT'S OPTIONS

A. Architect will be sole judge of acceptability of any proposed substitution.

B. Only approved substitutions may be used on Contract Work.

C. Each request for substitution approval shall include:
1. Identity of product for which substitution is requested; include specification page and paragraph number.
2. Identity of substitution; include complete product description, drawings, photographs performance and test data, and any other information necessary for evaluation.
3. Quality comparison of proposed substitution with specified product.
4. Changes required in other work because of substitution.
5. Effect on construction progress schedule.
6. Cost comparison of proposed substitution with specified product.
7. Any required license fees or royalties.
8. Availability of local maintenance service.
9. Source of replacement materials.

1.05 DURING BIDDING PERIOD

A. No request for substitution approval will be considered unless a written request in duplicate has been submitted on Substitution Request Form bound hereinafter, and has been received by Architect at least ten (10) calendar days prior to bid date.

1.06 AFTER CONTRACT AWARD

A. Approval will be granted only when:
1. Specified product has been discontinued, or
2. Specified product has been replaced by superior product, or
3. Specified product will not fit within designated space, or
4. Specified product does not comply with governing codes or regulations, or
5. Substitution determined by the Owner to be in his best interest.
6. Architect and/or Owner will be the sole arbiters on whether any of the above conditions warrant substitution approval

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

SUBSTITUTION REQUEST FORM

TO: **StemperArchitecture Collaborative**
4000 Delridge Way SW. Suite 200
lalo@stemperac.com
Seattle, WA 98106

PHONE: (206) 624-2777
EMAIL:

PROJECT Title: **Ray Williamson Pool Improvements, Phase 1**
Project No. **BIMPRD 20223**

We, the undersigned, hereby submit for your consideration the following product instead of the specified item:

1. Section: _____ Specified Item: _____

2. Proposed substitution: _____

3. Reason for substitution: _____

4. Attachments:
   ☐Yes ☐No Technical data, including laboratory tests, if applicable.

   ☐Yes ☐No Complete information on changes to Drawings/Specifications which proposed substitution will require for proper installation.

   ☐Yes ☐No Affects of substitution on Drawing dimensions.

5. ☐Yes ☐No The undersigned will pay for changes to the building and systems design, including engineering and detailing costs caused by the requested substitution.

6. ☐Yes ☐No Does substitution have effect on other trades; describe: _____

   _____

7. Describe differences between proposed substitution and specified item: _____

   _____

8. ☐Yes ☐No Maintenance and services parts will be as readily available as for specified item.

9. ☐Yes ☐No Manufacturer's guarantees of the proposed and specified items are the same; describe difference: _____

   _____

The undersigned further states that the function, appearance and quality of the proposed substitution are equivalent or superior to the specified item.

Submitted by:

Firm _____

Address _____

_____

By _____
(Signature and Title)

For use by Design Consultant:

☐ Accepted ☐Accepted as noted

☐ Not accepted ☐Received too late

By_____ Date _____

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY OF MODIFICATION PROPOSAL PROCEDURES:

A. Changes to the Work may be required due to field conditions, requests made by the Owner, clarifications to the Bid documents, or other needs that result in a change in the cost of the Work and/or change in the number of Contract days per Section 00 72 00. The changes to the Work will be tracked individually as Modification Proposals (MP). Modification Proposals may either be prepared as a Field Directive, or as a request for pricing prior to proceeding with the work.

B. Change Orders will be issued monthly or as needed for one or more MPs that have been approved for inclusion in the Contract since Contract Execution or the prior Change Order, as applicable. Payment for changed Work will not be made until the Change Order is finalized and signed by the Executive Director of BIPRD.

C. The Modification Proposal must clearly describe the change and identify all labor, material, equipment, subcontracted, and incidental costs associated with the change, including subcontractor and supplier invoices/quotes and Contractor's timecards. A reference from the latest approved schedule must be attached justifying any time extension request. Mark-ups accounting for all overhead, profit, bond cost, B&O taxes, and insurance must be applied in accordance with the Owner-approved "Mark-Up Agreement Form" (see Section 1.01.E below). The Modification Proposal form (see sample form included at the end of this section) will be used for directing the work to be done in one of the two manners described below.

D. The Contractor and Subcontractors (where required), must provide a "Project Labor List", identifying the hourly labor rates of the various trades supporting the Work, including a breakdown of basic wage rates, fringe benefits, FICA, FUTA, SUCA and other add-ons, per Section 00 72 00. Where premium time is involved, the Contractor must separately identify the premium labor rates broken down at the same level of detail.

E. Supplemental to Section 00 72 00 paragraph, mark-ups for overhead and profit on Modification Proposals must be in accordance with the mark-up rates negotiated by the Owner and the Contractor prior to commencement of Construction. The "Mark-Up Agreement Form" included at the end of this section will be used for documenting this agreement. Such mark-up rates must factor in general company overhead, taxes, bonding, project overhead, and reasonable profit for the project as a whole, and may not in any event exceed the Force Account mark-ups established in Section 00 72 00. If requested by the Owner, such mark-up rates must be justified by the Contractor as detailed in subparagraphs 1, 2, and 3 below.
   1. General Company Overhead: Costs of the Contractor's home or corporate office necessary to run the business and to support the projects in the field. The Owner may require that the general company overhead be supported with documentation of company financial information for the past two years.
   2. Project Overhead: Indirect costs that cannot be identified with a specific construction activity but support the project as a whole. The Owner may require documentation of actual costs accrued.

3. Profit: Net proceeds after expenses. The Owner may require a detailed justification with supporting documentation of the company's financial information for the past two years.

1.02 FIELD DIRECTIVE MODIFICATION PROPOSALS:

A. Changed conditions and/or unanticipated circumstances may require immediate revisions to Work which are essential and from which a delay would result in a time and/or cost penalty to the project. When such a condition exists, the Owner's Construction Manager may issue a written Field Directive to the Contractor on a form to be provided by the Owner. The Field Directive will be identified with an MP number.

B. The Owner's Construction Manager will provide direction for the Contractor identifying the necessary changes to be made.

C. When Field Directive Work is being done as a lump sum agreement, the Contractor must provide pricing per Section 00 72 00, as needed to substantiate the lump sum amount, within 15 days of the completion of the Work, utilizing the "Change Proposal Request" provided by the Owner.

D. When Field Directive Work is being done under Force Account pricing, a daily record of labor, materials, equipment use, subcontracted work, material disposal costs, and any other costs must be kept. The Contractor must use the "Daily Force Account Worksheet" (sample at the end of this section) provided by the Owner for this purpose, and must submit the completed form to the Owner no later than the next Working Day. Applicable mark-ups for Force Account work must be in accordance with Section 00 72 00.

1.03 LUMP SUM MODIFICATION PROPOSALS:

A. The Owner may request priced proposals which either add or delete work prior to proceeding with any changes.

B. When requested, the Contractor must provide pricing per 1.01.C of this section, utilizing the "Modification Proposal Worksheet" (sample at the end of this section) provided by the Owner, for review and approval by the Owner, prior to proceeding with the Work.

C. Once the Modification Proposal has been approved and signed by the Owner, a commitment has been made that a subsequent Change Order will be issued covering the changes to Contract Work, time, and price, as described in the approved Modification Proposal. The Contractor may commence work related to the Modification Proposal at this point. If the Contractor proceeds with work described by a Modification Proposal that has not been approved, such work will be construed as unauthorized per Section 00 72 00.

1.04 CHANGE ORDERS:

A. Change Orders to the Work including all approved Modification Proposals that have accumulated since Contract Execution or the prior Change Order will be issued monthly or as needed. The total amount of price adds and deducts along with the change in the number of days approved in each individual Modification Proposal will be added to or deducted from the Contract Price and time. The Change Order will incorporate and be appended with the approved MP forms (including all required back up materials), as itemized on the Change Order form. Once approved by the Owner, a lump sum price and time adjustment will be made to the Contract, corresponding to the approved Change Order form.

B. Any Change Order that causes the resultant Contract price (including tax) to exceed 125% of the Contract Bond will require the Consent of Surety per Instructions to Bidders.

C. The payment for Work performed under the Change Order cannot be made until the change order has been signed by the Director of Planning and Development Division.

D. If an individual change order exceeds 10% of the original contract amount and is over $50,000, a special review may be required by the Owner. In such cases, the Owner will notify the Contractor as to the special circumstance of the change.

PART 2 - PRODUCTS: *Not Used*

PART 3 - EXECUTION: *Not Used*

END OF SECTION

PART 1 - GENERAL

1.01 SCHEDULE OF VALUES

The Contractor must submit a Schedule of Values for review and approval by the Owner at the pre-construction meeting. The purpose of the Schedule of Values is to break down lump sum bid amounts into discrete items of Work for purposes of determining the amount due for progress payments, hereafter called "Pay Estimates". The Contractor must submit the proposed Schedule of Values for the Owner's approval. The Contractor may use their own discretion in defining the line items within the Schedule of Values, subject to the following requirements:

A. Identify each line item with the Specification section number that most closely aligns with the scope covered by the line item. It is acceptable for multiple line items to be associated with the same Specification section.

B. Mobilization must include all activities and associated costs for transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, traffic control measures, and other necessary general facilities for the contractor's operations at the site; construction fencing; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable; and other administrative items. The Schedule of Values must include at minimum one single line item for mobilization costs. Additional line items related to mobilization may be utilized; however, total mobilization costs must not exceed 10% of the Awarded Contract Price unless specifically approved by the Owner.

C. Demobilization must consist of all activities and costs for cleanup and removal from the site all personnel, equipment, and materials/supplies not required or included in the Work; including site cleanup and the disassembly, removal, and cleanup of offices, buildings, and other facilities assembled on the site specifically for this Contract. It does **not** include the provision of record/as-built documentation. There must be at least one line item for demobilization included in the Schedule of Values. The value of demobilization must be at minimum 1% of the Awarded Contract Price.

D. Identify a separate line item for the production and safe keeping of the Operations and Maintenance Manuals, Warranties and Bonds Manual, As-built drawings, annotated Project Manual, and all other Record Documents. **This item is minimally 2% for large projects.**

E. Include in each line item a directly proportionate amount of Contractor's overhead and profit.

F. For items on which progress payments will be requested for stored materials, break down the cost of materials, delivered and unloaded, including taxes and all applicable fees, and indicate the quantity.

G. Round off figures to the nearest whole dollar amount, if possible.

H. If any unit-priced Bid Items are included in the Awarded Contract Price, show each unit-priced Bid Item as a separate line item in the Schedule of Values. The quantity and unit price must match the values provided on the Bid Form.

I. If the Awarded Contract Price includes any Optional Bid Items, each such Optional Bid Item must be represented separately from the Base Bid items on the Schedule of Values. The Schedule of Values must include at minimum one single line item for each Optional Bid Item awarded. Additional line items related to a specific Optional Bid Item may be utilized; however, the additional line items must be described as pertaining to the correct Optional Bid Item, and they must add up to the total amount bid for the Optional Bid Item.

J. Verify that the sum of all items in the Schedule of Values equals the Awarded Contract Price.

1.02 APPLICATION FOR PAYMENT (PAY ESTIMATES)

A. Format and Data Required: Submit applications for payment with itemized data as established on Schedule of Values, and Change Orders information listed at the MP (modification proposal) level of detail. Procedures and terms will be presented and reviewed at the Pre-construction Conference. An example of the required form is appended to this section.

B. For each progress payment cycle, the Owner, Consultant, and Contractor must agree on the percentage of work completed on each line item. This will be the basis for the total amount payable identified on the Pay Estimate.

C. Preparation of progress payment applications (“Pay Estimates”):
   1. Complete all required information including:
      a. Provide information based upon the approved Schedule of Values;
      b. Change orders approved prior to Application submittal date, with line item pricing broken down to correspond with individual modification proposals (MPs) included in the change order;
      c. Signature of responsible officer of Contractor.
   2. Complete the following package of documents:
      a. “Monthly Pay Application Cover Page”
      b. Signed “Public Works Prevailing Wage Certification & Subcontractor List” statement (this certification is combined with Item C.2.a above)
      c. Signed “Contract Monthly Pay Estimate”
      d. “Summary of Waste Generated By Project” form, which must be completed in accordance with Section 01 74 19, paragraph 1.06.

   3. Submit the Pay Estimate package (all 4 forms described in Item C.2 above) to the Consultant, who will review and take one of the following actions:
      a. Approve requests for payment by signing the Pay Estimate and forwarding it to the Owner for his/her review, approval, and processing; or
      b. Reject the package by returning it to the Contractor with requested changes.

D. Substantiating Data for Progress Payments:

1. When the Owner or Consultant requires substantiating data, the Contractor must submit suitable information with cover letter including:
   a. Project Name.
   b. Application number and date.
   c. Detailed list of enclosures.
   d. For stored products: Identify item as shown on application; describe specific material; provide invoice from supplier.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SCHEDULE OF VALUES

PROJECT TITLE: _____ **PW Contract No.** _____

Contractor Name: _____ **Notice to Proceed Date:** _____

Contractor Address: _____ **Substantial Completion Date:** _____

_____ **Physical Completion Date:** _____

Ordinance Number: _____ **Working Days for Subst Compl:** _____

Activity (WC) Number: _____ **Retainage %** _____

Item #	Spec. Section	Item Description	Quantity	Unit Cost	Subtotal
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
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36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
54					
55					
CONTRACT TOTAL AMOUNT					

APPROVAL SIGNATURES

CONTRACTOR CONST MANAGER	DATE	PARKS PROJECT MANAGER	DATE
DESIGNER/CONSULTANT	DATE	PARKS CONSTRUCTION MANAGER	DATE
		PARK ENGINEER	DATE

PART 1 - GENERAL

1.01 PRE-BID SITE MEETING:

A. Scheduling of Meeting: If a Pre-Bid site meeting is to be held, the date, time, and location will be shown in the Bid Notice. If the Pre-Bid site meeting is mandatory, at least two meetings will be scheduled.

B. Attendance and Attendance Lists: The Pre-Bid site meeting is typically attended by the Owner, the Consultant, the Contractor, Subcontractors, and Suppliers. The Consultant will compile an attendance list based on actual attendance. Attendance lists will be posted as Addenda. Each attendee is responsible to ensure that their name and company is accurately included on the attendance list.

C. Mandatory Pre-Bid Site Meeting: If the pre-bid site meeting is mandatory, a representative for each Contractor planning to submit a Bid must be present for at least one of the scheduled meetings. The Owner will reject any Bid submitted by a Bidder that was not in attendance for at least one of the Pre-Bid site meetings. The attendance lists provided will be used to verify whether each Bidder attended a mandatory Pre-Bid site meeting.

D. Agenda: The following topics will be addressed by the Owner and/or Consultant as applicable:
   1. The Owner: Introduction, general scope, budget, schedule, special permits, requirements, review of the inclusion plan requirements, other special administrative conditions and/or requirements.
   2. The Consultant: Review of project drawings, technical specifications, and any special technical conditions and/or requirements affecting the project.
   3. Tour of the Work Site: If feasible, with additional comments from the Owner and/or the Consultant.

1.02 PRE-CONSTRUCTION CONFERENCE:

A. The Owner will establish the date, time and place for the pre-construction conference. The Owner will conduct the meeting to review responsibilities, procedures, personnel assignments and to exchange preliminary submittals. The Consultant will prepare meeting minutes using a format to be provided by the Owner. Copies of the minutes will be distributed by the Consultant at the first progress meeting.

B. Attendees: The Owner, the Consultant, the Contractor and his/her superintendent, major subcontractors, manufacturers, suppliers and other concerned parties.

C. Submittals: The Contractor must provide the Submittals indicated in paragraph 1.02.D below, as applicable.

D. Agenda: The following items will be reviewed at the meeting using a format provided by the Owner.
   1. Lines and methods of communication between the Owner, Consultant and Contractor.

2. Contract Compliance.
3. Coordination of Project.
    a. Owner's inspections.
    b. Construction Inspection Plan.
    c. Special inspections/testing.
    d. Working hours.
    e. Date, time and location for weekly construction meetings.
    f. Safety.
    g. Traffic control.
    h. Sound restrictions – (SMC) 25.08.
    i. Verification of schedule compliance and remaining construction days.
4. Owner-provided control surveys.
5. Submittals and information to be provided by Contractor at meeting:
    a. Identification of Contractor's Personnel: Project Manager, Superintendent, other key personnel;
    b. Traffic Control Plan;
    c. Temporary Vegetation, Soil, and Tree Protection Plan;
    d. Subcontractor Applications;
    e. Critical Path Schedule (preliminary);
    f. Schedule of Values.
    g. List of required submittals and Shop Drawings for long-lead items and Work subcomponents, as detailed in Specifications;
    h. List of Subcontractors List;
    i. List of Material Suppliers;
    j. Prevailing Wage Reports;
    k. Mark-up Agreement Form
    l. Preliminary data and information.
6. Procedures and sample Pay Estimate form, including prevailing wage certification and "Summary of Waste Generated by Project" form.
7. Procedures and examples of Design Clarification, Field Directives, Modification Proposals (MP), and Change Orders.
8. Procedures for submitting submittals/shop drawings and requesting substitutions.
9. Responsibility of contractor to maintain record documents.
10. Emergency Telephone List.
11. Special Items:
    a. Safety Data Sheets (SDS) for chemicals and materials to be used during construction or incorporated into the Work.
    b. Work Limits/Security and safety-first aid procedures and confined spaces procedure.
    c. Adjoining Work (if any) in progress.
    d. Permits.
    e. Staging, deliveries, and contractor/employee parking.
12. Verification of Drawings and Project Manual by Contractor.
13. Notice to Proceed date.
14. Other.

1.03 PROGRESS MEETINGS:

A. The Owner will conduct the weekly progress meetings on a day, time and location determined at the pre-construction conference. The Consultant will take and prepare weekly project minutes using a format provided by the Owner. Copies of the minutes will be distributed to attendees at least four calendar days prior to the next meeting. A copy of the minutes will be provided to the Owner.

B. Attendees: Owner, Consultant, Contractor, Facility Operator, and other concerned parties such as contractor's superintendent, subcontractors, and material suppliers.

C. Agenda: The following items will be reviewed and discussed at each progress meeting, using a format provided by the Owner:
   1. Review and approve minutes of the previous meeting.
   2. Review status, progress, issues related to compliance with construction schedule and identify Working Days used and remaining under the Contract and any request for time extensions.
   3. Review Critical Path schedule and two-week look-ahead schedule. Determine if schedule needs to be updated to reflect any changes. Develop and maintain a work item schedule status report using a format provided by the Owner.
   4. Review status/issues/problems of work in progress and action items. Create new action items as needed.
   5. Review new Work that has started prior to the last meeting and/or will be started before the next meeting and identify any issues, concerns, or problems requiring action.
   6. Establish and maintain a submittal/shop drawing log showing status for all such items/needs identified in the Specifications, using a format provided by the Owner. Review status of long-lead time items that may require expedited review.
   7. Establish and maintain log and status of Design Clarifications, Field Directives, MP, and Change Orders, using a format provided by the Owner. Review status of pending actions, degree of completion, and the need for processing change orders.
   8. Review status of special testing if required and implementation of inspection schedule.
   9. Review changes to record documents.
   10. Review status of Work in progress or completed, and pending pay estimates.
   11. Review other issues affecting implementation of project.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION: Not Used

END OF SECTION

PART 1 - CRITICAL PATH SCHEDULE AND SCHEDULE CONSTRAINTS

1.01 CRITICAL PATH SCHEDULE

A. GENERAL REQUIREMENTS: The scheduling of the Work is the responsibility of the Contractor. The construction of this project must be planned and tracked by use of a conventional Critical Path Method (CPM) schedule, which must be prepared, maintained, and regularly updated by the Contractor.
The Owner's review and acceptance of any critical path schedule does not transfer any of the Contractor's responsibilities to the Owner or to the Owner. Acceptance implies only that the Owner has determined that the Critical Path Schedule submittal with any noted exceptions is within reasonable conformity to the requirements of the Contract. Acceptance of any schedule does not relieve the Contractor of responsibility to complete the Work within the required Contract Time.
All schedules shall must the requirements outlined in this Section. If the Owner deems that the CPM Schedule is not within reasonable conformity to these specifications, it will be returned to the Contractor for correction and re-submittal.

1. **Terminology:**
   a. *Critical Path:* The series of sequentially-linked activities in a project schedule that will take the longest total amount of time to complete. Therefore, at any point in time, the critical path will be the path with the least amount of total float. The critical path does not have to follow the same logic path from start to finish and need not have zero total float.
   b. *Critical Task*: A discrete work activity within a critical path.
   c. "*Float:* The number of days that a scheduled activity can be delayed without affecting a given intermediate milestone or Physical Completion Date.
   d. *Milestone:* A zero-duration task marking the completion of a significant body of work or important date/event associated with the Contract.
   e. *"Summary Task":* A general name/descriptor that encompasses multiple linked, related subtasks. A summary task may be a broad category of work (e.g. electrical, grading, plumbing, etc.), phasing designation, or a locational reference (e.g. north site, playfield area, etc.).
2. **Scheduling Guidelines:** The baseline CPM Schedule and each Critical Path Schedule update must conform to the following guidelines:
   a. Schedules must be prepared, viewed, and printed utilizing standard Gantt-chart format.
   b. Show all activities necessary to complete the Work.
   c. Each task must be named/described in sufficient detail to understand the scope of work encompassed by that task. Overly-broad descriptors (e.g. "grading", "electrical", "plumbing", etc.) may be rejected by the Owner, especially when in conjunction with long durations.
   d. Broad descriptions (e.g. "grading, "electrical", "plumbing", etc.) are generally only acceptable when they are used as Summary Tasks.
   e. Activities must be assigned durations consistent with the activity's scope of Work, presuming that Work will be done continuously over the entire task duration. Float time must not be represented as a part of the task duration. Excluding the Preliminary CPM Schedule, the maximum duration for any one task/activity must be ten (10) Working Days unless otherwise accepted by the Owner.

f. Sequential work activities must be linked logically by precedent/successor activities.
g. Display the Critical Path as a red-colored sequence within the project schedule. Multiple parallel critical paths will not be allowed unless the Contractor can demonstrate that each of the parallel paths has minimal total float time.
h. Comply with all order of Work requirements included in the Contract.
i. Show durations in Working Days.
j. Show Contract milestones including the following:
    - Notice to Proceed Date,
    - Substantial Completion Date,
    - Physical Completion Date,
    - Any milestones defined in the Special Provisions of this Contract,
    - Other milestones at the discretion of the Contractor
k. Show required submittals for significant activities. Establish discrete work activities for provision and review of submittals, ensuring durations conform to the time allowed by the Contract.
l. Identify special labor or equipment needs that may constrain or limit the Contractor's ability to perform project tasks simultaneously. These may be shown as "Resources" within the CPM schedule, or described separately in narrative format.
m. Show procurement, manufacture and delivery activities for significant material items of Work that affect the schedule.
n. Show significant Owner activities and/or delivery of Owner-supplied materials that may impact the schedule.
o. Show significant elements of the Construction Stormwater and Pollution Prevention Plans. These elements may include but are not limited to the installation and removal of erosion/sedimentation controls, and stormwater control.
p. Include project close-out items such as punch-list items, provision of O&M manuals and as-built drawings.

3. **Owner's Time:** Unless otherwise specified in the Contract, the Contractor must allow the Owner sufficient time to perform inspections, reviews, administrative tasks, and other such activities. If not defined elsewhere in the Contract "sufficient" time will be construed as "customary or normal" for the type of work involved.
4. **Float Time:** Float available in the CPM Schedule, at any time, shall not be considered for the exclusive use of either the Contractor or the Owner. However, any float used by the Owner that is later needed by the Contractor and results in delay to the critical path may be considered an excusable non-compensable delay.

B. SCHEDULE TYPES
1. PRELIMINARY CPM SCHEDULE: The Contractor must prepare and submit a preliminary critical path schedule at the preconstruction conference. The preliminary schedule must show the first 30 Days of Work in reasonable conformity to these Specifications. The remaining schedule may show the critical path schedule using broad Work activities, and major milestones and durations for the purpose of review and discussion at the preconstruction conference.
2. BASELINE CPM SCHEDULE: The Contractor must submit for Owner's review and acceptance a baseline CPM Schedule no later than five (5) Working Days after receipt of the Notice to Proceed.
   Within five (5) Working Days of the Owner receiving the submittal, the Owner and the Contractor must meet for joint review, correction, and adjustment of the initial

baseline CPM schedule. Within five (5) Working Days after that, the baseline schedule must be resubmitted to the Owner showing the agreed upon adjustments. Adjusted baseline CPM schedules submitted by the Contractor will be reviewed by the Owner and returned to the Contractor within five (5) Working Days of the Owner's receiving the submittal. If necessary, the joint review and adjusted schedule submittal process may be repeated. However, the Baseline CPM Schedule must be finalized within 25 Working Days after Notice to Proceed.

3. CPM SCHEDULE UPDATES: The Contractor must submit CPM Schedule updates:
   - Monthly;
   - Whenever changes occur that have potential to delay substantial or physical completion by 5 or more Working Days;
   - Within 5 Working Days of request by the Owner
   - Within 5 Working Days of achieving Substantial Completion.

   a. Progress Meetings: At the discretion of the Owner, progress meetings may be held monthly for the purpose of updating the CPM schedule. Progress will be reviewed to verify actual start and finish dates, remaining duration and percent complete of uncompleted activities, and any proposed revisions to the schedule. The Contractor must provide the Owner with the status of activities at such meetings and prepare schedule updates based on this information once it has been verified and agreed upon. If the work is in accordance with the last accepted CPM schedule, the Owner may waive the monthly update or the final as-built CPM schedule.

      The updated CPM schedule must accurately convey Work progress and the schedule for future work as discussed in the progress meetings or it will be rejected by the Owner and returned to the Contractor for correction and resubmission.

   b. Presentation of Updated Schedules: CPM Schedule updates must conform to the following additional requirements:
      1) Schedule updates must be presented in a "Tracking Gantt" format, showing two sets of Gantt-style progress bars consisting of 1) the latest approved Baseline CPM versus 2) a combination of the actual start/finish progress of completed tasks and projected start/finish dates of uncompleted tasks.
      2) Include columns showing actual or projected start and finish dates of all activities. Identify changes to activity precedents, successors, and/or constraints that have altered the critical path.
      3) Highlight any new activities or additional activities resulting from the restructuring/splitting of existing baseline activity(ies).
      4) Identify the current critical path, which could vary from the baseline critical path due to actual Work progress, additional work, or changed conditions.
      5) Unresolved issues or disputes with asserted time effects may be reflected in a schedule update by comparing the Baseline critical path to the revised critical path shown in an updated schedule.
      6) If Work cannot be completed within the Contract Time, the updated schedule must reflect the earliest completion date practicable, and a narrative must be provided by the Contractor addressing the reason(s) behind the delay. Acceptance of late completion schedules will be at the discretion of the Owner and does not relieve the Contractor from Liquidated Damages.

7) When requested by the Owner, a written narrative describing the project schedule status, the critical path and any revisions to the schedule must be included with the updates.

4. 3-WEEK LOOK-AHEAD SCHEDULE: At each regular (weekly) construction progress meeting, the Contractor must submit a look-ahead schedule showing the anticipated Contractor Work activities, Subcontractor Work activities, any Owner activities impacting the Work, and/or major Material deliveries for the next 3 weeks. Include the description, duration and sequence of Work, and highlight any deviations between planned and regular hours of Work.
   The 3-week look-ahead may be reduced to a 2-week look-ahead with the approval of the Owner.
   Unless otherwise specified in the Contract, the Contractor must notify the Owner at least 2 Working Days in advance of changing Work as shown in the look-ahead schedule; an updated look-ahead schedule must be submitted with such notification.

C. SUBMITTALS: The Contractor must submit one (1) paper copy of the CPM schedule (in Gantt chart format, with columns displayed to show predecessors and successors of each activity) and any accompanying narrative; and one (1) full electronic copy in selected CPM software format. Unless approved otherwise by the Owner, the CPM Schedule must be printed on 24” x 36” paper or larger. The CPM Schedule and any narrative must also be submitted in PDF format.
   The Gantt chart format is a standard method of presenting schedule information. The following standard requirements apply:
   1. The schedule must include a horizontal time scale consistent with the project calendar.
   2. Each activity/task/milestone must be listed in order of start date in a tabular grid to the left of the time scale. The tabular grid must include the task number, description, start date, finish date, predecessors, successors, and float time. Baseline schedules must show the baseline-planned start and finish dates. Update schedules must show the actual/projected start and finish dates.
   3. Each activity must be provided with a corresponding task bar in the horizontal time scale, with a plotted length conforming to its duration and dates.
   4. Linked activities must be indicated by logic arrows in the timescale portion of the Gantt chart, as needed to clearly show the sequence and interdependence of all activities required for complete performance of all items of Work under the Contract.
   5. Activities on the critical path must be highlighted using red task bars.

   The electronic copy of the Critical Path Schedule must be compatible with Microsoft Project or other Owner approved software. The Contractor shall submit a functional and complete CPM schedule electronically via email, on compact disk (CD), or other medium accepted by the Owner.

D. SCHEDULE DEVIATIONS: The Contractor, or its Subcontractor(s), must not deviate from the projected start and completion times for major phase(s) of the Work shown on the accepted CPM Schedule without providing at least fourteen (14) Days advance notice to the Owner. Failure to notify the Owner of a deviation from projected start and completion times for a major phase of the Work shown on the schedule may impact costs to the Owner, including the cost of additional community outreach to communicate changes in schedule to the public. Resulting costs due to this "failure to notify" are the responsibility of the Contractor. The Owner will deduct these costs from any payment due or to become due to the Contractor.

E. EARLY COMPLETION: The Owner has established the number of Working Days allowed for Substantial Completion and Physical Completion within Division 00 52 00 Agreement Form submitted with the Bid, and these timeframes may only be amended by subsequent change order(s). The Owner allocates resources to a Contract based on the Contract Time. The Owner will review and accept a Critical Path Schedule indicating an early Substantial and/or Physical Completion Date but cannot guarantee the accuracy of the Contractor's accelerated schedule, nor that Owner resources will be available to meet the accelerated schedule. No additional compensation or time will be allowed if the Contractor is not able to meet its accelerated schedule due to the unavailability of Owner resources, for unforeseen conditions, or for other reasons beyond the Owner's control.

F. PAYMENT: Compensation for the cost necessary to complete the Work described in this section is considered incidental to and included in all Bid items of Work. No separate payment will be made for the work required in this section.

1.03 SCHEDULE CONSTRAINTS

The Contractor's CPM schedule must reflect constraints imposed by applicable laws and regulations, and those specified in the Contract. Constraints include but are not limited to the following:

1. Submittal Requirements and Review Durations per Section 01 33 10 - Submittals.
2. Holiday Construction Moratorium per Section 01 10 00 - Summary of Work.
3. Safety Restrictions per Section 01 35 29 - Health & Safety.
5. Environmental Restrictions per Section 01 57 19 - Temporary Environmental Pollution Control.

PART 2 - PRODUCTS: (Not Used)

PART 3 - EXECUTION: (Not Used)

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION: This Section describes administrative and procedural requirements for Submittal of Shop Drawings, Product Data, Samples, the Submittal Schedule, and other miscellaneous administrative and quality control Submittals.

1.02 RELATED SECTIONS: Other Sections containing requirements related to this Section include, but are not limited to:

A. Section 01 32 13 - Progress Schedules

B. Section 01 77 19 - Contract Closeout

C. Section 01 78 39 - Record Documents

1.03 SUMMARY:

A. Submittal Schedule: The Submittal Schedule must document the Contractor's plan for the provision of each and every Contract Submittal requirement in advance of incorporation of Submittal material(s) into the physical Work of the Contract, as needed to provide adequate review, resubmittal, and approval time to execute the Work of the Contract without delay and in accordance with Contract requirements. Refer to Paragraph 1.05 below.

B. Shop Drawings include, but are not limited to, the following: (Note: standard product information prepared without specific reference to the Project does not constitute a Shop Drawing).
   1. Fabrication drawings
   2. Installation drawings
   3. Setting diagrams
   4. Shopwork manufacturing instructions
   5. Templates and patterns
   6. Schedules

C. Product Data include, but are not limited to, the following:
   1. Manufacturer's product data
   2. Manufacturer's standard installation instructions
   3. Standard color charts
   4. Catalog cut sheets
   5. Roughing-in diagrams and templates
   6. Standard wiring diagrams
   7. Printed performance curves
   8. Operational range diagrams
   9. Mill reports
   10. Standard product operating and maintenance manuals

D. Samples include, but are not limited to, the following:
   1. Partial sections of manufactured or fabricated components

2. Small cuts or containers of materials
3. Complete units of repetitively used materials
4. Swatches showing color, texture, and/or pattern
5. Color range sets
6. Components used for independent inspection and testing

E. Quality control Submittals include, but are not limited to, the following:
1. Design data
2. Certifications
3. Manufacturer's instructions
4. Manufacturer's field reports

F. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative Submittals. Such Submittals include, but are not limited to, the following:
1. Permits
2. Schedule of Values
3. Mark-Up Agreement
4. Applications for Payment
5. Performance and payment bonds
6. Insurance certificates
7. Warranties
8. Listing of subcontractors

1.04 DEFINITIONS

A. *Field Samples:* Full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

B. *Intermediate Submittals*: Submittals specifically intended to convey a portion of the overall information needed for the related Work. Such Submittals may identify long-lead items/material that are acceptable for advance ordering, initial/preliminary information requiring preapproval for subsequent development, and other such intermediate items as may be appropriate or convenient for expediting overall Work progress and/or schedule needs. Intermediate Submittals may be specifically identified in the Contract Documents or identified by mutual agreement between the Contractor and Owner during the course of Work.

C. *Mock-ups:* Full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

D. Submittal Schedule: See Paragraph 1.05 below.

1.05 SUBMITTAL SCHEDULE

A. The "Submittal Schedule" must be developed by the Contractor and submitted at the Pre-Construction meeting for Owner's and Consultant's review.
   1. The Submittal Schedule is considered a separate document from the Critical Path (CPM) Schedule and other schedules separately described in Section 01 32 13.
   2. The information included in the Submittal Schedule must be limited to activities related to required Contract Submittals.
   3. The Submittal Schedule must be coordinated and consistent with the CPM Schedule and all other schedules pertaining to the Work.
   4. It is acceptable for the Submittal Schedule to consist of a subset of activities included in the CPM Schedule, provided the CPM Schedule contains detailed information meeting the requirements of this Section.

B. Prepare the schedule in chronological order. Provide the following information:
   1. Schedule date for the first Submittal
   2. Related Section number
   3. Submittal category (Shop Drawings, Product Data, etc.)
   4. Name of the subcontractor
   5. Description Work to which the Submittal pertains
   6. Scheduled date for resubmittal
   7. Scheduled date for the Consultant's final release or approval

C. Distribution: Following the Consultant's response to the initial Submittal schedule, print and distribute copies to the Consultant, Owner, subcontractors, and other parties required to comply with Submittal dates indicated. When revisions are made, distribute to the same parties. Delete parties from distribution when they have completed their portion of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting or other activity where revisions have been recognized or made. Issue the updated schedule prior to the next regular project meeting.

1.06 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of Submittals with performance of construction activities. Transmit each Submittal to the Consultant sufficiently in advance of schedule performance of related construction activities to avoid delay.
   1. Coordinate each Submittal with other Submittals and related activities that require sequential activity including:
      a) Testing
      b) Purchasing
      c) Fabrication
      d) Delivery
      e) Other Submittals and related activities that require sequential activity.
   2. Coordinate transmittal of multiple related Submittals to avoid delay in processing because of the Consultant's need to review Submittals concurrently for coordination.
      a) The Consultant reserves the right to withhold action on a Submittal requiring coordination with other Submittals until related Submittals are received.

3. Processing: The Contractor must provide Submittals in advance of related Work activities to ensure the minimum required Working Days are provided for the Submittal review and approval process. Minimum review times are as follows:
   a) Ten (10) Working Days for the Consultant's initial review of each Submittal,
   b) Fifteen (15) Working Days if both the Owner's and the Consultant's review is required.
   c) Allow additional time if the Consultant must delay processing to permit coordination with subsequent Submittals. The Consultant will advise the Contractor when a Submittal being processed must be delayed for coordination.
   d) When Intermediate Submittals are required, each Intermediate Submittal must be treated in the same manner as an initial Submittal.
   e) If a Submittal is rejected or otherwise not approved and requires resubmission, five (5) Working Days are required for each resubmittal that may be required until approval is achieved.
   f) No extension of Contract time will be authorized because of the Contractor's failure to transmit Submittals to the Consultant sufficiently in advance of the Work to allow the minimum required review time.
   g) No extension of Contract time will be authorized for Submittal items that are rejected or otherwise require resubmission due to need for revision.

B. Submittal Preparation:
   1. Place a permanent label or title block on each Submittal for identification.
   2. Indicate name of the firm or entity that prepared each Submittal on the label or title block.
   3. Provide a space approximately 4 by 5 inches (100 x 125 mm) on the label or beside the title block to record the review and approval status markings and the action taken by the Consultant.
   4. Include the following information on the label for processing and recording action taken:
      a) Project name
      b) Date
      c) Name and address of the Consultant
      d) Name and address of the Contractor
      e) Name and address of the subcontractor
      f) Name and address of the supplier
      g) Name of the manufacturer
      h) Number and title of appropriate Specification Section
      i) Drawing number and detail references, as appropriate
      j) Similar definitive information as necessary

C. Submittal Transmittal: Package each Submittal appropriately for transmittal and handling. Transmit each Submittal from the Contractor to the Consultant and to other destinations by use of a transmittal form. The Consultant will return Submittals received from sources other than the Contractor.

   1. Record relevant information and requests for data on the transmittal form. On the form, or an attached separate sheet, record deviations from the requirements of the Contract Documents, including minor variations and limitations.

2. Include the Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

D. Ordering Materials or Components Requiring Submittal Review: Unless specifically authorized by the Owner, do not order or procure materials or components before all related Submittals have been reviewed and approved in accordance with the Contract requirements. The Owner will not pay for any unauthorized component or material incorporated in the Work until and unless all related Submittals have been reviewed and approved per Contract requirements. Furthermore, any such Work that does not achieve related Submittal approval will be construed as Defective or Unauthorized Work per Section 00 72 00.

1.07 SHOP DRAWINGS

A. Submit newly prepared information, drawn accurately to scale. Do not reproduce Contract Documents or copy standard printed information as the basis of Shop Drawings.
   1. Include the following information on Shop Drawings:
      a) Identification of products and materials included
      b) Compliance with specified standards
      c) Notation of coordination requirements
      d) Notation of dimensions established by field measurement taken by the Contractor
      e) Correlation of Shop Drawings to Contract Documents by reference to sheet number, details, schedule and/or room number.
   2. Specifically note and bring to the Consultant's attention any deviations from the Contract Documents that appear on the Shop Drawings.
   3. Shop Drawing copies used for Work must bear the appropriate final stamp or other marking indicating approval for Construction by the Consultant. Any Work done based on Shop Drawings that have not been reviewed and approved by the Consultant will be treated as Defective or Unauthorized Work per Section 00 72 00.
   4. Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 42 inches (750 by 1050 mm). For electronic submittals, ensure that the document is formatted correctly for plotting/printing.
   5. Copies: The submittals may be submitted electronically.

1.08 PRODUCT DATA

A. Collect Product Data into a single Submittal for each element of construction or system. Mark each copy to show which choices and options are applicable to the project.
   1. Where Product Data includes information on several similar products, some of which are not required for use on the Project, mark copies clearly to indicate which products are applicable.
   2. Where Product Data must be specially prepared for required products, materials, or systems because standard printed data are not suitable for use, submit as Shop Drawings, not Product Data.
   3. Include the following information in Product Data:
      a) Manufacturer's printed recommendations

b) Compliance with recognized trade association standards
c) Compliance with recognized testing agency standards
d) Application of testing agency labels and seals
e) Notation of dimensions verified by field measurement
f) Notation of coordination requirements

4. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed. Include a signed certificate of compliance with each Product Data Submittal.

B. Submittals: electronic submittals are acceptable.

C. Distribution: Furnish copies of final Product Data Submittal to the manufacturers, subcontractors, suppliers, fabricators, installers, governing authorities and others as required for performance of the construction activities. Show distribution on transmittal forms.
1. Do not proceed with installation of materials, products, and/or systems until a copy of reviewed and accepted Product Data applicable to the installation is in the Installer's possession.
2. Do not permit use of unmarked copies of Product Data in connection with construction.

1.09 SAMPLES

A. Samples must be submitted for all paints, floorings, surfacing materials, paving, and other such materials/products incorporated in the Work, and as additionally described or required elsewhere in the Contract Documents. Submit full-size, fully fabricated Samples, cured and finished in the manner specified, and physically identical with the material or product proposed for use.
1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Consultant's instructions where so indicated. Include the following information:
a) Generic description of the Sample
b) Size limitations
c) Sample source
d) Product name or name of manufacturer
e) Compliance with recognized standards
f) Compliance with governing regulations
g) Availability
h) Delivery time
2. Submit Samples for review of kind, color, pattern, and/or texture for a final check of these characteristics with other elements and for a comparison of these characteristics between the final Submittal and the actual component as delivered and installed.
a) Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented by a Sample, submit at least 3 multiple units that show approximate limits of the variations.
b) Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, and details of assembly, connections, operation, and similar construction characteristics.

c) Samples not incorporated into the Work or otherwise designated as the Owner's property belong to the Contractor and must be removed from the site prior to Substantial Completion.

B. Intermediate Submittals: Where Samples are provided for selection of color, pattern, texture, or similar characteristics from a manufacturer's range of standard choices, submit a single, full set of available choices for the material or product.
   1. Intermediate Submittals will be reviewed and returned with the Consultant's marking indicating selection (if approved) and action taken.

C. Submittals: Except for Samples intended to illustrate assembly details, workmanship, fabrication techniques, connections, operation, and other characteristics, submit 3 sets of Samples. The Consultant will return one set to the Contractor marked with the action taken, retain one set, and transmit one set to the Owner.
   1. Maintain sets of Samples, as returned by the Consultant, at the project site, available for quality-control comparisons throughout the course of construction activity.
   2. Unless the Consultant or Owner observes noncompliance with the Contract requirements, the Submittal may serve as the final Submittal.
   3. Samples and sample sets may be used for quality control comparisons related to acceptance of the Work associated with each Sample. If the finished Work does not match the Sample in any respect (including, but not limited to, color, finish, pattern, texture, consistency, material properties, etc.), the Work will be treated as Defective or Unauthorized per Section 00 72 00.

D. Distribution of Samples: Distribute additional sets of Samples to the subcontractors, suppliers, fabricators, manufacturers, installers, governing authorities, and others as required for performance of the Work. Show distribution on transmittal forms.

E. Field Samples specified in individual Specification Sections are special types of Samples. Comply with Sample Submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.10 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control Submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control Submittals as additionally described or required elsewhere in the Contract Documents.
B. Certifications: When the Contract requires certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with the specified requirements. Such Certification must be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

C. Inspection and Test Reports: Requirements for Submittal of inspection and test reports from independent testing agencies are specified in Section 01 45 00 - Quality Control.

1.11 CONSULTANT'S ACTION

A. Unless specifically stated otherwise, every Submittal must be reviewed by the Consultant, and the Consultant will take appropriate action to accept, reject, or return the Submittal for subsequent revision/correction by the Contractor based on that review. The Consultant will respond consistent within the timeframes described in Section 1.06.A.3 above and per the approved Submittal Schedule described in Section 1.05 above.
   1. Compliance with Contract requirements is the Contractor's responsibility. Review, acceptance, and any other action related to any Submittal, regardless of whether such action is taken by the Consultant or the Owner, is intended primarily as a quality control measure, and shall not relieve the Contractor of the responsibility to comply with Contract Requirements.
   2. If the Submittal involves changes to the Drawings and/or Specification requirements, or contains information not reviewed and approved by the Owner as part of the Contract Documents, the Owner shall also review and approve the Submittal. Additional time is required for such review per Paragraph 1.06.A.3 above.

B. Action Stamp: The Consultant will stamp each Submittal with a uniform action stamp. The Consultant will mark the stamp appropriately to indicate the action taken, as follows:
   1. Final Unrestricted Release: Where Submittals are marked "No Exceptions Taken," the Work covered by the Submittal may proceed, provided it complies with the requirements of the Contract Documents. Final acceptance will depend on that compliance.
   2. Final-but-Restricted Release: Where Submittals are marked "Make Corrections Noted," the Work covered by the Submittal may proceed provided it complies with both the Consultant's notations and corrections on the Submittal and requirements of the Contract Documents. Final acceptance will depend on that compliance.
   3. Returned for Resubmittal: When a Submittal is marked "Revise and Resubmit," do not proceed with the Work covered by the Submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new Submittal according to the Consultant's directions. Resubmit without delay. Repeat if necessary to obtain an action mark that will allow the Work to Proceed.
      a) Do not permit Submittals marked "Revise and Resubmit" or "Rejected" to be used at the project site or elsewhere where construction is in progress.
   4. Other Actions: When a Submittal is primarily for informational or record purposes or for special processing or other activity, the Submittal will be returned, marked "Action Not Required," or "Not Reviewed."

PART 2 - PRODUCTS: (Not Used)

PART 3 - EXECUTION: (Not Used)

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY: This section includes administrative and procedural requirements for cutting and patching existing structures and paved areas.

1.02 RELATED SECTIONS: This Section relates to construction that is incidental to the overall Project and/or is not addressed elsewhere in the Contract Documents. Refer to other sections for specific requirements and limitations applicable to cutting and patching individual elements of the Work.

A. Requirements of this section apply to mechanical and electrical installation

1.03 SUBMITTALS

A. Cutting and Patching Proposal: When the Owner's approval of cutting and patching procedures is required per Section 01 33 10, submit a proposal for the Owner's review at least 15 Working Days in advance of when cutting and patching is anticipated. The proposal must be approved by the Owner prior to proceeding with the Work. Include the following information in the proposal, as applicable:
   1. Describe the extent of cutting and patching required. Describe how it will be performed and indicate why it cannot be avoided.
   2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the Work's appearance and other significant visual elements.
   3. List products to be used and firms or entities that will perform work.
   4. Indicate dates when cutting and patching are planned to be performed.
   5. Describe methods that will be used to ensure proper prevention, containment, and/or disposal of dust, debris, sediments, chemicals, slurries, hazardous materials, and other construction byproducts. Such methods must comply with all applicable City, County, State, and Federal health and environmental codes. Submit Safety Data Sheets (SDSs) for any chemical products used during cutting and patching.
   6. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
   7. When cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.

B. The Cutting and Patching Proposal must be treated as a Submittal requiring the Owner's review, in full accordance with Section 01 33 10 "Submittals". The Work described by this proposal must not commence until the Submittal has been reviewed and approved in accordance with the Contract requirements. Any such Work that does not achieve related Submittal approval will be construed as Defective or Unauthorized Work per Section 00 72 00.

C. Approval by the Owner to proceed with cutting and patching does not waive the Contractor from the responsibility to perform the Work in accordance with all applicable local, state, and federal regulations and pertinent Contract requirements.

1.04 RETAIN ORIGINAL DESIGN FUNCTION

A. Identify Structural Elements: All affected structural elements must be specifically identified in and addressed by the Cutting and Patching proposal. Structural elements include, but are not limited to, the following:
   1. Foundation construction.
   2. Bearing and retaining walls.
   3. Structural concrete.
   4. Structural steel.
   5. Lintels.
   6. Timber and primary wood framing.
   7. Structural decking.
   8. Stair systems.
   9. Miscellaneous structural metals.
   10. Equipment supports.
   11. Piping, ductwork, vessels, and equipment

B. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

C. Identify Operational Elements/Systems: All affected operational systems or elements must be specifically identified in and addressed by the Cutting and Patching proposal. Such elements include, but are not limited to, the following:
   1. Primary operational systems and equipment.
   2. Air or smoke barriers.
   3. Water, moisture, or vapor barriers.
   4. Membranes and flashings.
   5. Fire protection systems.
   6. Noise and vibration control elements and systems.
   7. Control systems.
   8. Communication systems.
   9. Conveying systems.
   10. Electrical wiring systems.

D. Requirements for Operational Elements/Systems: Do not cut and patch operating elements, systems, or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements, systems, or related components in a manner that would result in increased maintenance or decreased operational life or safety.

E. Visual/Aesthetic Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Owner's opinion, reduce the pre-existing aesthetic qualities. Do not cut and patch construction in a manner that would result

in visible evidence of cutting and patching. Remove and replace any construction cut and patched in a visually unsatisfactory manner, as determined by the Owner.

1.05 WARRANTY

A. Existing Warranties: Replace, patch, and/or repair materials and surfaces modified or damaged by construction activities in such a manner as to maintain any existing warranties currently in effect. The Contractor must request from the Owner information about existing warranties in effect before associated work commences.

PART 2 – PRODUCTS

2.01 MATERIALS – GENERAL

A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to cutting, examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

B. Prior to cutting, meet at the Project Site with parties involved in cutting and patching and the structures/surfaces being cut, including mechanical and electrical trades and utility representatives if/as applicable. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.02 PREPARATION: The following preparatory measures must be fully described in the Cutting and Patching Proposal and incorporated in the Work in accordance with the approved Proposal.

A. Temporary Support: Provide temporary support of work to be cut.

B. Temporary Erosion and Sediment Control: Provide TESC measures in accordance with the Contract and applicable regulations.

C. Safety: Utilize safety equipment, methods, and personnel as required by the Contract and applicable regulations.

D. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Work that might be exposed during cutting and patching operations.

E. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Avoid cutting existing pipe, conduit, or ductwork serving the Project unless absolutely necessary. If so, provide temporary or permanent alternative services prior to beginning the Work.

3.03 PERFORMANCE

A. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

B. Cut existing construction only to the extent necessary to accommodate execution of the related Contract Work, and as may be needed for subsequent fitting and patching required to restore surfaces to their original condition.

C. Cutting Methods: Cut existing construction using methods least likely to damage retained elements or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.
   1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to required size, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
   3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
   4. Comply with requirements of applicable Division 2 sections when cutting and patching requires excavating and backfilling.
   5. When services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug-and-seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting.

D. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
   1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
   2. 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.
   3. Where removal of walls and partitions extends one finished area into another, patch and repair floor, wall, and ceiling surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing ceiling system or finish, and floor and wall coverings, and replace with new materials as necessary to achieve uniform color and appearance.

4. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.
5. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.04 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION

PART 1 – GENERAL

1.01 DESCRIPTION: This Section covers the requirements for compliance with health and safety precautions and controls for projects without hazardous waste operations.

1.02 RELATED SECTIONS:

A. Section 01 33 10 – Submittals

1.03 HEALTH AND SAFETY PLAN

A. Within five (5) days after receipt of Notice to Proceed, the Contractor must submit a site-specific Health and Safety Plan addressing health and safety management methods specific to the project. The Plan must include the following, at minimum:
   1. The name of the individual at the jobsite responsible for implementation and compliance with this Plan.
      a. The Plan must include a "Competent Person Evaluation" if the project involves excavations covered by WAC 296-155.
      b. If applicable, the Plan must include the name and qualifications of any electrical safety observer to be provided by the Contractor.
   2. Protection of the public.
   3. A description of tasks to be undertaken, and equipment mobilized for this project.
   4. A list of all known safety or health hazards, problems, and proposed control mechanisms.
   5. Safety Data Sheets (SDS) of and procedures for use, disposal, and storage of all chemicals, products, or materials regulated by WAC 296-62 to be used by the Contractor.
   6. A list of personal protective equipment, monitoring devices, and hazard-specific plans or permits as appropriate and required by State and Federal regulations.
   7. A description of emergency response measures and equipment available for emergency response to address accidents and releases of materials, including but not limited to first aid, eye wash/showers, and fire extinguishing equipment. Include location of this equipment at the jobsite.
   8. Emergency phone numbers contacts, and location of the nearest medical facility.
   9. A monitoring and inspection plan and record keeping measures to ensure that equipment and work practices comply with this Plan.
   10. Personnel names, training and notification procedures as appropriate to ensure that all jobsite personnel are familiar with the Plan elements. Include copies of training certificates.
   11. Procedures for safe storage and handling of flammable liquids, in accordance with WAC 296-24-330.
   12. If applicable, the Contractor must include procedures for safe storage and handling of compressed gasses in accordance with WAC 296-24-295, Compressed Gas General Requirement.
   13. Other issues which the Contractor determines are appropriate and necessary to protect worker safety and health.

1.04 ACCIDENT REPORTING

A. Serious accidents such as those resulting in treatment of an injury at a medical facility, response to the site by emergency medical personnel or damage to property other than that of the Contractor must be reported to the Owner within twenty-four (24) hours of the occurrence.

B. A copy of each accident report which the Contractor or subcontractors have submitted to their insurance carriers must be forwarded to the Owner as soon as possible, but in no event later than seven (7) calendar days after the accident occurred.

1.05 HEALTH AND SAFETY REPRESENTATIVE

A. The Contractor must designate a Health and Safety Representative and must ensure that each Subcontractor designates a Subcontractor's Health and Safety Representative. The Health and Safety Representative must be capable of identifying all hazards and have the authority to stop work and take immediate action to correct the hazard.

B. The Contractor must authorize each such Health and Safety Representative to resolve safety-related issues raised by the Owner or any of its employees.

C. The Contractor must ensure that such Health and Safety Representative is present on the Project Site whenever the Owner Safety Observer is present on the Project Site.

D. Each Contractor's or Subcontractor's Health and Safety Representative must identify himself or herself to the Owner and the Owner Safety Observer at the briefing/tailgate conference.

E. The Health and Safety Representative must verify that all work is performed in accordance with the Health and Safety Plan.

F. At the daily job briefing and/or tailgate conference, Contractor must provide the Owner's representative in attendance at the meeting all relevant information on the Work to be performed, its location, and the equipment to be used.

G. The Contractor must provide all safety equipment required for the Work.

H. At minimum, Contractor and Subcontractor personnel directly involved in the Work must have training in:
   1. First aid, for each Contractor's and Subcontractor's Health and Safety Representative;
   2. Confined space work, if the employees will be working in or around confined spaces;
   3. Shoring and trenching, if work will be in excavations; and
   4. The Contractor's procedures for confined space rescues.

I. Nothing in this Contract shall be construed as imposing any duty upon the Owner or any of its employees with regard to, or as constituting any express or implied assumption of control or responsibility over, Project Site safety, nor over any other safety conditions relating to employees or agents of Contractor, its Subcontractors, or the public.

PART 2 – PRODUCTS (NOT USED)

PART 3 – **EXECUTION** (NOT USED)

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY OF WORK:

A. All workmanship and materials are subject to inspection by the Owner, who may select samples of materials in such number and quantities as he/she may deem necessary to determine their conformance with the Specifications and project intent.

B. All rejected materials and Work must be promptly removed by the Contractor from the premises and adjacent surroundings.

C. All rejected Work or materials must be promptly replaced by the Contractor to the satisfaction of the Owner.

D. The Owner reserves the right to inspect any component of the Work at any time. Such inspections are intended to verify conformance with the design intent as well as workmanship and quality of materials. The Contractor must cooperate with the Owner's inspections.

E. Inspection requirements are generally identified in the Specification sections pertinent to the Work. The Contractor must provide notification of readiness for inspection to the Owner a minimum of two (2) full Working Days in advance.

PART 2 - PRODUCTS: (Not Used)

PART 3 - EXECUTION

3.01 INSPECTION AND TESTING:

A. Upon request by the Owner, the Contractor must furnish test samples of materials at no additional cost. Tests by the Owner will be conducted in accordance with commonly recognized standards of national materials testing organizations and other test methods as deemed necessary by the Owner.

B. Any and all materials necessary for the construction of any part of the Work and associated improvements but not otherwise specified in the Contract must be of high quality, sourced from reputable supplier(s) with minimum five years experience in the applicable industry, specifically identified to the Owner, and are subject to the Owner's approval.

3.02 SAMPLES:

A. The Contractor must prepare and submit samples required by the Contract sufficiently in advance to allow for retesting or modification of the Work, which may be required at the Owner's discretion based on the results of the Owner's evaluation of the samples, as necessary to avoid delaying the Contract's Critical Path Schedule.

3.03 FINAL INSPECTION:

A. The Owner will conduct a final inspection after all requirements for Substantial Completion have been completed, including all punch list items identified during the Substantial Completion inspection and any other concluding Work elements identified in the Contract. Final inspection of the work by the Owner will be made no later than five (5) Working Days after receipt of Contractor's written request for final inspection.

B. Before Final Payment will be made and before the Owner accepts the Work as complete, defects or omissions noted on the final inspection must be corrected by the Contractor to the satisfaction of the Owner and without additional cost to the Owner. See Section 01 77 19 - Contract Closeout.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This work includes furnishing, installing, operating, maintaining, and removal of temporary construction facilities.

1.02 TEMPORARY FACILITIES

A. All costs associated with utilities and services required by the Contractor to execute the Contract Work must be borne by the Contractor.

B. Meals and Lodging: The Owner will not provide meal or lodging facilities for the Contractor's personnel.

C. Temporary Buildings: The Contractor may construct or provide temporary buildings, at an approved or designated location, as may be necessary for the performance of the Work. At the completion of the Work, the Contractor must remove all temporary buildings. All costs associated with temporary buildings and related facilities must be borne by the Contractor.

D. Toilet Facilities:
   1. The Contractor must provide and maintain adequate chemical toilet facilities for all individuals connected with the Work, with separate facilities for men and women.
   2. The Contractor must keep the toilet facilities in sanitary condition in accordance with the Washington Department of Health.
   3. The Contractor must remove the toilet facilities at completion of the Contract and must disinfect the premises.

E. The Contractor must make all arrangements for temporary water, electrical, telephone and fire hydrant services. The Contractor must obtain required hydrant use permits from the Bainbridge Island public utilities, water department.

F. The Contractor must maintain the construction area in a neat and orderly condition throughout the Contract. Food and garbage must be stored properly to prevent attracting animals and insects. Remove food and garbage from the site during non-work hours. Use appropriate controls to prevent rodent infestation of temporary facilities and the job site.

G. Staging and stockpiling areas must be as shown on Plans/or determined during the pre-construction conference.

H. After completion of Work, the Contractor must remove all temporary facilities and must restore the temporary facilities area(s) to original state or as may be required by the Contract.

1.03 MATERIAL DELIVERY AND STORAGE

A. Delivery of materials must be made only during the Contractor's working hours and at such times as the Contractor has a representative available to accept delivery.

B. The Contractor must store materials within the work site area at location(s) determined during the pre-construction conference or designated by the Owner.

PART 2 – PRODUCTS NOT USED.

PART 3 – EXECUTION NOT USED.

END OF SECTION

PART 1 - GENERAL

1.01 Description:

A. This Section describes temporary fencing Work as required by the Contract. Work includes but is not limited to the following:
   1. Provision of all materials required for temporary security fencing.
   2. Installation, continuous maintenance, and final removal of each element included in this Section.

1.02 Related Sections: In addition to the Sections listed below, all work of the Contract must be performed in compliance with the requirements of this Section.

A. Section 01 56 39 - Temporary Tree & Plant Protection

B. Section 01 57 13 - Construction Stormwater Control

C. Section 02 41 13 - Selective Site Demolition

1.03 Submittals:

A. Submit the following product information for approval prior to delivery or installation;

   1. Shop drawing of portable temporary fencing panels and connection hardware.

PART 2 - PRODUCTS

2.01 Temporary Chain Link Fencing: Prefabricated portable galvanized chain link fence panels including fabric, posts, top and bottom rails, and driven posts with rolled fabric & wire ties for areas of uneven terrain.

A. Prefabricated portable fence panels must be minimum 6 feet high by maximum 10 feet wide. Post bases must be minimum 16 inches by 8 inches by 8 inches high concrete pier with sleeve for post, or as approved by the Owner. Prefabricated portable temporary fence panels must be constructed to industry standards for fixed chain link fencing.
   1. Posts - minimum 1-1/2" Schedule 40 galvanized steel pipe.
   2. Fabric - minimum 11 gauge galvanized two-inch diamond mesh steel wire interwoven. Knuckled or twisted selvage is acceptable.

B. Bracing: Provide additional panels or outriggers as necessary to provide a rigid, stable run of fence.

C. Driven Post Fencing:
   1. Posts – minimum 1-1/2" Schedule 40 galvanized steel pipe.
   2. Fabric - minimum 11 gauge galvanized two-inch diamond mesh steel wire interwoven. Knuckled or twisted selvage is acceptable.
   3. Wire Ties – minimum 9-gauge aluminum wire.

D. Gates must be 20 feet wide (two prefabricated panels) with double padlocks to allow Contractor and Owner vehicle entry. Hinged sides of each operating panel must include double bracketing. The Owner will provide one (1) lock keyed for Parks personnel at each entry. The Contractor must provide a lock keyed for Contractor and Subcontractor use at each entry.

E. Signage: Provide warning signage every 50’ of running fence line. Signage must be a minimum of 18” square, brightly colored with contrasting lettering. Text must read as follows, or as otherwise approved by the Owner:

WARNING
CONSTRUCTION
KEEP OUT

F. Barbed wire is not allowed.

2.02 Temporary PVC Fencing:

A. 4’ wide rolls Orange PVC Web Fencing may be utilized for low security and tree protection applications when approved by the Owner.

B. Supporting posts must be formed of 6’ lengths of #5 steel reinforcing bar (5/8” nominal diameter).

C. Supporting post protruding ends must be fitted with OSHA-approved safety caps for #5 steel reinforcing bar.

PART 3 - EXECUTION

3.01 Authorization to Commence:

A. The Owner will issue a formal Notice to Proceed authorizing commencement of the work. No Work may begin until the date specified on this notice.

B. Obtain required permits and permission from local governing authorities and Owner prior to commencing Work.

3.02 Temporary Security Fence: Secure the project site from trespass or unintentional entrance by unauthorized personnel.

A. Temporary chain link fence panels:
   1. Panels must be connected mechanically by means of pre-fabricated, bolted brackets manufactured specifically for the purpose. Fencing must not be wired together.
   2. Where long straight runs result in an unstable condition, sufficient out-rigging must be incorporated to maintain fencing upright. Use only pre-manufactured outriggers or additional fence panels. Outriggers must be placed on the interior side of the fence unless approved otherwise by the Owner. Alternatively, and where appropriate, a “zig-zag” arrangement of panels may be used for stability.

B. Uneven Terrain:
   1. Where uneven terrain will not allow the use of pre-manufactured portable fence panels, or where otherwise directed by the Owner, drive posts directly into the earth plumb and 8’ on center along the approved alignment.
   2. The Contractor is responsible for performing complete locates for underground utilities in any area to receive driven posts.
   3. Drive posts to sufficient depth to assure stability and durability for the life of the installation. Maintain a minimum of 6’ above grade.
   4. Reset loose posts at the direction of the Owner.
   5. Secure chain link fabric to posts using approved wire ties within 6” of the top and bottom of each post, and a minimum of 18” on center between.
   6. Provide posts at each end of each driven post installation at a point that is sufficiently level to clamp prefabricated portable fence panels directly to the driven post installation.

C. Where approved for short-term, low security applications, use 4’ high orange PVC web fencing wired to #5 reinforcing bar “posts” set 5’ maximum on center. Cap each bar with an OSHA-approved safety cap manufactured specifically for #5 reinforcing steel.

3.03 Removal: All materials and debris associated with the Work of this Section must be removed at the appropriate time as follows;

A. When the Owner has accepted the Work as Substantially Complete, the Contractor must disassemble and remove from the premises all temporary fencing.

B. All removal must include complete site restoration by the Contractor as required by the Contract or directed by the Owner.

END OF SECTION

PART 1 - GENERAL

1.01 Summary:

A. This section describes administrative and procedural requirements for the temporary protection of trees, shrubs, grass, vegetation, plant materials and soils not designated for removal. Such trees, shrubs, grass, vegetation, plant materials and soils must be left in place and protected from damage or injury by the Contractor during construction, using full and adequate methods of protection as described herein or as directed by the Owner. This section also includes provisions for restoration or replacement of trees, vegetation (including grass and turf), and soils that are damaged as a result of construction activities, and establishes related Warranty requirements. Work of this section may include, but not be limited to:
   1. Ensure required protection of all existing trees, vegetation, and soils that may be affected by the Work of the Project.
   2. Furnish all labor, materials, equipment, supplies, and operations necessary to install and maintain temporary tree and plant protection as required.
   3. Maintain newly installed tree protection elements, including, but not limited to: fencing, woodchip mulch, landscape fabric, cabling, and signs.
   4. Restore areas damaged by construction activities. The work may include such repairs as turf and landscape renovation or replacement, and soil replacement and preparation, and other activities needed to return construction-damaged areas of the site to “as good as” or “better than” pre-existing conditions.
   5. Compliance with Contract Warranty requirements related to trees, vegetation, and soils.

1.02 References:

A. This Section incorporates by reference the following documents:
   1. Council of Tree and Landscape Appraisers: *Guide for Establishing Values of Trees and Other Plants*
   2. American National Standards Institute Standards (ANSI) A300 - Pruning Standards.

1.03 Related Sections:
Section 01 57 13 - Construction Stormwater Control
Section 01 76 00 – Protection of Existing Facilities
Section 02 41 13 - Selective Site Demolition
Section 31 00 00 - Earthwork

1.04 Definitions and Terminology:

A. *Consultant:* Individual(s) and firm(s) responsible for preparation of the Project design and related Contract documents, as well as design guidance during construction. Used interchangeably with “Designer” and “Design Consultant”.

B. *DBH:* Diameter of a tree at Breast Height, as measured 4-1/2 feet above root crown.

C. *Dripline:* Defined as the area on the ground beneath the outer edge of the tree's canopy.

D. *Hand Excavation:* Defined as excavation by the use of hand tools only without the use of motorized equipment.

E. *ISA:* International Society of Arboriculture.

F. *Landscape Requiring Protection:* All Trees, vegetation & soils, which may be affected by the Work.

G. *Tree Protection Area:* All portions of the project site within the dripline of existing trees, all areas identified on the plans as a tree protection area, and all areas within or behind tree protection fencing.

1.05 Tree, Vegetation and Soil Protection Plan: (not used)

1.06 Contractor Submittals: (not used)

1.07 Additional Conditions:

A. The Owner may order the Work stopped if:
   1. Landscape protection measures are not completed prior to start of the Work;
   2. Unauthorized uses of protected areas are occurring; or
   3. Tree protection fencing is not restored within 24 hours of notice to do so.

B. Tree Identification: In all correspondence regarding Landscape Requiring Protection and tree protection systems, refer to the specific tree number on the Contract Documents, or as listed herein.

1.08 Replacement Plant Warranty:

A. The Contractor must replace any trees and plants which, in the opinion of the Owner, are in unhealthy or unsightly condition or that have lost their natural shape due to dead branches, excessive pruning, excessive defoliation, or other damage caused by the Contractor.

B. The Contractor is responsible for maintenance of all replacement trees, plants, grass, and any other vegetation during the Warranty Period. The Contractor must periodically inspect the plant materials to ensure that they are receiving proper care. The Owner may conduct periodic reviews and notify the Contractor of any areas needing attention.

C. The Contractor must warrant all replaced material for a period of 1 year from date of replacement.

D. The Contractor must replace unacceptable trees/plants/vegetation no later than the next succeeding planting season. Unacceptable trees/plants/vegetation must be replaced in accordance with the original specifications.

E. Any tree or plant that is 25 percent or more dead or disfigured is considered dead. Plants are considered disfigured when excessive dead wood has been removed or when the symmetry, typical habit of growth, or sculptural form has been impaired by the removal of dead wood.

F. The above Warranty is applicable to any growing conditions through which plants of like kind could be expected to survive and any deformity or cause of death which could be attributed to, or affected by, the physiological conditions of the plant. The Warranty does not apply to plant losses due to abnormal weather conditions such as floods, excessive wind damage, drought, severe freezing, or abnormal rain, as determined by the National Weather Service.

PART 2 – PRODUCTS

2.01 Temporary Landscape Protection Fencing:

A. Landscape protection fencing must be comprised of the following:
   1. Use chain link fencing only.
   2. Fencing Type 1 and/or Type 2, or as designated by Owner:
      a. Chain link fence materials including footings, posts, braces, and mesh to be used to form a 6-foot-high enclosure.
      b. Footings:
         1) Type 1: no footings required.
         2) Type 2: above ground precast concrete block type footings, 100 pounds minimum or minimum 16”x 8” x 8” high concrete piers, with sleeves for posts.
      c. Posts: 1-1/2 inch steel pipe, minimum. Use with approval by the Owner in areas where fence must cross existing paved surfaces or as indicated on the Contract Documents or accepted TVSPP.
      d. Mesh: 2 inch by 2 inch, 11-gauge chain link fabric, minimum.

B. Landscape Protection Signage: If required by owner, signage must meet the following requirements:
   1. Provide weather resistant, fluorescent green or yellow signs 48 inch by 48 inch with minimum of 3-inch-high letters indicating the following:
      a. Tree Protection Warning: *“No Trespassing on the Critical Root Zone of this/these tree/trees/plants without direct approval of the* Owner*. Unauthorized activities or Work within the Critical Root Zone will result in a fine of $1,500, or the appraised landscape value, whichever is greater.”*
      b. Botanical/common names.
      c. Appraised value of plants.

PART 3 – EXECUTION

3.01 Preparation

A. Prior to any construction activity the Contractor must:
   1. Review protective measures required by the Contract.
   2. Verify adequacy of the extent of Landscape Requiring Protection, as defined in the Contract Documents.
      a. Protect Landscape in accordance with Contract Documents.
      b. Coordinate with the Owner regarding areas requiring special attention as identified and specified on the Contract Documents.

3.02 Fencing and Signage:

A. Landscape protection fencing:
   2. Type 2 Fencing: Install fence on above ground precast concrete block type footings in locations as indicated by Contract Documents.
   3. Install fencing and mulch (wood chips) to protect Trees Requiring Protection from construction activities when trees are located inside the construction fence.
   4. For Landscape Requiring Protection located outside the construction fence, no additional protection fencing is required if construction activities will not impact the landscape. If construction activities are expected adjacent or near Trees Requiring Protection, install chain-link fencing Type 2 for the duration of any construction activities.
   5. Do not compact soil or use heavy equipment in the Landscape Protection Area when installing protective fencing installation.
   6. Provide diagonal bracing to vertical posts at corners of enclosures and wherever needed to ensure rigidity of the fencing.
   7. Install chain link fabric tight to grade at the bottom edge and stretched uniformly between posts. Install top of fabric 6 feet above grade, minimum.
   8. Install fabric to form continuous fencing as indicated on Contract Documents. Attach fabric to posts 12 inches on center with 11-gauge wire ties securely fastened, or with bolted ring clips, and to top rail 3 feet on center maximum.
   9. Attach orange flag strips 12 inches long at 3 feet on center along the fence, 5 feet above grade.
   10. Provide 1 locked gate at each fenced area.

B. Landscape Protection Signage:
   1. Securely attach at least one landscape protection sign to each landscape protection area fence. Multiple signs may be required for extensive lengths of fencing if so directed by the Owner.

3.03 Tree, Vegetation, and Soil Protection:

A. Where existing trees or vegetation are within the area of work, or where existing trees outside the area of work, have drip-lines extending into the area of work, the Contractor

must employ all methods necessary to prevent adverse impact to these existing trees including protection against cutting, breaking or skinning of roots, skinning or bruising of bark, compaction of root zones, and breaking of branches. These methods may include but are not limited to:

1. Tree protection fencing: Do not compact soil or use heavy equipment when installing protective fencing. No work may commence until the tree protection fence is in place for any given work zone and no tree protection may be moved until the work is substantially complete in any given work zone. Tree protection fencing is temporary and may be moved from completed areas and re-used as the construction progresses.
2. Temporary tie-up of low limbs: Under the supervision of the Owner, tie back flexible limbs and overhead branches that could be damaged by the passage or activity of equipment. Anticipate limbs that could be in the way of necessary equipment to avoid limb damage and provide a remedy before work occurs. Do not remove tree limbs without the prior written acceptance of the Owner.
3. Surface Protection Measures: Surface protection measures must be provided in all landscape protection areas (including tree driplines) except areas where existing or proposed pavement is present and areas where only hand tools will be utilized. Areas within the dripline of existing trees which are designated for pavement replacement require surface protection measures while pavement is removed. Surface protection methods utilized must be sufficient to prevent root damage and soil compaction:
    a. Protect soil and roots within the landscape protection areas with a 1” mesh opening coir mat under 4 inches of wood chips. Provide a 36-inch diameter zone clear of mulch at the base of each tree.
    b. For protection from repetitive foot traffic, light equipment use, and other light construction activities, apply a 6-inch thick layer of mulch and/or plywood planking within the dripline of trees. Provide a 24-inch radius clear zone at the base of each tree.
    c. For protection from heavy equipment use, truck use and other heavy or repetitive construction activities place steel plates and/or timber planking within the dripline of trees. Provide sand, soil or other approved material below steel plates and planking to prevent contact with roots.
    d. In areas of Landscape Requiring Protection with understory landscape (such as lawn or shrubs) as indicated by Contract Documents, provide mulch when directed to do so by the Owner as needed to protect soils and roots from any work taking place within the fencing.
4. Tree root protection, root pruning and root treatment: Preserve and protect surface roots and perform all Trenching, Excavation and Tunneling within the Drip-Line as specified in Paragraph 3.05 herein and in the Contract Documents.

B. Maintenance of Tree, Vegetation, and Soil Protection Measures
    1. Monitor maintenance of each landscape protection areas to ensure it is in a healthy condition and immediately report any deficiencies or concerns to the Owner immediately.
    2. Perform on-site review as needed during construction for activities that are adjacent to or affecting any landscape protection areas.

3. Monitor any work within landscape protection areas including all excavation,

3.04 Above Grade Work:

A. Use of the area within protective fences and within the landscape protection area:
   1. Do not store materials potentially harmful to tree roots within 20 feet of outside limit of protected areas. Potentially harmful materials include, but are not limited to: petroleum products, cement and concrete materials, cement additives, lime, paint coatings, waterproofing agents, form coatings, detergents, acids, and cleaning agents.
   2. No grades may be altered within the required protective fence area.

3.05 Repair, Replacement and Payment for Damage:

A. Trees, shrubs, grass, or other plant material not ordered or designated to be removed but that are destroyed or irreparably damaged by Contractor's operations as determined by the Owner, must be repaired or replaced by the Contractor in accordance with the Owner's recommendations.
   1. Replacement of trees must adhere to the City's Tree Replacement policy (at least 2 replacement trees for every 1 tree removed).
   2. Replacements must be of the same species and as nearly as possible of the same size as the trees to be replaced (minimum of 2" caliper).
   3. Replacement of damaged or destroyed shrubs, grasses, and/or other plant materials must restore such vegetation or areas of vegetation to pre-construction conditions or better, to the satisfaction of the Owner.
   4. The Contractor must allow two (2) Working Days advance notice for inspection of nursery stock replacements by the Owner.

B. Payment: If for any reason a tree, shrub, grass area, or other plant material/area cannot be fully replaced or restored in accordance with 3.06.A above, in addition to the Contractor's restoration approved by the Owner, the Contractor will be assessed damages for the difference in the dollar value of the damaged tree, shrub, or other plant material, and the dollar value of the replacement.
   1. The dollar value will be determined by the Owner from the "Guide for Establishing Values of Trees and Other Plants," prepared by the Council of Tree and Landscape Appraisers, current edition. Damages assessed will be deducted from moneys due or that may become due to the Contractor.

C. Planting of replacement stock must be done in accordance with the requirements of the Contract Documents during the first fall or spring planting period, whichever comes first.

3.07 General Site Restoration

A. Lawn Area Restoration: The Owner will determine the level of restoration necessary depending on the amount of damage to the existing turf and soils. Areas that have been driven on extensively and are compacted or bare will require replacement, whereas areas where turf is thinned or dead but still present will require reseeding only.

3.08 Fence Removal:

A. Do not remove temporary protection fencing until the Owner has given approval to do so. Fence removal is subject to all protective measures for landscape protection areas as stated in Section 01 56 39.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This Section describes work consisting of the furnishing, installing, maintaining, removing, and disposing of Construction Stormwater Controls (CSC, also referred to as TESC "Temporary Erosion and Sedimentation Controls"). The CSC must be designed and implemented to prevent erosion and scour, to treat sediment laden water for acceptable discharge, and to prevent the conveyance of sediment into surface waters, drainage systems, and environmentally critical areas.

B. At the end of this Section two sample forms are attached. These are the CSC Monitoring & Maintenance Log and the CSC-BMP Construction Change Tracking Form, and are intended for use by the Contractor during the execution of the Work.

1.02 GENERAL

A. During construction, the Contractor must incorporate practices that prevent erosion (or control erosion when prevention is unavoidable) and must make every effort to maintain effective erosion and sediment controls throughout the Work, including implementing timely corrective actions as may be necessary. Sediment must be prevented from entering any surface water, drainage facility, or natural drainage system, and must be prevented from transport beyond the Project Site.

B. The Contractor must provide a Construction Stormwater Control Plan prepared in accordance with the above regulations and as specified in this Section, which is subject to review and approval by the Owner. The CSC Plan must identify and confirm qualifications for the Contractor's Certified On-Site Construction Erosion Control Lead . The plan must be compatible with and coordinated with the Work and its phasing, ensuring continuous protection.

1.03 SUBMITTALS

A. Construction Stormwater Control (CSC)
   1. At the preconstruction conference, the Contractor must be prepared to discuss temporary erosion and sedimentation controls. Following the outcome of these discussions, the Construction Stormwater and Pollution Prevention Coordinator (CSPPC) must prepare and submit interim or full CSC Plans as indicated in the table below, unless agreed to otherwise at the preconstruction conference.

Working Days After Notice to Proceed Date	Submittal Description	Comment
≤ 5	CSC Plan for first 15 Working Days	Allow 5 Working Days for Owner Review
≤ 10	CSC Plan for first 30 Working Days	Allow 10 Working Days for Owner Review
≤ 30	CSC Plan for all Work (first draft)	Allow 15 Working Days for Owner Review
≤ 50	See Final CSC Plan Submittal	Allow 15 Working Days for Owner Review

4. Content of CSC Plan:
   a. The CSC Plan must show, as relevant to the Contractor's critical path schedule, the scheduling of installation, maintenance, phasing, and removal of erosion and sedimentation controls as required by the Work and applicable codes. Work areas to be addressed in this plan include as applicable:
      1) The Project Site, identifying staging, storage, stockpiling, non-Work boundaries, and other construction-related areas;
      2) Areas beyond the Project Site, but potentially impacted by Site Work;
      3) Transportation facilities including construction traffic routes and access/exit control areas on and off the Project Site;
      4) Environmental Critical Areas (ECA), as defined in Ch 25.09 SMC, within or near the Project Site, such as geologic hazard areas, flood prone areas, riparian corridors, wetlands, fish and wildlife habitat conservation areas, and abandoned landfills;
      5) Inlets, catch basins, ditches and channels whether dry or water-filled, and other surface drainage facilities;
      6) Surface waters such as streams, lakes, and other bodies of water; and
      7) Identify areas of erodible soil not being worked and in excess of 4,000 square feet that may be exposed, and any areas of erodible soil that may be or unprotected/ uncovered for more than 2 calendar days.
   b. The CSC Plan submittal must include the following descriptive information as applicable to the Work:
      1) Shop Drawings of sufficient scale and detail to clearly reflect the Project Site and the locations and types of temporary erosion and sediment controls. When applicable, show by a series of time sequence Shop Drawings, how CSC controls are to be installed, maintained, removed and coordinated with the Work and the schedule;
      2) Describe how non-work areas potentially impacted by Work will be identified and protected;
      3) Describe the details and continuing maintenance of entrance and exit equipment wash areas;
      4) Show locations and describe CSC details of existing and proposed ditch, berm, culvert, pipe, sediment basin, basin outfall, scour control, inlet, catch basin, drain, bypass, subsurface drain, and related features. Include cross-section views if helpful or necessary to describe CSC details;

5) Describe treatment processes for, controls of, and the disposal of waters resulting from dewatering, surfacing groundwater, and rainfall;
6) Describe protections and covering practices for stockpile, muck, and similar accumulated materials;
7) Describe the controls to prevent sediment, debris, and other pollutants from entering surface waters and drainage features;
8) Provide Manufacturer's Certificate of Compliance, certified laboratory test reports, catalog cuts, samples, and other information providing adequate description of Supplies and Material proposed for CSC applications;
9) The name of the Certified Erosion and Sediment Control Lead (CESCL), qualifications, experience, and certifications directly related to temporary erosion and sediment control, and other information as the Contract and the Work may require, including contact information that will ensure timely response. If the Work is of sufficient magnitude to require backup or additional CESCL coverage, describe the qualifications of additional individuals providing such coverage, any on-site training that may be necessary, and frequency and type of reporting to the CESCL;
10) A schedule of typical inspections, as needed to ensure timely maintenance and repair;
11) Identify and provide timelines for submitting permit required or related documentation;
12) Provide details of seed mix, amendment, mulch, and protections for placing and establishing temporary seeded erosion control areas;
13) In areas where exposed erodible soil exceeds 4000 square feet or that may be unprotected for more than 2 calendar days, describe the controls, and the proposed monitoring ensuring erosion and sedimentation remains compliant; and
14) Provide details of other CSC measures as applicable.

c. The Contractor shall have at a designated location at the Project Site, and the CESCL shall have immediately available, copies of the current CSC Plan.

5. Maintaining CSC Plan Current:
   a. The Contractor and CESCL must continuously be prepared to discuss with the Owner the status of CSC controls in-progress and pending as they relate to the Work, to the progress schedule, to permits, to Change Order, and as may be required in the Contract.
   b. When revisions to the current CSC Plan are required by the Owner, the Contractor and CESCL must update the CSC Plan as discussed and must submit the updated CSC Plan to the Owner within 5 Working Days unless the Owner agrees to other arrangements.
6. Authority of CESCL.

PART 2 - PRODUCTS

PART 3 – EXECUTION

3.01 GENERAL CONSTRUCTION REQUIREMENTS

A. Guiding Regulations, Codes, and Rules
   1. Work involving erosion and sedimentation control must comply with Paragraph 1.02 of this Section.

B. General Guidelines and Measures for Doing the Work
   1. As part of Contract Work execution, the Contractor must:
      a. Prevent and control erosion and sedimentation processes,
      b. Prevent and control scour and scour processes in water bearing channels,
      c. Prevent transport of sediment,
      d. Protect surface waters and drainage systems from entry of sediment and other construction byproduct,
      e. Prevent erosion and sedimentation impacts to areas not designated for Work and
      f. Coordinate erosion and sedimentation controls with scheduling of the Work.
   2. Methods of accomplishing these goals include, but are not be limited to:
      a. Installing temporary ditches, berms, culverts, and other measures to control and redirect surface waters;
      b. Installing temporary dams, settling basins, energy dissipaters, and other measures to detain water, prevent scour, and allow for sediment drop and controlled removal;
      c. Installing measures controlling surfacing groundwater and dewatering discharges;
      d. Installing temporary covers or otherwise protecting slopes, stockpiles, and exposed or disturbed soils from erosion and sediment producing processes;
      e. Installing temporary work area perimeter and sediment transport prevention measures, such as silt fences, wattles, filters, and berms;
      f. Treating sediment laden waters, and removing and disposing of sediment;
      g. Installing sediment and debris removal controls for equipment entering and leaving designated Work areas, and
      h. Installing temporary fencing, flagging, and other markings at boundaries of areas identified as not part of the Work.

3.02 STRUCTURAL AND BIOMECHANICAL EROSION CONTROLS

A. Equipment Wash Area
   1. Where Equipment and vehicular traffic may contribute to the transport of sediment and other debris beyond a work area within a Project Site or beyond the Project Site, the Contractor must have in place a stabilized construction wash area at a location or locations to remove sediment, mud, and other debris from tires and other areas of the equipment or vehicles here such materials tend to collect.
   2. Stabilized construction wash areas must be in place and ready for operation before the potential for transporting such material occurs.
   3. The wash area must consist of one or more of the following as the Work requires and as the Contract may require:
      a. Graded entrance and exit water trough all Equipment and vehicles must go through. The Contractor may require a water trough for each direction. The depth of water in the trough must be maintained at a level adequate for the size of

Equipment and vehicle expected. The length and width of the trough must be sized to ensure all length and width Equipment and vehicle can be acceptably cleaned.

b. Hose, hose brush, long handled brush, and similar Supplies, and adequate labor to acceptably handle the size and volume of traffic.
c. Adequate source of water and means to contain the water within the designated wash area.
d. Regular removal and disposal of sediment and debris.
e. Removal and disposal of non-debris and non-sediment pollutants and contaminants.
f. A drain as may be necessary with controls in place to discharge water, compliant with applicable regulation, law, permit, and as the Contract may require.
g. An area before and after the wash area of sufficient size with quarry spall or other coarse aggregate to allow for after-wash drip collection.

B. Road Stabilization
1. Temporary road stabilization measures may be required in areas within and beyond the Project Site, such as access roads, haul roads, subdivision roads, parking areas, staging areas, and other vehicular and Equipment traffic routes. The stabilization required must be adequate for the Equipment and vehicular traffic and for the Project Site local conditions, local climate, and weather typical for the Contract Time.
2. Temporary road stabilization measures may consist of placing and compacting a thickness of quarry spall, a thickness of Mineral Aggregate Type 2 or Type 13, other aggregate, or a combination of these and other Material.
3. Where temporary road construction cannot be aligned to avoid areas within the dripline of trees not identified for removal, the Contractor must comply with the requirements of Paragraph 1.05 of Section 01 76 00 – Protection of Existing Facilities.
4. Temporary road stabilization measures must be maintained by repairing ruts, tracks, settling, and other failing areas. Such repairs may include placing and compacting additional aggregate. Settled, broken, rutted, and otherwise damaged timber, mulch, and other material within the drip lines of trees must be repaired by increasing the thickness of material.
5. Upon completion of the Work, or as may be required to accommodate the Work, temporary road stabilization measures must be removed and disposed of. Within the dripline of tree, the removal must be conducted to prevent damage to feeder and surface roots and minimize compaction of soils.

3.03 TEMPORARY SEDIMENT CONTROLS

A. Silt Fence (Sediment Fence or Filter Fence):
1. Silt fences must act as a filter to both allow the passage of water through the fence and also to prevent the passage of sediment through, under, or over the fence. Silt fences must be in-place before the area is disturbed and must be coordinated with soil disturbance activity.
2. Silt fence(s) must be constructed at locations downstream or down slope of surface runoff areas and upstream or upslope of surface bodies of waters. Silt fences must be spaced to account for grade of slope, runoff flow rate and velocity, sheeting and rilling, type and relative density of soil(s), rate of sediment loading, expected maintenance

type and frequency, and other factors as the site and Work require. Silt fences must not be placed across or in streams, channels and ditches.

3. Silt fences must be located along contours with the ends turned uphill to capture runoff and prevent flow around the end of the fence. Where the installation requires crossing of contours in areas other than at the ends, gravel check dams must be placed perpendicular to the uphill face of the fence to minimize concentrated flow and erosion along the fence. The gravel check dams must be approximately 1 foot deep at the fence and must continue perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface. The gravel check dams must consist of crushed surfacing base course gravel backfill for walls, or shoulder ballast. The gravel check dams must be spaced at 10-feet maximum intervals along the fence where the fence crosses contours. The slope of the fence line where contours are crossed must not be steeper than 3H: 1V.
4. The height of the fence fabric (geo-textile) above ground surface must be between 30 and 36 inches.
5. Posts must be of sufficient length, depth, and spacing to withstand maximum loading for the durations estimated between sediment removals. Unless the Contractor can justify otherwise to the Owner, posts must be installed to a depth of 30 inches minimum, except within the drip line of a tree (see Item 7 below), and must be spaced no more than six (6) feet apart in a fence line. If required post depth penetration cannot be obtained, the posts must be adequately secured on the upslope side by bracing or guying to an adequately installed anchor. Posts must be either wood or steel. Wood posts must have minimum dimensions of 1-1/4 inches by 1-1/4 inches and must be white oak or other hardwood resistant to rot, with no defects. Steel posts must consist of U, T, L, or C shape posts with a minimum weight of 1.33 pounds per foot, or other steel posts having equivalent or greater strength and bending resistance.
6. The fence fabric and support backing systems must be attached on the up-slope side of the posts with staples, wire, hog rings, or other connection device as recommended by the manufacturer, in a manner that does not tear or damage the fabric. At the bottom of the fence, the fabric and support backing system must be buried at least 6 inches below the ground surface, and then backfilled with native soils compacted by tamping or other appropriate compaction methods.
7. Excavation for installation of silt fence within the drip line of trees, and around other vegetation to be retained, must be without damage to roots. Roots that are exposed must not be damaged and must be promptly covered with earth. Where the bottom of fabric and support backing cannot be installed to a 6 inch depth due to interference with roots, the fabric and backing must be placed flat on the upside of fence for a minimum 12 inch width and then covered with a minimum 6 inch depth of large size aggregate ballast. In non-trench fabric bottom installations, post penetrations into the earth must be increased and the height of fence above the top of ballast must not exceed three (3) feet.
8. Fence support backing system, in the form of wire or plastic mesh with maximum mesh spacing of 2 inches by 4 inches and of adequate strength to withstand maximum loading, must be attached to posts and fabric as recommended by the Supplier. Plastic mesh must have the same or greater ultraviolet (UV) resistance as the geo-textile fabric. All geo-textile fabric must have backing whether exposed or buried.
9. Fence fabric must be continuous along any single length of filter fence. Continuous fence requirements include:

a. The geotextile fabric must be sewn together during manufacture or by the Supplier to form a single length of geo-textile for a continuous fence application. All sewn seams must be located at a support post.
b. Separate geotextile fabric may be installed across posts with a minimum 10 foot overlap where the overlap is supported by no less than three (3) posts with spacing between any posts not greater than 4 feet. Overlapped fabric must always be secured to support backing.
c. The Contractor may place 2 posts, one on each side of the overlapped fabric and backing, and twist the overlapped fabric at least 2 complete revolutions before driving the posts into the earth. The overlaps must extend a minimum one (1) foot beyond the 2 posts before twisting.

10. Lapped or twisted fabric and backing that slip is considered defective and must be replaced with sewn geotextile. For pre-staked silt fence, laps may be performed in accordance with the manufacturer's written recommendations.

B. Sediment Removal: Sediment must be removed and disposed of when the sediment build-up reaches a height of 10 inches to 12 inches. Removal is also required if build-up exceeds one third (1/3) the height of fence.

C. Damaged Fence Repair
1. Damaged or improperly functioning silt fence must be promptly repaired or replaced.
2. Rips, tears, holes, and other defects in the geo-textile fabric or the backing must be promptly repaired by placing new material(s) over the damaged materials the full width and height of fence including buried or covered fabric and backing, and must overlap existing fence material(s) a minimum 5 feet each side of the defect. The repaired fence must be supported by and securely tied to at least 5 evenly spaced posts.
3. Broken posts must be replaced with 2 posts spaced 1 foot on each side of the broken post. New posts must be driven to 30 inches into the soil or braced to upslope anchors. The fabric and backing must be securely tied to each new post.
4. Posts that lean greater than 1H: 4V must be replumbed and must be supported at the top with bracing or guying to an adequately installed upslope anchor.
5. Water or sediment escaping beneath the silt fence must be repaired by installing new fabric and backing over the existing material extending 3 feet upslope with a minimum 3 foot overlap on both sides. Ballast must be placed over the on-surface repair with a minimum 6 inch depth large aggregate ballast. A new post or posts must be installed along the leak with spacing of 2 feet maximum.
6. Any other conditions that reduce the effectiveness of the silt fence requires immediate repair and/or replacement.

3.04 DRAINAGE AND SEWER SYSTEM PROTECTION

A. The Contractor must prevent the introduction of pollutants, contaminants, sediment, and other material from entering Storm Drain, combined Sewer, and other drainage system via any entrance vehicle. Sediment prevention for drainage structures may require such apparatus as sediment sumps, cover filters or outlet pipe cover filters.

B. Filters must allow the passage of water into or from the drainage structure without unreasonable backup or ponding and must prevent the passage of sediment and other debris.

C. Filters must be secured to the opening being protected to withstand all loadings and to resist movement including sediment and debris build-up, flows typical for the drainage structure and the local drainage conditions, and the potential for disturbance from construction and traffic activity.

D. Filters covering large areas not having adequate structural support must be reinforced with and secured to a plastic or wire mesh support backing system.

E. Where filters are expected to be in place for a considerable period of exposure, UV resistance and other climate and environmental strengths must be adequate.

F. Frequency of maintenance must include removal of sediment and other debris when either the sump build-up reaches approximately 1/3 capacity, or when obstructed filtration or the allowance for the passage of water is causing water back up.

G. Sediment and debris removal must be done carefully to prevent the escape of these materials into the drainage system.

3.05 CONSTRUCTION STORMWATER CONTROL MAINTENANCE

A. The Contractor must keep a record of the CSC-BMP measures using forms similar to the samples attached to the end of this section during the entire duration of the Work.

B. Construction Stormwater Control measures must be inspected at regular intervals and immediately following significant runoff producing rainfall events. The individual BMP and other control measures must be verified as performing acceptably and must be maintained until they are no longer needed, or are to be converted as part of a permanent erosion and sediment control when specified in the Contract.

C. The various devices must be inspected for damage, bypass, undercutting, and non-performance, and must be promptly repaired. Sediment buildup must be removed as specified or more frequent intervals when performance becomes questionable. Debris and contaminated sediment must be properly disposed of. Clean sediments may be stabilized on-site as the CSC plan indicates.

D. When wet weather is forecast, the CESCL must verify that all measures are in-place and are functioning effectively and acceptably.

3.06 REMOVAL AND REUSE OF CONSTRUCTION STORMWATER CONTROLS

A. When a temporary erosion or sediment control feature is no longer required, the Contractor must remove the measure or measures.

B. Reuse of a control measure may be acceptable if

1. The measure or device has been thoroughly cleaned of all debris;
2. The measure or device is free of tears, holes, or other damage; and
3. The measure performs as intended and required.

3.07 SWEEPING AND WASHING

A. The Contractor must ensure that soil, debris, or other material tracked and deposited is removed by sweeping or washing and properly disposed of.

END OF SECTION

Sample forms follow:
CSC Monitoring & Maintenance Log
CSC-BMP Construction Change Tracking Form

CSC MONITORING & MAINTENANCE LOG

Use this form manually or electronically to track maintenance activities related to BMPs and other CSC measures. Form(s) must be maintained on-site, reflecting most current status. If forms kept manually, make additional copies of form as needed. Keep all completed copies of this form with the on-site CSC Plan.

PW #	PROJECT NAME:	CONTRACTOR

PRIOR TO EARTHWORK:

I hereby certify all required BMPs are in place prior to construction

Printed Name of CESCL | Signature & Date

DURING EARTH WORK:

Date Inspected	Inspected by (Name)	BMP & Location	Repairs/Modifications Needed (Briefly Describe; write "N/A" if none)	Comments/Sampling Results

CSC - BMP CONSTRUCTION CHANGE TRACKING FORM

Use this form manually or electronically to track revisions/changes to BMPs and other CSC measures as work progresses. Form(s) must be maintained on-site, reflecting most current status. If forms kept manually, make additional copies of form as needed. Keep all completed copies of this form with the on-site CSC Plan. Reflect all CSC BMP changes on the CSC Plan Sheets.

PW #	PROJECT NAME:	CONTRACTOR

Change Number	Change Date	Name of CESCL Making BMP Change	CESCL Certification Expiration Date	Description of CSC Plan Sheet Change With Drawing Number

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section covers the requirements for compliance with environmental precautions and controls.

1.02 RELATED SECTIONS

A. Section 01 32 13 - Progress Schedules

B. Section 01 33 10 – Submittals

C. Section 01 57 13 - Construction Stormwater Control

1.03 SUBMITTALS

A. Within 10 Working Days of Notice to Proceed, the Contractor must submit an Environmental Pollution Control Plan. The Plan must include:
   1. Water quality
   2. Air quality, including dust control
   3. Noise pollution
   4. Temporary water pollution/erosion control
   5. Oil, Fuel, and Chemical Storage, Handling, Spill Prevention, and Control.

1.04 NOTIFICATIONS RELATIVE TO CONTRACTOR'S ACTIVITIES

A. The Contractor must plan and schedule Contractor work activities to conform to and allow time for notifications, approvals, reviews, and other conditions of the Contract Documents as detailed in Section 00 72 00.

B. Required notifications pertaining to spills, discharges, and similar incidents and emergencies are also detailed in Section 00 72 00. These include, but may not be limited to:
   1. Sanitary Sewer Spills
   2. Chemical, Oil, Hazardous Substance, or other Contaminant Spill or Discharge

1.05 CHANGE ORDERS DUE TO ENVIRONMENTAL PROTECTION REQUIREMENTS

A. General: During the life of the Contract, the Contractor must comply with all provisions of federal, State, and local statutes, ordinances, and regulations pertaining to the prevention of environmental pollution and the preservation of public natural resources. Pursuant to RCW 39.04.120, if the Contractor must undertake extra work not contemplated by the Contract due to the enactment of new, or the amendment of existing, statutes, ordinances, rules, or regulations occurring after the submission of the successful Bid, the Owner will issue a Change Order setting forth the extra work that must be undertaken, which shall not invalidate the Contract.

1.06 WATER QUALITY

A. The Environmental Pollution Control Plan must identify the onsite individual responsible for water quality, and specific activities and locations and specific means and methods to prevent and/or control impacts to water quality.

B. The Contractor must comply with city ordinances, State, and federal laws and other regulations or rules applicable to water pollution occurring in waters of the State and in interstate waters. The Contractor must:
   1. Exercise precautions throughout the life of the Contract to prevent pollution, erosion, siltation, and damage to property.
   2. Provide for the flow of all watercourses, including but not limited to streams, ditches, sewers, and drains intercepted during the progress of the Work.
   3. Completely restore disturbed watercourses in as good condition as the Contractor found them, or make such final provisions for them as the Owner may direct.
   4. Not obstruct the gutter of any Street.
   5. Use all proper measures to provide for the free passage of surface water.
   6. Remove and dispose of all surplus water, mud, silt, slicking, or other run-offs pumped from excavations or resulting from sluicing or pavement cleaning or other operations.
   7. Make all applicable notifications required by Section 00 72 00.

C. The Contractor must comply with the water quality criteria required by the Department of Ecology and regulations of:
   1. The Washington State Department of Fish and Wildlife.
   2. Those federal statutes on oil spills enacted under the federal Water Pollution Control Act Amendments of 1972 (a copy of which may be obtained from the U.S. Environmental Protection Agency).
   3. The water quality standards of the State of Washington as set forth in Chapter 173-201A WAC.
   4. Any local statutes, regulations, ordinances, or rules, which stipulate the various types of discharge prohibited in public sewer systems or any drainage ditch in the local jurisdiction.

D. State statutes on water pollution covering liability of the Contractor, penalty for violation, liability and damages for injury or death of fish, animals or vegetation are set forth in Chapter 90.48 RCW. As an aid to the Contractor, some (but not all) of the rules set forth by the various State departments are summarized below. The Contractor is cautioned, however, that each Department of the State may add other restrictions, as they deem necessary, to protect fish and to prevent air or water pollution:
   1. State Department of Fish and Wildlife: In doing the Work the Contractor must:
      a. Not degrade water quality in a way that would harm fish. (The Washington State Water Quality Regulations will serve as water quality criteria for the Work.)
      b. Release into a flowing stream or open water any fish stranded by the Work.
      c. Replant any stream bank or shoreline areas if the Work has disturbed the vegetative cover. (Any trees, brush, and grasses used in replanting must resemble the type and concentration of surrounding vegetation, unless the Contract provides otherwise.)

d. Provide an open water channel at the lowest level of any isolated pothole remaining when the Work is complete.
e. Protect fish by preventing harmful siltation on the bed or bottom of any body of water.
f. Not block stream flow or fish passage.
g. Keep all Equipment out of any flowing stream or other body of water (except as the Contract may permit).
h. Not remove gravel or other bottom material from within the high-water flow channel bed of any stream nor from the bottom of any other body of water (except as the Contract may permit).
i. Dispose of any Project debris beyond high-water flows.

2. State Department of Ecology: In doing the Work, the Contractor must:
   a. Obtain a waste discharge permit from the Department of Ecology before:
      1) Washing aggregate, or
      2) Discharging water into a ground or surface waterway from pit sites or excavations when the water contains turbidity, silt, or foreign materials.
   b. Provide the Owner with a copy of each waste discharge permit before starting the Work.
   c. Control drainage and erosion to minimize the pollution of any waterway.
   d. Dispose of all toxicants (including creosote, oil, cement, concrete, and water used to wash Equipment) in ways that will prevent them from entering State waters.
   e. Dispose of all debris, overburden, and other waste materials in ways that will prevent them from entering State waters.

E. The Contractor must perform such temporary work as may be necessary to effectively control water pollution, erosion, and related damage within the Project Site or which might be necessary at work areas located outside the Project Site. These outside areas may include, but are not limited to, equipment, material and other storage sites. When temporary control facilities or measures are no longer needed, they must be removed and the areas restored or finished as designated by the Owner.

F. If Work is suspended for an extended period of time, the Contractor is responsible for controlling erosion, pollution, sedimentation, and runoff during the shutdown period.

G. The Contractor must protect water quality using appropriate methods subject to review and approval by the Owner. In addition to other requirements in the Contract, water quality control measures may include, but are not limited to, the following:
   1. Diversion of Storm Water: Storm water may be diverted around the Project to prevent pickup of silt. This may be accomplished by pumping; improvising ditches; lining channels or by placing metal, plastic or concrete gravity pipe; constructing ditches, berms, culverts, etc., to control surface water; or constructing dams, settling basins, or energy dissipaters to control downstream flows.
   2. Intercepting Ground Water: Surfacing ground water may be intercepted and routed around the construction site to prevent silt erosion by the use of gravel trenches, French drain tiles, well points, or interceptor ditch. The Contractor must provide means of controlling underground water that may be encountered during the Work.
   3. Turbid Water Treatment Before Discharge:

a. The term turbidity means the optical property of sample demonstrating the scattering and absorption of light caused by suspended material as expressed in Nephelometric Turbidity Units and measured with a calibrated turbidimeter. Surface water turbidity must be measured in a manner acceptable to the Owner and is subject to verification by the Owner.
b. Turbid water from the Project Site must be treated before being discharged into stream or other State waters.
c. Turbulence limitations include:
    1) For Lake Class Receiving Waters, turbidity must not exceed 5 NTU (Nephelometric Turbidity Units) over background conditions;
    2) For Class AA and Class A Waters, turbidity must not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU;
    3) Discharges to a State waterway caused by aggregate washing, drainage from aggregate pit sites, and stockpiles or dewatering of pits and excavations must not increase the existing turbidity of the receiving waters;
    4) For other classes of waters, refer to WAC 173-201-045 and WAC 173-201A-030.
d. Turbidity may be removed by the use of lagoons or holding ponds, settling basins, overflow weir, polymer water treatment, discharging to ground surface, by percolation, evaporation or by passing through gravel, sand or fiber filters.

4. Temporary Erosion Control: Temporary erosion control measures are required to minimize exposed areas and slopes until permanent measures are effective. Plastic sheet covering must be placed over exposed ground areas to protect from rain erosion. Other alternative methods for erosion control under certain situations may include netting, mulching with binder, and seeding. Should rutting or erosion occur, the Contractor is responsible for restoring damaged areas and for cleanup of eroded material, including that in ditches, catch basins, manholes, culverts, and other pipes.
5. Chlorine Residual: Water containing chlorine residual must not be discharged directly into Storm Drains, streams, or State waters. Chlorine water may be discharged into sanitary sewers or disposed on land for percolation. Chlorine residual may be reduced chemically with a reducing agent such as sodium thiosulphate or vitamin C. Water must be periodically tested for chlorine residual.
6. Vehicle and Equipment Washing: Water used for washing vehicles and Equipment must not be allowed to enter Storm Drains, streams or other State waters unless separation of petroleum products, fresh concrete products or other deleterious material is accomplished prior to discharge. Detergent solution may be discharged into sanitary sewers or held on the ground for percolation. A recirculation system for detergent washing is recommended. Steam cleaning units must provide a device for oil separation.
7. Oil and Chemical Storage and Handling: Handling and storage of oil and chemicals must not take place adjacent to waterways. The storage must be accomplished via use of dike tanks or barrels with drip pans provided under the dispensing area, or other such method approved by the Owner. Shut-off and lock valves must be provided on tanks. Shut-off nozzles must be provided on hoses. Oil and chemicals must be dispensed only during daylight hours unless the dispensing area is properly lighted. Should an oil or chemical spill occur, the Contractor must provide timely notification in accordance with

Section 00 72 00. Fencing must be provided around oil storage. Locks must be provided on valves, pumps, and tanks.

8. Sewage: If a sanitary Sewer line is encountered and repair or relocation work is required, the Contractor must provide blocking and sealing of the sanitary Sewer line. Sanitary Sewer flow must be pumped out, collected, and conveyed or pumped directly to a sanitary Sewer system manhole for discharge. The existing Sewers must be maintained by the Contractor, without interruption of service, by the use of temporary Sewer bypasses. In addition, the excavated materials adjacent to and around a rupture of a sanitary or combined Sewer pipeline must be removed to a disposal site. Equipment and tools in contact with the above materials must be washed by pressure water lines and the attendant wash water discharged into a sanitary Sewer line for transmission to a sewage treatment plant.
9. Sawcutting, Planing, and Grinding By-Products: The Contractor must take special precautions to ensure that no concrete, asphalt, concrete by-products, or asphalt byproducts from, or used in, the saw-cutting, grinding, or planing of asphalt cement or cement concrete pavements, sidewalks, curbs, etc. are discharged into any Storm Drain or surface water system. Such discharge is prohibited by the Department of Ecology. Inasmuch as saw-cutting by-products increase the pH of the wastewater, filtering prior to discharge is NOT acceptable. Impervious surfaces contaminated with sediment and grit from saw-cutting, planing or pulverizing operations must be cleaned by sweepers to prevent contaminants from entering the Storm Drainage system or surface waters when it rains.
10. Gutters and other Surface Drainage Channels: All Construction, Demolition, and Landclearing Waste and byproduct entering gutters and other pavement surface drainage channels must be prevented from entering any inlet, catch basin, or other drainage structure or feature. Accumulated sediments and material must be removed from drainage channels on a regular basis. If necessary, temporary filters or filter materials must be placed in drainage channels to prevent the passage of material.

1.07 AIR QUALITY

A. The Contractor must identify those portions of the Work that have potential to impact air quality. Specific means and methods to prevent and/or control impacts to air must be described for each such portion of work.

B. The Contractor must not cause or allow the discharge of particulate matter, the emission of any air contaminants, or odor-bearing gases in excess of the limits specified under Regulation I of the Puget Sound Clean Air Agency, Article 9 - Emission Standards.

C. The Contractor must maintain air quality within the National Emission Standards for Hazardous Air Pollutants. Air pollutants are defined as that part of the atmosphere to which no ambient air quality standard is applicable, and which, in the judgment of the Administrator of the Environmental Protection Agency Clean Air Act, may cause or contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness.

D. The Contractor must minimize the potential for air pollution by the use of emission control devices on Contractor-operated equipment and by the shut-down of motorized equipment when not in use.

E. The Contractor must control dust throughout the project.

F. No burning, including trash or vegetation, will be permitted.

G. Refer to Regulation III Puget Sound Clean Air Agency Article 4, Asbestos Control Standard, in the event the Contractor damages an existing duct, asbestos cement pipe, or any other facility that may contain asbestos.

1.08 NOISE POLLUTION

A. The Contractor must take all reasonable measures for the suppression of noise resulting from Work operations. Mobile engine driven cranes, loaders and similar material-handling Equipment; engines used in stationary service for standby power; air compressors for high and low-pressure service; and other similar Equipment must be equipped with exhaust and air intake silencers designed for the maximum degree of silencing. The type of silencer(s) required must be consistent with those used for high density residential, hotel, and hospital areas.

1.09 LIABILITY AND PAYMENT

A. The Contractor must be liable for the payment of all fines and penalties resulting from failure to comply with the Federal, State and local pollution control regulations, including when the Owner is on the job at the time of the violation.

B. Except as may be otherwise provided for in the Contract, costs pertaining to the prevention of environmental pollution and the preservation of public natural resources as outlined in the Contract must be considered as incidental to the Work and such costs must be included in the Lump Sum Bid.

1.10 ARCHAEOLOGICAL AND HISTORIC PRESERVATION

A. Should the Contractor discover during any construction activity or in any other way discover any artifacts, skeletal remains, or other archaeological resources (as defined under RCW 27.53.040) at the Project Site, the Contractor must immediately cease construction activity at the discovery site and surrounding area and promptly notify the Owner. If ordered by the Owner, the Contractor must suspend construction activity that, in the opinion of the Owner, would be in violation of Chapter 27.53 RCW. Suspension of this construction activity must remain in effect until the Owner has obtained permission to proceed from the State Historic Preservation Officer or from other authority.

1.11 TEMPORARY WATER POLLUTION, EROSION, AND SEDIMENTATION CONTROL

A. Temporary water pollution, erosion, and sedimentation control work must comply with the Construction Stormwater Control Technical Requirements Manual, which describes temporary measures. Such measures may be indicated in the Contract, proposed by the Contractor and approved by the Owner, or may be ordered by the Owner during performance of the Work. This temporary work is intended to provide prevention, control, and abatement of water pollution/erosion/sedimentation within the limits of the Project, and to minimize damage to the Work, adjacent property, streams, and other bodies of water.

B. Controlling and preventing pollution, erosion, run-off, sedimentation, and related damage may require the Contractor to perform temporary work items including but not limited to:
   1. Providing ditches, berms, Culverts, and other measures to control surface water;
   2. Building dams, settling basins, energy dissipaters, and other measures, to control downstream flows;
   3. Controlling underground water found during construction; or
   4. Covering or otherwise protecting slopes until permanent erosion-control measures are working.

C. If required by the Contract, the Contractor must, before starting the Work, submit to the Owner for approval a Construction Stormwater Control (CSC) Plan in accordance with Section 01 57 13 Construction Stormwater Control.

E. The Contractor must comply with the CSC Plan approved per Section 01 57 13, and must not perform clearing, grubbing or any other earthwork on the Project, other than that specifically authorized in writing by the Owner, until the plan has been approved. The Contractor is responsible for the effectiveness of any and all CSC/TESC measures, whether approved within the CSC plan or not. The Owner shall not be held liable for any failure of any TESC/CSC measure, nor for any delays to the Work due to the Contractor's failure to submit an acceptable plan.

F. The Contractor must coordinate CSC measures with the permanent drainage, sedimentation, and erosion control work that may be specified in the Contract to ensure continuous water pollution/erosion/sedimentation control is maintained during performance of the Work.

G. If the Owner orders the Work suspended for an extended time under Section 00 72 00, the Contractor must make, before the Owner assumes maintenance responsibility, every effort to control erosion, pollution, sedimentation, and run-off during the suspension, such that no additional TESC/CSC measures are required. Section 00 72 00.H describes the Owner's responsibility in such cases.

H. The extent of excavation, borrow, and embankment operations in progress must be limited commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other permanent pollution/erosion/sedimentation control measures current according to the accepted critical path schedule. If the Owner determines that

water pollution or erosion or sedimentation could occur due to seasonal limitations, the nature of the material, or the Contractor's progress, temporary CSC measures must be taken immediately. The Owner may require the Contractor's operations to be scheduled so those permanent pollution/erosion/sedimentation control features will be installed concurrently with or immediately following grading operations.

I. The amount of surface area of erodible earth material exposed at one time by clearing and grubbing, excavation, borrow or fill within the Right of Way must not exceed 18,000 square feet without prior approval by the Owner.

J. Permanent pollution/erosion/sedimentation control work ordered by the Owner and not covered in the Bid will be considered extra Work and paid for as such. Only pollution/erosion/sedimentation control included in the Bid Form or designated by the Owner and ordered as extra Work will be considered permanent control measures.

K. Temporary erosion control, temporary sedimentation control, and temporary water pollution control is the Contractor's responsibility. Costs for temporary erosion control, for temporary sedimentation control, and for temporary water pollution control work must be considered incidental to the Work and such costs must be included in the Lump Sum Bid.

L. Records of submitted and actual pollution/erosion/sedimentation controls and plans must be retained for a period of three years after the Completion Date and must be available at reasonable times and places for inspection by the Owner and, when applicable, other entities that may have interest in the Project.

1.12 DEWATERING

A. The Contractor must operate and maintain all pumps, tanks and other equipment necessary for the environmentally safe removal and disposal of water from the various parts of the work. The method proposed by the Contractor for removal of water from excavations shall be subject to the approval of the Owner. The Owner has the right and authority to disapprove any method proposed for discharge of water from excavations.

B. When discharge of water from the site is subject to approval of any Federal, State or local agency, the Contractor is responsible for obtaining such approval before commencing any pumping or de-watering operation.

C. The Contractor must include measures for control and treatment of any wastewater created from dewatering activities in the Environmental Pollution Control Plan.

1.13 DUST CONTROL

A. Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with all local regulations.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

PART 1 - GENERAL

1.01 GENERAL:

The Contract drawings provide baseline and benchmark references; however, the Contractor is responsible for the layout of individual items of the Work. Such responsibilities are outlined in this Section and pertain to other Work as separately described in individual Drawings and Specifications.

1.02 RELATED SPECIFICATION SECTIONS: Related sections include, but are not limited to:

A. Section 01 11 00 - Summary of Work

B. Section 01 33 10 – Submittals

C. Section 01 76 00 - Protection of Existing Facilities

D. Section 01 78 39 - Record Documents

1.03 SURVEYING

A. The Contractor must provide such field engineering services as are required for proper execution of the Work including, but not limited to:
   1. Establishing and maintaining lines and levels from control points and baselines provided by the Contract drawings.
   2. Construction staking for all construction activities, such as location of features, gridlines, structures (including elevations of inverts), pipe slopes, and rim elevations.
   3. Recording of as-built information.

B. Survey base data: Any survey information provided with the Contract Documents is subject to the following caveats:
   1. The site plan for the construction project area was compiled by the designer of record.
   2. The Engineer makes no representation that the survey information is complete or that it addresses every site condition which may be significant to the Work.
   3. The provision of the survey information by the Contract Documents does not relieve the Contractor of the responsibility to carefully examine the site and account for any conditions/elements that vary from or are in addition to the conditions/elements shown on the survey.
   4. The existence and location of underground and other utilities and facilities indicated as existing are not guaranteed. Before beginning site Work, the Contractor must investigate and verify the existence and location of underground utilities and other construction. Refer to Section 01 76 00 - Protection of Existing Facilities.

1.04 QUALITY ASSURANCE

A. Survey Requirements:
   1. The Contractor’s surveyor must be a licensed professional surveyor in the State of Washington.

2. The Contractor must keep updated survey field notes in a standard field book and in a format set by the Engineer.
3. Survey field notes must include all survey work performed by the Contractor's surveyor in establishing line, grade and slopes for the construction work.
4. Copies of these survey field notes must be provided the Engineer upon request.
5. Upon physical completion of the Contract Work, the survey field books must be submitted to the Engineer and become the property of the Engineer.

B. If the survey work provided by the Contractor does not meet the standards of the Engineer, the Contractor must, upon the Engineer's Written Notice, remove the individual or individuals doing the survey work and retain a suitable replacement surveyor. If this fails, the Engineer, at the Contractor's expense, may complete the survey work required and deduct the cost from the Contract amount.

C. The Engineer reserves the right to check all work laid out by the Contractor during the progress of the work, as deemed necessary to verify conformance with the Plans and Specifications. The Contractor must allow sufficient time to permit such checks before completing the Work. These checks will be made during the regular working hours.

D. If existing reference and control points are damaged, moved, altered, or destroyed by the Contractor, the Park Surveyor's cost of re-establishing such points must be borne by the Contractor at the crew rate of $300 per hour.

E. All costs for survey work required to be performed by the Contractor must be included in the Bid.

1.05 SUBMITTALS

A. Comply with pertinent provisions of Section 01 33 10 - Submittals.

B. Upon request of the Engineer or the Consultant, the Contractor must submit:
1. Data demonstrating qualifications of persons proposed to perform survey or other field engineering services.
2. Documentation verifying accuracy of field engineering work.
3. Certification, signed by the Contractor's surveyor, that elevations and locations of improvements are in conformance or non-conformance with the Contract Documents.

1.06 PROCEDURES

A. In addition to procedures directed by the Engineer or the Consultant for proper performance of the Contractor's responsibilities, the Contractor must:
1. Protect construction control points, including grade control.
2. Preserve permanent reference points during progress of the work as shown on the contract drawings or staked in field.
3. Preserve grade control stakes.
4. Not relocate existing reference and control points without approval of the Engineer and Parks Surveyor.

5. Report damaged or destroyed reference or control points to the Parks Surveyor.
6. Be responsible for any increased costs or delays to the Contract relating to reference and/or control points which are damaged, moved, altered or destroyed by the Contractor or its subcontractors, suppliers, agents or employees.
7. Discontinue use of reference points alleged to be in error until accuracy of the points can be verified.

PART 2 - PRODUCTS: (Not Used)

PART 3 - EXECUTION

3.01 CONSTRUCTION LAYOUT

A. The Contractor must:
   1. Employ a surveyor licensed by the State of Washington to lay out the Work of this Contract.
   2. Establish working lines for each structure and at reasonable intervals across the site.
   3. Lay out the work described by the Contract Documents using recognized surveying methods and keep an accurate field book of work completed.
   4. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale drawings to determine dimensions.
   5. Advise the entities engaged in construction activities of marked lines and levels provided for their use.
   6. As construction proceeds, check every major element for line, level and plumb.
   7. Provide stakes as required by various sections of these specifications and as required for accurate construction. Make staking information available to the Consultant for review prior to executing construction based on staking.
   8. Record deviations from required lines and levels and advise the Engineer when deviations that exceed indicated or recognized tolerances are detected. Record drawings deviations that are accepted and not corrected on as-built drawings.

3.02 AS-BUILT INFORMATION

A. The Contractor must locate and establish grade of completed construction for use in preparing as-built documents of the project. Do not cover work until survey has been completed. As-built information is necessary for, but not limited to, the following:
   1. Locations of utility structures, fittings and changes of direction of underground utilities.
   2. Locations of shutoffs, valves and clean-outs for underground utilities, including locations of solenoid valves for irrigation systems.
   3. Corners and/or center lines, and benchmark elevations of bridges, buildings, and other major structures.
   4. Center lines and grades of roads, paths, vehicle gates.
   5. Points at which new utility lines intersect existing.

END OF SECTION

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. All Wastes generated during the Project must be managed and disposed of in accordance with Bainbridge Island, Kitsap County, and all other applicable local, State and federal regulations. This includes utilization of all waste material and disposal forms per the jurisdictional requirements.

B. Unless otherwise specified in the Contract, the Contractor is responsible for arranging and implementing the proper handling, management, segregation, storage, transport, and disposal of all wastes that are not Contaminated Soils and/or Dangerous Waste(s), including processing and maintaining required documentation. This may include:
   1. Identifying, proposing, and contracting with disposal sites that can legally accept the types of identified or characterized wastes.
   2. Identifying, proposing, and contracting with waste transporters qualified and licensed to transport the types of identified or characterized wastes. All wastes must be transported in accordance with federal, state and local transportation requirements, including driver training, placarding and use of shipping papers or waste manifests.
   3. Obtaining waste clearances or other waste acceptance approvals through agencies as appropriate and as required.
   4. Creating and processing all necessary documentation, such as Certificates of Disposal or Recycling, sampling and analysis reports, waste clearance forms, waste acceptance forms, bills of lading, scale tickets, waste receipts, and others as applicable.
   5. Providing the Engineer timely notice for reviewing documentation before transporting waste.
   6. Providing the Engineer copies of all documentation pertaining to waste generation, recycling and disposal.

1.02 RELATED SECTIONS - NOT USED

1.03 DEFINITIONS – NOT USED

1.04 GENERAL WASTE DISPOSAL

A. The following recyclable materials cannot be disposed as construction and demolition waste.
   1. Concrete, bricks and asphalt paving
   2. Metal (both ferrous and non-ferrous)
   3. Cardboard
   4. New construction gypsum scrap
   5. Unpainted and untreated wood
   6. Tear-off asphalt shingles
   7. Carpet
   8. Plastic film wrap

B. The Owner has established that this Project must generate the least amount of waste possible. The Contractor must utilize processes and procedures that minimize production of waste caused by error, poor planning, breakage, mishandling, contamination, or other factors.

C. Private disposal companies and waste sites may require other documentation. Laboratory analysis of waste material may be required to obtain waste clearance or acceptance. Copies of all waste clearance, acceptance forms, and any accompanying laboratory tests/reports or related supplemental information must be provided to the Owner.

D. Disposal sites used under the Contract must comply with all applicable rules, ordinances, codes, regulations and law, and must have all required authorizations for the waste to be disposed. This may require the Contractor to obtain required permits for the waste site.
   1. Disposal of excess material within a wetland area will not be allowed without a Section 404 permit issued by the U.S. Army Corps of Owner's and approval by the local agency with jurisdiction over the wetland. The Contractor must notify the Owner prior to submittal of an application for this or any other environmental permit.

E. The selection of waste sites and their use is subject to Owner approval.
   1. Sites, operations, or results of operations, which create a definite nuisance problem, or result in damage to public or private properties, are not acceptable.
   2. Utilization of a site without submitting a legal grading permit and Consent Agreement from the property owner to the Owner and obtaining approval of the Owner will be considered unauthorized.
   3. Surplus material must not be wasted within public properties or rights of way without all required permitting.

F. Options for the disposal of woody debris from clearing and grubbing include on-site grinding for use as mulch or delivery to facilities that compost or recycle woody debris into soil amendment or mulch end products. Any action required to comply with any permit and/or any approval requirements at a Contractor-provided disposal site must be performed by the Contractor at no additional cost to the Owner.

1.05 DISPOSAL OF SPECIAL OR UNACCEPTABLE WASTE

A. Any asbestos, contaminated soils, hazardous, dangerous, or otherwise unacceptable waste must be disposed of in accordance with all applicable local, State, and federal regulations.

B. Occurrences of treated wood, potentially contaminated soils, asbestos, dangerous waste and other unacceptable waste are specified in contract documents. Contractor will include these potential wastestreams in the draft waste management plan and will coordinate with the Owner to review waste documents and determine final disposal of these wastestreams.
   1. If other hazardous wastestreams are encountered outside of those specified in the contract documents, such unacceptable waste must be disposed of in accordance with all applicable local, State, and federal regulations, and the Owner will consider this as a "Changed Condition."

1.06 SUBMITTALS

A. Draft Waste Management Plan: Within 10 Working days after receipt of Notice to Proceed, or prior to any waste removal, whichever occurs sooner, the Contractor must submit to the Owner a Draft Waste Management Plan. The Draft Plan must contain the following:
   1. Analysis of the waste that the project will generate, including a list of types of wastestreams and estimated quantities of each wastestream.
   2. For each wastestream, identification of disposal or recycle site(s) with the estimated quantities of the wastestream; and permits for the disposal sites, if necessary.
   3. Identification of the proposed transporter to be used for each wastestream and applicable licenses that may be necessary for transporting the wastestream.
   4. For each wastestream, descriptions of the storage of each wastestream on the project site before recycling or disposal. Include procedures to ensure that wastes are stored in a safe, secure manner that does not allow for leakage or other releases of waste. Include details regarding controls, signage and inspections.

B. Final Waste Management Plan: Within 5 Working Days of the receipt of Owner's review and comments to the Draft Waste Management Plan, the Contractor must submit a Final Waste Management Plan that incorporates revisions to the draft plan.
   1. The Final Waste Management Plan must also include:
      a. Identification of the Manager and all on-site parties responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the Project.
      b. A description of how Contractors will instruct the waste management procedures to staff and subcontractors and document such trainings. The Contractor must provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.
      c. A description of the regular meetings to be held to address waste management. Refer to Section 01 32 13 – Progress Schedules.
   2. The Contractor must distribute copies of the Waste Management Plan to the Job Site Foreman, each Subcontractor, the Owner, and the Consultant.

C. Should additional or alternate waste sites become necessary during the life of the Contract, the locations and information for each site must be submitted to the Owner for approval at least 10 Working Days prior to its use.
   1. Furnish copies of permits for waste sites.

D. The Contractor must submit to the Owner within 10 Working Days of receipt by the disposal site, 2 copies of each shipment list, bill of lading, and/or transmittal document, listing and describing the waste material shipped from the Project Site and deposited at the waste disposal site. The submitted shipment list must have the waste site operator's confirmation of receipt of the waste, and the name of the waste transporter. The Contractor must also provide the Owner with the following copies:
   1. Documentation of disposal as applicable

2. Waste sampling and analysis reports as applicable
3. Waste clearance or acceptance forms (copies of agency-approved forms must be provided to the Owner).

E. Application for Progress Payments: The Contractor must submit with each Application for Progress Payment a Summary of Waste Generated by the Project. Failure to submit this information will render the Application for Payment incomplete and may delay Progress Payment. The Summary must be submitted on a form acceptable to the Owner. An acceptable form is included in the "Contractor Forms Workbook" (a Microsoft Excel file containing most of the commonly used forms pertinent to the Contract), which can be found on a spreadsheet set created when the "Pay Estimate" package is created/exported by the Contractor (contact the Owner if further instruction is needed). The form must contain the following information:
   1. The amount (in tons or cubic yards) of material landfilled from the Project, the identity of the landfill, the total amount of tipping fees paid at the landfill, and the total disposal cost. Attach manifests, weight tickets, receipt, and invoices as applicable.
   2. For each material recycled, reused, or salvaged from the Project, the amount (in tons or cubic yards), the date removed from the jobsite, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings from salvage or recycling of each material. Attach manifests, weight tickets, receipts, and invoices as applicable.

F. The Owner may request to review or approve all shipping papers prior to wastes leaving the project site.

G. When operations are complete, a release from all damages, duly executed by the waste site property owner and stating that the restoration of the property is satisfactory, is required.
   1. Retainage withheld from the Contractor's payments will not be released until all such property owner releases have been furnished to the Owner.
   2. Should the release be, in the opinion of the Owner, arbitrarily withheld, the Owner may, at its sole discretion, accept that portion of the work involved and cause final payment to be made.

PART 2 – PRODUCTS

Not used

PART 3 – EXECUTION

3.01 GENERAL

A. Use only approved waste sites.

B. Take the protective measures required for the type of waste being handled. Hazardous must shall be separated, stored, and disposed of according to applicable regulations.

C. After disposal, perform all operations necessary to put the waste sites in a neat, clean and orderly condition.

D. Final cleanup must be in accordance with the Contract and the requirements of the Stormwater Code, Grading Ordinance, permits, and residential property agreements.

3.02 SITE MAINTENANCE

A. Keep work area, site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris resulting from Contractor's operations.

B. The Contractor must lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat, clean, and clearly marked in order to avoid contamination of materials.

C. Provide on-site containers for collection of waste materials, debris, and rubbish. Periodically remove waste from the site.

D. Do not use the Owner's waste containers for construction waste.

E. Dispose daily of all flammable, hazardous, and toxic waste materials. Dispose of trash and debris in compliance with governing codes, ordinances, regulations, and anti-pollution laws.

F. Locate dumpster(s) inside the staging area or at a site designated by the Owner.

3.03 DISPOSAL OF SURPLUS MATERIAL

A. Material obtained from all excavation within the Project boundary must not be wasted unless the excavated material is designated by the Owner as unsuitable for use in embankment construction, trench backfill, or for other purposes.
   1. All excavated material not required for backfill must be removed from the site as the work progresses.

B. Other surplus, excess, or salvaged materials of value remaining after completion of associated Work must be offered to the Owner. If declined by the Owner, the Contractor must dispose of these materials in accordance with the requirements noted herein.

C. Material determined to be unsuitable by the Owner must be disposed of in accordance with the requirements noted herein.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes administrative and procedural requirements for final cleaning of the Work prior to Substantial Completion, including but not limited to:
   1. Cleaning procedures
   2. Inspection

PART 2 – PRODUCTS

2.01 MATERIALS - GENERAL

A. Do not use cleaning materials that may damage finished surfaces.

B. Do not use cleaning materials hazardous to health or property.

C. Use only cleaning materials and methods recommended by manufacturer of item or material to be cleaned.

D. Submittals: Provide for the Engineer's review and approval manufacturer's Safety Data Sheets (SDS) for any and all chemical cleaning products utilized.

PART 3 – EXECUTION

3.01 FINAL CLEANING

A. Cleaning: The Contractor must employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a typical commercial building/site cleaning and maintenance program. Comply with manufacturer's instructions. Final cleaning includes but is not limited to the following procedures:
   1. Remove dust and dirt in corners.
   2. Remove grease, mastic, adhesives, paint splatter, glazing compounds, dust, dirt, stains, fingerprints, non-permanent labels, and other foreign materials from interior and exterior surfaces exposed to view.
      a) Clean hard-surface finishes to dirt-free condition, free of dust, stains, adhesives, films and any other discernible substances or contaminants.
      b) Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces.
      c) Restore reflective surfaces to original reflective conditions.
      d) Replace chipped, cracked, broken, or otherwise damaged materials, including but not limited to glass and transparent materials.
      e) Remove excess lubrication and other substances from mechanical and electrical equipment.
      f) Clean plumbing fixtures to a sanitary condition.
      g) Clean light fixtures and lamps.

3. Remove debris and surface dust from limited-access spaces including trenches, equipment vaults, manholes, catch basins, crawl spaces, and similar spaces.
4. Clean project site (yard and grounds), including landscape development areas, of litter and foreign substances. Rake grounds which are neither planted nor paved to a smooth, even-textured surface.
5. Sweep paved areas to a broom-clean condition. Remove stains, petrol-chemical spills, paint splatter, and other foreign deposits.
6. Leave concrete floors broom-clean. Remove stains, spills, and other foreign deposits.
7. Vacuum carpeted surfaces. Remove coverings, stains, spills, and other substances. Any areas that in the opinion of the Engineer show noticeable wear, staining, or other damage are subject to rejection and replacement.

B. Pest Control: Engage an experienced, licensed exterminator to conduct a final inspection and rid the Work of rodents, insects, and other pests that may be identified as a result of such inspection.

C. Removal of Protection: Except as otherwise indicated or requested by the Consultant or the Engineer, remove temporary protection devices and facilities installed to protect pre-existing features and/or previously completed Work.

D. Extra Materials: Excess materials of value remaining after completion of associated Work must be offered to the Engineer. If declined by the Engineer, the Contractor must dispose of these materials as directed by the Engineer.

3.02 INSPECTION

A. Prior to requesting inspection for certification of Substantial Completion, the Contractor must inspect the Work site and verify it has been cleaned and debris removed in accordance with Contract requirements.

B. Prior to certifying Substantial Completion, the Engineer will conduct a detailed inspection of the Work and Work site. If any Work items are identified as insufficiently cleaned per Contract requirements, such items will be included on the inspection Punch List. If any such item is, in the sole opinion of the Engineer, sufficiently deficient as to render the Work unsuitable for full and beneficial use by the Owner or otherwise not meet Substantial Completion requirements, Substantial Completion will be denied.

C. No additional time will be allowed in the Contract for correction of deficiencies identified per paragraph 3.02.B above. The Contractor must correct all such deficiencies to the satisfaction of the Engineer before certification of Substantial Completion. In order to achieve Substantial Completion, the entire Project must be clean and ready for occupancy by staff and public.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section covers the requirements for Contractor's protection of existing facilities.

1.02 NOTIFICATIONS AND COMPLIANCE

A. Notifications Relative to Contractor's Activities
   1. The Contractor must plan and schedule Contractor work activities to conform to and allow time for notifications, approvals, reviews, and other conditions of the Contract Documents.

B. The Contractor shall be liable for all damages arising from noncompliance with this Section.

1.03 LOAD LIMITS

A. General
   1. When moving Equipment and materials on any public Highway, the Contractor must comply with any law that controls traffic or limits loads. The Contract does not exempt the Contractor from such laws nor does it license overloads. At the Owner's request, the Contractor must provide any information needed to determine the weight of Equipment on the roadway.
   2. When the Contractor moves Equipment or materials for the Project, legal load limits apply on any:
      a. Road open to or in use by public traffic.
      b. Existing Road not designated for reconstruction under the current Contract.
      c. Newly paved Road (with its final lift in place) built under this Contract. The Contractor may haul overloads (not exceeding 25 percent) on such roads not open to public traffic if this does not damage completed Work. Should damage occur, the Contractor must pay all repair costs.
   3. On all other parts of the Project, the Contractor may operate Equipment without load-limit restrictions except as restricted by Subsection 1.03.B below.
      a. In doing so, however, the Contractor remains responsible for any damage that may result.
      b. All vehicles subject to licensing on a tonnage basis are required to obtain licenses to cover the maximum legal capacity before being eligible to operate under the load-limit restrictions described in the Subsection 1.03.B below.
   4. The Owner may approve higher load limits than those allowed by Subsection 1.03.B below (Load Limit Restrictions) if it is necessary and safe to do so.
      a. To obtain such approval, the Contractor must make this request in writing to the Owner at least 5 Working Days in advance of the need.
      b. The request must describe in detail the loading, configuration, and movement or position of the Equipment on the structure or over the culverts and pipes.
      c. The request must state that the Contractor assumes all risk for damages.
      d. The Contractor must include in the Bid item prices any and all costs associated with operating over bridges or culverts.

e. Nothing in this Section shall serve to eliminate, reduce, or otherwise alter the Contractor's other responsibilities under the Contract or under public Highway laws.

B. Load-Limit Restrictions:
1. The following load limits apply:
a. Structures Designed for Direct Bearing of Live Loads: On these structures, the gross or maximum load on each individual vehicle axle must not exceed the legal load limit by more than 35 percent. No more than one vehicle may operate over any structure at one time.
b. Underpasses and Reinforced Concrete Box Culverts Under Embankments: Over these structures, maximum loads are 24,000 pounds on a single axle and 16,000 pounds each on tandem axles spaced less than 10 feet apart, provided that:
1) The embankment has been built in accordance with the paragraphs a), b) and c) below.
a) The Contractor must place earth embankments in horizontal layers of uniform thickness. These layers must run full width from the top to the bottom of the embankment. Slopes must be compacted to the required density as part of embankment compaction.
b) During grading operations, the Contractor must shape the surfaces of embankments and excavations to uniform cross-sections and eliminate all ruts and low places that could hold water.
c) On a tangent, the Contractor must raise the center of the embankment above the sides. On a sidehill, the high point of any layer must intersect the original ground and must slope uniformly toward the lower side. This slope must not exceed 1 foot in 20 feet.
2) The embankment has reached at least 3 feet above the top of the underpass or Culvert.
a) When the embankment has reached 5 feet above the top of the Culvert or underpass, the Contractor may increase axle loads up to 100,000 pounds each if outside wheel spacing is at least 7 feet on centers on the axle.
c. Pipe Culverts and Sewer Pipes: Loads over pipe Culverts and sewer pipes may not exceed 24,000 pounds on a single axle and 16,000 pounds each on tandem axles spaced less than 10 feet apart. These limits are permitted only if:
1) The Culvert or pipe has been installed and backfilled to specifications, and
2) The embankment has reached at least 2 feet above the top limit of pipe compaction.
3) When the embankment has reached 5 feet above the top limit of pipe compaction, the Contractor may increase per-axle loads up to 100,000 pounds if outside wheel spacing is at least 7 feet on centers on the axle centers, except that:
a) For Class III reinforced concrete pipes, the embankment must be risen above the top limit of compaction at least 6 feet
b) For Class II reinforced concrete pipes, the maximum load for each axle is 80,000 pounds if outside wheel spacing is at least 7 feet on axle centers. In this case, the embankment must be risen above the top limit of compaction at least 6 feet.

1.04 PROTECTION AND RESTORATION OF PRIVATE AND PUBLIC PROPERTY

A. The Contractor must protect from damage or destruction private and public property located on or near the Work that is not designated for repair, replacement or removal. The Contractor must ensure that interference with the use of such property is minimized.

B. Property includes land; improvements lawfully occupying the Right of Way; trees, shrubbery and landscaping; electrical distribution and transmission systems; water distribution and transmission systems; survey markers and monuments; buildings and structures; conduits and pipes; fences; highway facilities such as signal systems (including loop detection systems in pavement structures both approaching and at signalized intersections), roadway lighting systems, signs, guardrails, pavements, curbs, driveways, sidewalks, traffic buttons, paint striping and other channelization; and other property of all descriptions whether shown on the Drawings or not.

C. The Contractor is alerted to the existence of cast iron Water Mains within the Right of Way having pipe joints very sensitive to disturbance.
   1. These pipe joints have been known to develop leakage when disturbed by shifting earth, or excessive vibrations, or adverse impacts of any other construction excavation work
   2. The Contractor must take additional precautions to eliminate adverse impact to cast iron Water Main.

D. The Contractor must, at no additional cost to the Owner, provide and install safeguards acceptable to the Owner to protect public and private property.
   1. If the use of public or private property is interfered with by the Contractor, the Contractor's agents or the Contractor's employees, such interference must be terminated immediately.
   2. If public or private property is damaged or destroyed by the Contractor, the Contractor's agents or the Contractor's employees, such damaged or destroyed property shall be considered defective, and repaired and restored immediately to its former condition by the Contractor at the Contractor's expense.
   3. Should the Contractor refuse or not respond promptly to a written request to restore damaged or destroyed property to its original condition, the Owner may have such property restored by other means at the Contractor's expense.

E. Per WAC 332-120, no survey monument may be damaged or removed without proper permit. If any survey monument is in danger of being dislodged or lost because of nearby construction, or in danger of being disturbed during removal of pavement where monumentation, whether cased or not, exists within the pavement, the Contractor must secure a permit and provide advance notification.
   1. The cost to replace survey monumentation damaged or lost because of the Contractor's failure to follow the requirements of Section 00 72 00 will be at the sole expense of the Contractor. Costs include, but may not be limited to, the cost of replacement survey monuments and the survey labor and supervision needed to set monuments as closely as possible to their original locations.

1.05 PROTECTION AND RESTORATION OF TREES, SHRUBS, AND PLANT MATERIAL

A. See Section 01 56 39 - Temporary Tree, Vegetation, and Soil Protection.

1.06 PROTECTION AND RESTORATION OF FENCES, MAILBOXES, AND MISCELLANEOUS ITEMS

A. The Contractor must enclose the Work area by installing and maintaining temporary fencing when Work is within easements or abuts private property.

B. When trenching is required within a planting strip the Contractor must protect the existing curb, gutter and sidewalk from damage, utilizing timber pads or other surface protection if/as necessary.
   1. The Contractor must demonstrate to the Owner's satisfaction that the measures proposed to protect existing improvements are adequate prior to proceeding with trenching in the planting strip.

C. Where sprinkler systems are encountered in a planting strip, the Contractor must carefully remove the existing sprinkler system for reinstallation by the Contractor after the work in the planting strip is complete.

D. When, due to the Contractor's operations, plastic traffic buttons, lane markers or pavement markings are damaged, destroyed or obliterated outside the neat lines of a trench or area of pavement restoration, the Contractor must restore them in kind at no expense to the Owner.

1.07 UTILITIES AND SIMILAR FACILITIES

A. Locations and dimensions shown in the Drawings for existing facilities are based on available information obtained without uncovering, measuring or other verification.

B. The Contractor must protect from damage private and public utilities encountered during the Work. Utilities include, but are not limited to, Sewer and Storm Drain systems; water supply and distribution systems; electrical transmission and distribution systems; natural gas distribution systems; telephone, telegraph, and CATV systems; fiber optic systems; fire alarm systems; petroleum pipe lines; steam distribution systems; traffic control systems; power lines and appurtenances; railroad tracks and appurtenances; and similar facilities and systems.

C. Public and private utilities, or their contractors, will furnish all work necessary to adjust, relocate, repair, or construct their facilities unless otherwise provided for in the Contract.
   1. Where it is necessary to remove or relocate private utilities in order to accommodate the Work, the removal or relocation will normally be accomplished in advance of construction.
   2. Under some circumstances however, this removal or relocation may have to be performed concurrent with the Work. In this case, the Contractor must coordinate the Contract Work with that of the utility company as needed to minimize interference with both kinds of work.
   3. Where a private utility should have been removed or relocated prior to the Contractor beginning the Work at the point affected, and such work by the utility was not accomplished, the Contractor must document the location, type, size, and other relevant information regarding the utility and immediately notify the Owner in writing.

D. The Contractor may encounter underground facilities that are not reflected or accurately shown in the Contract Documents. When the relocation of these facilities is necessary to accommodate the Work, the Owner will provide for the relocation of these facilities by other forces, or the relocation may be performed by the Contractor as extra Work pursuant to a Change Order.

E. The Contractor may encounter private water-service utilities that are not reflected or accurately shown in the Contract Documents. Such private water-service utilities may be either a single water-service utility from the water meter or a multiple water-service utility(ies) from the water meter.
   1. Records of such utilities are not maintained by the Owner and therefore may not appear on the Drawings and may not be field located by Bainbridge Island Public Utilities.
   2. The locations of these private utilities can usually be ascertained by relative meter location, residence location, or through discussion with various private property owners.
   3. The Contractor must locate and protect these private water services from damage.

F. The Contractor is also alerted to the existence of RCW Chapter 19.122, an act relating to underground utilities and prescribing penalties, herein prescribing certain notification to be made by the Contractor.
   1. Any cost or scheduling impact incurred by the Contractor by reason of Contractor's required compliance with these statutory and contractual provisions shall be borne by the Contractor.
   2. No excavation may begin until all known facilities near the excavation area have been located and marked.

G. The Owner and the owners of utilities, or their authorized agents, reserve the right to enter upon the Right of Way for the purpose of making changes, connections, or repairs to their facilities.
   1. The Contractor must cooperate with forces engaged in such work and must avoid any unnecessary delay or hindrance to work being performed by other forces.
   2. The Contractor must provide all notifications and applications needed to effectively coordinate utility and Contractor Work (See Section 00 72 00).

H. Should the Contractor desire to have an adjustment in line or grade made on a utility or other improvement for the Contractor's convenience and the rearrangement is in addition to, or different from, that indicated in the Contract, the Contractor must make all necessary notifications and applications with the owner of the utility for such rearrangement and bear all expenses in connection with that work.

I. If it is necessary to provide temporary water supply connections due to conflict with private water-service pipes during construction, the Contractor must to do so at no additional cost to the Owner.

J. In all cases, private water-service lines damaged by the Contractor must be repaired by the Contractor at the Contractor's expense.
   1. The Contractor must notify the Owner immediately of any such damage and must begin repairs immediately and work continuously until water service is restored.

2. Repair of damaged private water-service lines must be inspected by applicable water utility prior to backfilling.

K. Except as otherwise provided herein, all costs incurred by the Contractor in complying with requirements of this Section must be included in the Lump Sum Bid. When others delay the Work through late removal or relocation of any utility or similar facility, the Contractor's loss of time will be adjusted by extending the Contract Time per Section 00 72 00.
The Contractor must, before an excavation begins, submit a locate request via the Utilities Underground Location Center 1-800-424-5555 or http://www.callbeforeyoudig.org/washington/, in accordance with Section 00 72 00,
1. The Contractor must also notify the Owner prior to excavation and provide the results of the utility locate.

1.08 UTILITY CLEARANCES

A. Clearances Between Water Mains and Other Utilities
1. Where possible, sewers must be laid at a lower invert elevation than Water Mains.
2. Water mains and sewers must be spaced apart horizontally a minimum of 10 feet, measured center to center, except the spacing may be reduced to the following "nearest point" measurements:
   a. Five (5) feet horizontal when the Water Main is a ductile iron Water Main.
   b. Less than 5 feet to a minimum of 18" when the Water Main is ductile iron, and:
      1) The sewer is constructed of materials and with joints that are equivalent to Water Main standards, including pressure-testing requirements.
      2) The bottom of the Water Main is at least 18 inches above the top of the sewer.
3. Water mains crossing over sewers must be constructed of ductile iron and must be spaced to provide a minimum separation of 18 inches between the bottom of the Water Main and the top of the sewer.
4. Water Mains passing under sewers must be protected by providing:
   a. A minimum vertical spacing of 18 inches between the bottom of the sewer and the top of the Water Main.
   b. Adequate support for the sewer to prevent excessive deflection of joints or any possibility of the sewer line bearing weight on the Water Main.
   c. The point of crossing centered between two successive joints of the Water Main pipe.
5. When the Water Main is existing and new side sewers are being installed or reconnected the following requirements apply:
   a. Ductile iron pipe must be used for all side sewers crossing over Water Mains, for a perpendicular distance of at least 5 feet from the center of the Water Main.
   b. Side sewers laid below Water Mains must be laid at least 6 inches below and 12 inches horizontal, from all Water Mains and water-service lines as measured from the "nearest points," unless ductile or cast iron pipe is used for the side Sewer.
6. All utilities, both public and private, passing over, under, or very close to existing Water Mains within distances specified in this Section must be coordinated with Utility companies at least 15 Working Days in advance of construction, as well as coordinated with and approved by the Owner.
   a. Provide minimum 5 foot horizontal separation from the existing Water Main.
   b. Provide minimum 18 inch separation vertically under the existing Water Main.

c. No new utility may be installed over an existing Water Main.

7. Notifications regarding shutdowns of Water Mains or obstructions of hydrants and valves shall be in accordance with Section 00 72 00.
8. Exceptions to the requirements in this Section must be approved by the Owner.

B. Clearances Between Gas Mains and Other Utilities
1. Minimum clearances of 1 foot vertical and 6 inches horizontal are required to separate an existing gas main, or a gas service line, from a new ductile iron water line to be installed above or below the gas line.
   a. If these minimum clearances cannot be maintained, a protective wrap must be provided for the entire distance where clearances are less than required.
   b. Wrapping material must consist of either a split PVC pipe or PVC wrapping of at least 0.04-inch thickness and may be applied to either one of the pipes.
2. Horizontal and vertical clearances of 6 inches or more are preferred between Water Mains and all other utilities except gas and sewer lines (see Subsections 1.08.B and 1.08.A, respectively, for gas and sewer lines). If a smaller separation is unavoidable, the space between the Water Main and the other utilities must be filled with polyethylene plastic foam material before backfilling.

C. Clearances Between Sewers
1. Whenever a new Sewer /drain pipe clears an existing or new utility by 6 inches or less, polyethylene plastic foam must be placed between the utilities as a cushion prior to backfilling.

D. Clearances with Electrical Distribution and Transmission Systems
1. When an underground electrical facility is identified or “marked for locate” as specified in Subsection 1.07.L above and is within the vicinity of a proposed excavation, the Contractor must provide advance notification as per Section 00 72 00, and an Electrical Safety Observer may be required. Clearances must be maintained.
2. If Work involves tree removal, tree trimming, or trees proposed for planting within 10 feet of an overhead electrical distribution or transmission wire, the Contractor must provide advance notification as specified in Section 00 72 00, Overhead Electrical Power Lines and Trees.

PART 2 – PRODUCTS

2.01 POLYETHYLENE PLASTIC FOAM

A. Polyethylene plastic foam used in sanitary Sewer and Storm Drain construction must meet Federal Specification PPP-C-1752C Type 1, Class 2, (ETHAFOAM™).

PART 3 - EXECUTION

(Not Used)

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The requirements described in this Section are supplemental to related requirements described by Section 00 72 00 and expand on the conditions that must be met to achieve Substantial and Physical Completion. This section also provides further description of administrative procedures required to close out the Contract in accordance with Specification requirements.

B. Related Sections include, but are not limited to:
   1. Section 00 72 00 - General Conditions
   2. Section 01 78 23 - Operations and Maintenance Manual
   3. Section 01 78 36 - Warranties and Bonds
   4. Section 01 78 39 - Record Documents

1.02 REQUIREMENTS FOR ACHIEVING SUBSTANTIAL COMPLETION:

A. Prior to requesting Owner's Representative's inspection for certification of Substantial Completion, the Contractor must meet the following requirements, as applicable to the Contract scope requirements:
   1. The Work required for the site/facility must be sufficiently complete and cleaned, with all construction material removed, to allow the unrestricted use of the site/facility, excluding any temporary protection measures that may have been approved by the Owner's Representative.
   2. When required by the Contract, permanent cores must be installed in all locks, and keys transmitted to the Owner's Representative.
   3. Submit a payment request (Pay Estimate) including all Work completed in satisfaction of the Work progress required for achieving Substantial Completion.
   4. Complete and submit a release, granting the Owner's Representative's staff and facility users full and unrestricted use of the Work and access to services, utilities, and amenities provided by the Contract.
   5. If applicable, provide final building permit inspection and occupancy or temporary occupancy permits as required.
   6. Complete start-up of HVAC and other mechanical systems and provide copies of initial balancing reports.
   7. Submit two (2) copies of draft As-built Records and Red-Line Drawings in accordance with Section 01 78 39 "Record Documents" for review and approval by the Consultant and Owner's Representative.
   8. Submit two (2) copies of the draft Operating and Maintenance Manual in accordance with Section 01 78 23 "Operating and Maintenance Manual" to the Consultant and Owner's Representative.
   9. Submit two (2) copies of the draft Warranties and Bonds Manual in accordance with Section 01 78 36 "Warranties and Bonds" to the Consultant and Owner's Representative
   10. Request confirmation of Substantial Completion by writing a letter to the Owner's Representative on Contractor's letterhead. This letter must conform to the attached example letter, requesting that a Substantial Completion

inspection be scheduled as needed to establish the actual Substantial Completion date.

B. Process to achieve Substantial Completion:
   1. Upon receipt of Contractor's request per Item 1.02.A.10 above, the Owner's Representative will confirm that the Consultant agrees the project meets the requirements for Substantial Completion.
      a. If the Consultant so agrees, the Owner's Representative will schedule a Substantial Completion inspection within ten (10) Working Days of receipt of the inspection request.
      b. If the Consultant does not agree the project is Substantially Complete, the Owner's Representative will notify the Contractor of the general Work items that must be complete before a substantial completion inspection can be scheduled.
      c. If Item B.1.b. above applies, the Contractor must complete the Work items identified and submit another inspection request per Paragraph A.10 above. Step B.1 must be repeated until the Consultant agrees the Work is ready for Substantial Completion inspection by the Owner's Representative.
   2. The Owner's Representative has sole discretion to designate and invite inspectors/participants that should be present for the Substantial Completion inspection. Each participant in the inspection is responsible for providing a list of any Work deficiencies observed to the Consultant. The Consultant is responsible for preparing the Punch List of outstanding Work items based upon the results of the inspection. All individual lists will be compiled into a single Punch List by the Consultant and issued to the Contractor.
      a. If the inspection reveals that the Work is not Substantially Complete, the process in 1.02.B.1 and B.2 shall be repeated.
   3. Once inspection confirms that the Work is Substantially Complete, the Owner's Representative shall prepare a letter confirming Substantial Completion achievement and the date thereof. The letter will be appended with a Punch List describing any remaining Work items required to achieve Physical Completion.
   4. The confirmed date of Substantial Completion will be used to determine any Liquidated Damages that may be due to the Owner. Unless specifically set forth elsewhere in the Specifications, no further Liquidated Damages will accrue after this date.
   5. Re-inspection Fees: When inspection shows that the Work has not attained the completion status claimed, the Contractor must compensate the Owner's Representative for additional labor and expenses that may be required at the Owner's Representative's sole discretion for subsequent inspections. Labor will be charged at the Owner's hourly billing rate (with standard overhead loadings applied) for the employee classification. Other expenses (such as third-party inspection firms, special tools, etc.) will be charged to the Contractor as paid by the Owner, without markup.

1.03 REQUIREMENTS FOR ACHIEVING PHYSICAL COMPLETION

A. Prior to requesting Owner's Representative's inspection for certification of Physical Completion, the Contractor must meet the following requirements, as applicable to the Contract scope requirements:
   1. All applicable conditions of permits required by regulatory agencies must be met.
   2. Discontinue (or change over) and remove from project site temporary facilities and services, along with construction tools and facilities, mock-ups, and similar elements.
   3. Testing of the operations of all systems must be complete and copies of the final balancing report submitted to the Owner's Representative.
   4. All deficiencies identified on the punch list must be corrected.
   5. Final versions of the As-built Records and Red-Line Drawings must be provided in accordance with Section 01 78 39 "Record Documents" and approved by the Owner.
   6. Final version of the Operating and Maintenance Manual must be provided in accordance with Section 01 78 23 "Operating and Maintenance Manual" and approved by the Owner.
   7. Final version of the Warranties and Bonds Manual must be provided in accordance with Section 01 78 36 "Warranties and Bonds" and approved by the Owner.
   8. Upon completion of all the above items, the Contractor must request confirmation of Physical Completion by writing a letter on the Contractor's letterhead to the Owner's Representative. This letter must conform to the attached example letter form, requesting that a Physical Completion inspection be scheduled as needed to establish the actual Physical Completion date. A form letter for this purpose is also provided in the Contractor Forms Workbook.

B. Process to Achieve Physical Completion:
   1. Upon receipt of Contractor's request per Item 1.03.A.8 above, the Owner's Representative will confirm that the Consultant agrees the project meets the requirements for Physical Completion.
      a. If the Consultant so agrees, the Owner's Representative will schedule a Physical Completion inspection within ten (10) Working Days of receipt of the inspection request.
      b. If the Consultant does not agree the project is Physically Complete, the Owner's Representative will notify the Contractor of the general Work items that must be complete before a Physical completion inspection can be scheduled.
      c. If Item B.1.b. above applies, the Contractor must complete the Work items identified and submit another inspection request. Step B.1 must be repeated until the Consultant agrees the Work is ready for Physical Completion inspection by the Owner's Representative.
   2. The Owner's Representative has sole discretion to designate and invite inspectors/participants that should be present for the Physical Completion inspection. Each participant in the inspection is responsible for providing a list of any Work deficiencies observed to the Consultant. The Consultant is

responsible for preparing the Punch List of outstanding Work items based upon the results of the inspection. All individual lists will be compiled into a single Punch List by the Consultant and issued to the Contractor.

3. If the inspection reveals that the Work is not Physically Complete, the process in 1.03.B.1 and B.2 shall be repeated.
4. Once inspection confirms that the Work is Physically Complete, the Owner's Representative shall prepare a letter acknowledging Physical Completion achievement and the date thereof.
5. The acknowledged date of Physical Completion will be used to determine the start of the one-year and extended warranties period.
6. Re-inspection Fees: When inspection shows that the Work has not attained the completion status claimed, the Contractor must compensate the Owner's Representative for additional labor and expenses that may be required at the Owner's Representative's sole discretion for subsequent inspections. Labor will be charged at the Owner's hourly billing rate (with standard overhead loadings applied) for the employee classification. Other expenses (such as third-party inspection firms, special tools, etc.) will be charged to the Contractor as paid by the Owner, without markup.

1.04 OWNER'S REPRESENTATIVE'S RECOMMENDATION FOR CONTRACT COMPLETION DATE:

A. The Owner's Representative's written recommendation for Contract Completion Date initiates the Contract completion approval process. The Owner's Representative will issue the written recommendation for Contract Completion Date to the Owner upon the Owner's Representative's determination that the following requirements have been fulfilled:
   1. Terms and requirements of all permits issued by regulatory agencies have been satisfied.
   2. All required special testing has been completed and approved.
   3. All changes to the Work have been completed and approved by Change Order, with associated changes to Contract price, time, and bonding requirements incorporated in the final pay request.
   4. Dates for Substantial and Physical Completion have been established in writing by the Owner's Representative.
   5. Contractor's Performance Evaluation by the Owner's Representative's Project Manager has been filed.
   6. Requirements for training of the Owner's Representative's personnel and final testing of operating systems have been satisfied.

PART 2 - PRODUCTS: *(Not Used)*

PART 3 - EXECUTION: *(Not Used)*

END OF SECTION

(Example form letters for requesting confirmation of Substantial and Physical Completion follow.)

(NOTE: Print letter on Contractor's letterhead.)

SUBSTANTIAL COMPLETION

(Date)

Mr. Mrs. …
Project Manager
Bainbridge Island Park & Recreation District
11700 Meadowmeer Cir NE
Bainbridge Island, WA 98110

SUBJECT: (*Project # and Name)*
Request for Confirmation of Substantial Completion

The Work performed under this Contract has been substantially completed. The Contractor, *(Name)*, hereby requests a Punch List Inspection of Substantial Completion and establishment of the actual date of Substantial Completion.

The Contractor agrees that if Substantial Completion is confirmed as a result of the inspection, the Owner will have full and unrestricted use and benefit of all facilities and worksites included in the Work of the Contract.

The Contractor also agrees to complete or correct any and all items described on the Substantial Completion Punch List in accordance with the Contract requirements and in compliance with the Physical Completion due date established by the Contract and any Change Orders.

By:

SIGNATURE
DATE
(Contractor Name)

(NOTE: Print letter on Contractor's letterhead. This form is also provided in Contractor Forms Workbook.)

PHYSICAL COMPLETION

(Date)

Mr. Mrs. …
Project Manager
Bainbridge Island Park & Recreation District
11700 Meadowmeer Cir NE
Bainbridge Island, WA 98110

SUBJECT: *Project # and Name*
Request for Confirmation of Physical Completion

The Work items identified in the Substantial Completion inspection Punch List have been completed. The Contractor, *(Name)*, hereby requests certification of Physical Completion and establishment of the date of Physical Completion and the beginning of the Contract warranty period(s).

The Contractor understands that Bainbridge Island Metro Park & Recreation District will assume all maintenance of the facility upon establishment of the Physical Completion date.

By:

SIGNATURE
DATE
(Contractor Name)

PART 1 - GENERAL

1.01 RELATED DOCUMENTS: Drawings and general provisions of the Contract apply to work in this Section.

A. Specific related Sections include, but are not limited to:
   1. Section 00 72 00 - General Conditions
   2. Section 01 77 19 – Contract Closeout
   3. Section 01 78 36 - Warranties and Bonds
   4. Section 01 78 39 - Record Documents

1.02 WORK IN OTHER SECTIONS: Coordinate related work specified in other parts of the Project Manual

1.03 DESCRIPTION OF WORK: The Operations and Maintenance (O&M) Manual must contain all operating and maintenance instructions, information, and/or data relevant to all:

A. Landscape and irrigation components;

B. Architectural products;

C. Finishes and furnishings;

D. Mechanical equipment and components;

E. Electrical equipment and components; and

F. Any other special equipment and components required for the project.

An itemized indexed list of all warranted items and products and their warranty term must be placed at the beginning of the O&M Manual for easy reference. The O&M Manuals must be prepared in both physical form (paper) and electronic form (.pdf).

1.04 O&M MANUAL FORM AND MATERIALS:

A. Organization - the O&M Manual must be organized in accordance with the 48 Division CSI (Construction Specifications Institute) numbering system. Divisions must be flagged with tabs.

B. Size - must be 8-1/2" x 11"

C. Paper - provide 20 pound (74 g/m^2) minimum; white for text pages.

D. Text - provide Manufacturer's printed data, or neatly typewritten information.

E. Drawings - accordion fold all oversize drawings to 8-1/2" x 11" size for binding.

F. Separation of Information – Separate each CSI Division with heavy-weight, durable paper or plastic tabbed index dividers, 110-lb index (210 g/m^2) or equivalent, resistant to folding and tearing. Separate each product and or component parts of equipment within a CSI Division with standard tabbed dividers, 90-lb index (165 g/m^2) or equivalent, followed by typewritten page describing the contents of the section.

G. Index Tabs- Each index tab must be neatly and legibly printed (using typewriter or laser printer) to describe the contents of the section. Index tabs must be durable, plastic coated, reinforced, and indexed to match the names and order listed in the Table of Contents. Inserted index tabs are not allowed.

H. Binders - provide:
   1. Commercial quality three-ring hard cover binders with durable and cleanable plastic covers for inserting required cover and spine information.
   2. Ring size: As suitable to content; 3 inch-maximum, 1-inch minimum.
   3. When multiple binders are used, correlate data into related groupings.

I. Manual Cover - the Cover of the O&M Manual must include the following information in the order shown:
   1. Title of Project
   2. Project Number 2208
   3. The words "Operations and Maintenance Manual"
   4. If applicable, the volume number (label volumes as 1 of 4, 2 of 4, 3 of 4, etc.)
   5. Company Name of primary Consultant/Designer
   6. Company Name of Prime Contractor
   7. If applicable, Company Name(s) of primary Subcontractor(s) (e.g. Mechanical, Electrical, etc.)
   8. Physical Completion Date (this may be provided as a placeholder for the Owner to fill in after acknowledgement of Physical Completion.

J. Manual Spine - the spine of the O&M Manual must show the name of the project followed by “O&M Manual” and the year completed. If there are multiple volumes, identify the volume number and the general subject matter covered in that volume.

1.05 CONTENTS:

A. Title Page - provide the title of the Project; name of the Project Manager; names, addresses, telephone numbers of the Consultant, major Subconsultants, General Contractor, and major Subcontractors; and date of Physical Completion.

B. Table of Contents - provide a complete table of contents listing major sections of the Manual and clearly identifying categories of information in each section.

C. Owner’s Acknowledgment of Physical Completion - since the O&M Manual is due in advance of Physical Completion, this may be provided as a placeholder page, with the actual acknowledgment to be inserted by the Owner after receipt of the approved O&M Manual.

D. Warranty List noted in 1.03 listed above.

E. The Contractor must provide a table summarizing recommended and required maintenance activities and schedules for all equipment/components, i.e. scheduled maintenance spreadsheet. The Consultant will utilize this information in part for developing a Preventive Maintenance Schedule.

F. Body of Manual - must be in the Construction Specification Institute (CSI) Format.

1. Divisions 02 through 48: Bind all product data, product maintenance data, and warranty information together for each product listed. All products and systems that could reasonably be expected to require repair or replacement within 40 years after Project Physical Completion must be covered in this manual. Include:
   a. Product Data - submit original product literature only. Mark each sheet to clearly identify specific products and component parts and data applicable to installation. Modify product data as required to accurately represent completed installation. Delete inapplicable information.
   b. Products, Applied Materials and Finishes- include all product data with catalog number, size, composition, and color and texture designations. Provide all necessary information for re-ordering custom manufactured items.
   c. Paintings and Coatings - for all painting work, provide a complete finish schedule of products, color names and numbers, formulas, and gloss used. Provide a drawing showing all paint and color locations.
   d. Moisture Protection and Weather Exposed Products- include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
   e. For each product or finish, list names, addresses and telephone numbers of suppliers, including local source of supplies and replacement parts.
   f. Drawings - supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Document as maintenance drawings.
   g. Additional Requirements- as specified in individual specification sections and such data or information that may be identified as useful or important during instruction of Parks' personnel.
   h. Preventive Maintenance Instructions: Include for each piece of equipment or system furnished requiring periodic inspections, lubrication, adjustment and/or other periodic tasks, as appropriate to ensure optimum and continued performance as specified.
   i. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommend schedule for cleaning and maintenance.

G. Warranties and Bonds:
   1. Product Warranties: Include copies of all Extended Warranties with products that have them. See individual Project Manual sections for requirements. Identify such warranties in the table of contents at the beginning of the O&M Manual.
   2. Bind in a copy of each warranty with each product or system. The original of each warranty must be bound in a separate labeled hard cover binder and submitted with the Approved O&M Manuals. See section 01 78 36 - Warranties and Bonds.

1.06 SUBMITTAL SCHEDULE

A. At least ten (10) days prior to scheduled Substantial Completion, submit two (2) copies of preliminary draft of proposed formats and outlines of contents to the Project Manager for review and approval by the Consultant and the Engineer. After the review, the copy will be returned to the contractor with accompanying comments. Incorporate comments in the draft O&M manual submitted per Paragraph 1.06.B.

B. Prior to requesting acknowledgement of Substantial Completion, or prior to Contractor training of Parks' personnel (whichever is earlier), submit two (2) copies of completed draft O&M Manual in approved final form to the Project Manager for review and approval by the Consultant and Engineer.

C. If the draft O&M Manual is not approved by both the Consultant and Engineer per Paragraph 1.06.B above, during the period between Substantial and Physical Completion, revise the O&M Manual to incorporate any comments, corrections, revisions, or requests for additional information received by the Consultant or Engineer. All such changes will be reviewed by the Consultant and Engineer to verify adherence to Contract requirements. The Contractor shall not request confirmation of Physical Completion until the As-Built Documents have been approved by both the Consultant and Engineer.

C. Submit two (2) copies of approved O&M Manual(s) in final form to the Project Manager prior to Physical Completion. If the original two (2) draft copies submitted per Paragraph 1.06.B were approved by both the Consultant and Engineer without any changes needed, only one (1) final O&M Manual need be submitted at this time.

D. Submit one (1) copy of approved O&M Manual(s) in electronic format (.pdf) along with the physical copies of the O&M Manual to the Project Manager prior to Physical Completion.

PART 2- PRODUCTS: *(Not Used)*

PART 3- EXECUTION: *(Not Used)*

END OF SECTION

PART 1 – GENERAL

1.01 GENERAL:

A. This Section addresses the need, if required, to either extend the bonded warranty for the Contractor and/or obtain extended warranties from Subcontractors, Suppliers and or Manufacturers for Materials, equipment, and installation as identified in the technical specifications of the Project Manual, and warranty inspections.

B. Unless otherwise extended per paragraph 1.02.A below, the general guaranty and warranty for the entire project must be as provided per Section 00 72 00, paragraph 1.03.J.

C. Related Sections include, but are not limited to:
- Section 00 72 00 - General Conditions
- Section 01 77 19 – Contract Closeout
- Section 01 78 23 - Operations and Maintenance Manual
- Section 01 78 39 - Record Documents

1.02 EXTENSION OF STANDARD CONTRACTOR-BONDED WARRANTY:

A. The general guaranty and warranty for the entire project must be as provided per Section 00 72 00, with the exception that the duration of that warranty period must extend “TBD” years from the date of Physical Completion.

1.03 EXTENDED WARRANTY FOR MATERIALS, EQUIPMENT, AND INSTALLATION:

A. Individual technical Sections may require specific warranties beyond the standard one-year bonded warranty.

B. Subcontractors, Manufactures and Suppliers must provide limited or full warranties for products that they provide as specified elsewhere in the Project Manual.

C. Extended warranties must start on the Physical Completion date established by the Owner and cover the warranty period specified in the technical specifications or the time period provided by the subcontractor, supplier and/or manufacturer, whichever is longer. Warranties must cover material and or equipment replacement, costs of installation, and costs associated with repair of damages caused by the removal and replacement of the defective product.

D. Form of Extended Warranty: The Contractor must provide a separate written Warranty for each element of work wherein a separate extended warranty period is required under the Contract. Each Warranty must be printed on the Contractor’s letterhead, and any information or printed materials pertaining to that warranty must be attached thereto. The Warranty must be stated, at minimum, to include all aspects of the model statement appended to this section, and must not include any conditions or qualifications that would reduce the coverage provided by this model statement. The Contractor also has the option

to utilize the model warranty language as generated by the "Warranty" sheet contained within the Contracting Forms Workbook, provided that the form letter has been fully and accurately populated with the necessary information.

1.05 WARRANTY PROVISIONS:

A. Unless extended per Paragraph 1.02.A above, the bonded warranty period for the general Contractor must be as specified in Section 00 72 00.

B. In the event of failure of any part of the Work during the warranty period, the Contractor must repair or remove and replace the defective components, including repair/replacement of any overlying or dependent construction, at no additional charge to the Owner.

C. Repairs and replacements must be completed in accordance with all the requirements of the Contract Documents. Repaired or replaced Work must be equivalent to the original work unless otherwise approved in writing by the Owner.

D. In the event of repeated failure of any repaired component, or if the Owner is not satisfied that the quality of repairs meets the requirements of the Contract Documents, the Owner may order defective work completely removed and replaced with new.

E. The Owner will schedule a warranty inspection of all work completed under the Contract prior to expiration of the General Warranty period. The Owner will establish the date, time and place for the warranty inspection and notify the Contractor and Consultant to send representatives. Working with the Owner and the Contractor, the Consultant will identify warranty defects and prepare a warranty inspection list of items to be corrected. The Consultant will provide a copy of the warranty inspection list to the Owner and the Contractor. The Contractor must correct and/or replace defective items or defective workmanship in a reasonable time, not to exceed two months. Failure of the Contractor to correct identified warranty deficiencies may result in the Owner referring the matter for corrective action in accordance with Section 00 72 00.

F. If any replacement or repair is made under the Warranty provisions of this Contract, the Warranty period for all Work involved in such replacement or repair must be renewed for an additional one-year period, provided, however, that the revised Warranty expiration date for such Work shall not extend more than two years past the original Warranty expiration date established upon Physical Completion.

PART 2 - PRODUCTS: *(Not Used)*

PART 3 - EXECUTION: *(Not Used)*

END OF SECTION

(Model Warranty Statement follows)

(NOTE: Print letter on Contractor's letterhead.)

CERTIFICATE OF WARRANTY

<Date>

Mr. Mrs. …
Project Manager
Bainbridge Island Park & Recreation District
11700 Meadowmeer Cir NE
Bainbridge Island, WA 98110

SUBJECT: *<Project # and Project Name>*
<Subcontractor Name if applicable>, <Description of Warranted Work>

<Contractor Name> certifies that the <description of warranted work>, installed by <"our company" or subcontractor name, as applicable> as part of <PW# & Project Title> located at *<Park Name>* (*<Park Address>*), is performed in strict accordance with the Contract Documents.

Furthermore, *<Contractor Name>* guarantees this Work to be free of defects in materials and workmanship until *<last day of warranty period>*, which is *<number, spelled>* (*<#, numeric>*) years from the established Physical Completion date of *<Owner-confirmed Physical Completion date>*, as required by the Contract.

During this warranty period, at no cost to the Owner, *<Contractor Name>* will repair or replace, without delay, any defects in materials, equipment, installation, and/or workmanship, as well as correct any associated damage to the Owner's property caused as a result of such defect occurring and/or repair of such defect, in full accordance with Contract requirements.

Sincerely,

<Contact name & title>,
<Company name>
<Company street address>
<Company City, State, & Zip Code>
<Contact telephone number>

PART 1 - GENERAL

1.01 RELATED SECTIONS

A. Related Sections include, but are not limited to
- Section 00 72 00 - General Conditions
- Section 01 77 19 – Contract Closeout
- Section 01 78 23 - Operations and Maintenance Manual
- Section 01 78 36 – Warranties and Bonds

1.02 AS-BUILT DOCUMENTS:

A. As-Built Records: These consist of Redline Drawings, Architect/Engineer-approved Shop Drawings, and any other drawings or documents that accurately describe the Work actually done under the Contract, including any and all deviations from the Work as originally bid. As-Built documentation must therefore include, but not be limited to, design changes, fabrications, assembly diagrams, and other as-built records as specified in the Contract or as required by the Architect/Engineer.

B. Redline Drawings: The Contractor must maintain a clean, undamaged set of bond copies of the Contract Drawings. This drawing set must be clearly labeled: "REDLINE DRAWINGS". This Redline Drawing set (which is sometimes referred to as “As-Built Drawings”) must be neatly annotated to show the actual installation of materials and systems wherever the installation varies substantially from the Work as originally shown in the Contract Documents. The Contractor must annotate all drawings where variation between the design depicted in the Contract Documents and the As-Built conditions can be reasonably discerned. When Shop Drawings apply, record a cross-reference at the corresponding location on the Contract Drawings and affix the Shop Drawings to the prints. Clearly identify as-built modifications resulting from Change Orders with the appropriate Modification Proposal number. Give particular attention to underground or concealed elements that would be difficult to measure and record at a later date.

1.03 USE AND PROTECTION

A. Do not use Redline Drawings or other As-Built Records for construction purposes. Protect from deterioration and loss in a secure, fire-resistive location at the project site. Provide access to all As-Built Records for the Consultant’s reference during normal working hours.

1.04 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of As-Built Documentation to one person on the Contractor's staff, as approved by the Architect/Engineer. Identify this person at the pre-construction meeting and place on the Contractor’s Personnel submittal.

B. Make entries on the Redline Drawings clearly showing as-built conditions within 24 hours after completing any element of work.

C. Accuracy of records:

1. If changes or additions pertain to the specifications contained in the Contract Project Manual, coordinate such changes and additions within both the Redline Drawings and the pertinent Project Manual pages, making adequate and proper entries on each page of specifications and each sheet of drawings and other documents where such entry is required or relevant to show the change(s) fully and accurately.
2. Accuracy of records must be such that future search for items shown in the final project Record Documents may rely reasonably on information obtained from the approved project As-Built Documentation,

1.05 MAINTENANCE OF RECORD DOCUMENTS

A. Maintain and store in field office apart from documents used for construction, the following documents:
   1. Permit drawings, bearing building permit approval from regulatory agency having jurisdiction, if any.
   2. Project Manual, bearing building permit approval from regulatory agency having jurisdiction, if any.
   3. The Signed Contract, Bonds, Insurance, Addenda, Design Clarifications, Field Directives, Modification Proposals, Change Orders, and approved Substitutions.
   4. Approved shop drawings and all other submittals.
   5. Field test records.
   6. A 3-ring binder containing clearly-identified pages from the Project Manual that have been annotated to reflect As-Built conditions as described in Section 1.04.C.1 above.

B. Provide files and racks for storage of documents

C. File documents in accordance with Project Manual table of contents.

D. Make documents available for weekly progress meeting and at all times for inspection by Consultant.

E. In the event of loss of recorded data, the Contractor must use all means necessary to again secure the data to the Architect/Engineer's satisfaction.

F. Payment may be withheld or pay requests modified for incomplete or inaccurate recording of as-built information.

G. The Architect/Engineer may request confirmation of recorded work by independent survey or inspection. If inaccuracies are found, Architect/Engineer may order hidden elements to be exposed for recording. All costs associated with this work may be deducted from the Contractor's Contract amount if the information has either not been recorded or has been recorded incorrectly.

1.06 SUBMITTALS

A. Before requesting confirmation of Substantial Completion, the Contractor must deliver two (2) complete color copy sets of draft As-Built Documents to the Owner for review and approval. The As-Built Documents must include the full Redline Drawing set; annotated

Project Manual; Change Orders; and approved shop drawings, product data, and samples which clearly and legibly show all deviations from the Contract Documents with red-colored pencil. The As-Built Documents must be approved by both the Architect/Engineer and the Consultant.

B. If the draft As-Built Documents are not approved by both the Consultant and Architect/Engineer per Paragraph 1.06.A above, during the period between Substantial and Physical Completion, revise the As-Built Documents to incorporate any comments, corrections, revisions, or requests for additional information received by the Consultant or Architect/Engineer. All such changes will be reviewed by the Consultant and Architect/Engineer to verify adherence to Contract requirements. The Contractor shall not request confirmation of Physical Completion until the As-Built Documents have been approved by both the Consultant and Architect/Engineer.

C. Once approved by both the Consultant and the Architect/Engineer, the Contractor must submit scanned color copies (PDF format) and the final, approved originals of the approved As-Built Documents to the Architect/Engineer. These must be provided prior to the Contractor requesting establishment of the actual Physical Completion date from the Architect/Engineer.

PART 2 - PRODUCTS: *(Not Used)*

PART 3 - EXECUTION

3.01 RECORDING

A. Mark As-Built Documents with red erasable pencil; other colors may be used when appropriate to distinguish between elements of the Work on the same drawing, such as different systems or Work resulting from different Modification Proposals.

B. Mark new information that was not shown on Contract Drawings or Shop Drawings, and as directed by the Architect/Engineer.

C. Indicate changes to the Work and/or the project site that were not known prior to beginning the Work but became visible as part of the project implementation and did not result in a change order.

D. Note all changes resulting from Modification Proposals by MP number.

E. Note all changes resulting from Field Directives.

F. Note all product or material substitutions.

G. Record information concurrently with construction progress. Do not conceal any work until all relevant as-built information is recorded.

H. The Contractor and its Subcontractors must coordinate recording of as-built information as follows:

1. The Contractor must ensure each Subcontractor makes record notations for his/her own Work and forwards these at least weekly to the general Contractor while such Work is in progress. The general Contractor must transfer each Subcontractor's notations as well as record their own notations of the general Work to a single set of As-Built Documents.
2. Legibly mark record As-Built documents to show the following:
   a) Accurate measurements and locations of underground services and utilities referenced to the building or other permanent construction as directed by the Architect/Engineer.
   b) Note changes of direction and locations, by horizontal dimension and vertical elevations, as utilities are actually installed.
   c) Note deviations from the Contract documents, and reference reason for change (e.g., construction meeting minutes, telephone call report, field order, etc.).
   d) Show details and locations not on original Contract drawings.
   e) Indicate field changes of dimensions and details.

I. Project Manual Specifications (including relevant Addenda): Legibly mark each section to record:
   1. Manufacturer, trade name, catalog number, and Supplier of each equipment item and material actually installed; and
   2. Changes made by field directive or by change order.

J. Shop Drawings, product data sheets and samples: Maintain one complete set as Record Documents and legibly annotate to record all approved changes.

3.02 ORGANIZATION OF RECORD DOCUMENTS:

A. Organize all Record Documents into a manageable set, and print suitable titles, dates and other identification on the cover sheet(s).

END OF SECTION

DIVISION 02

Existing Conditions

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:
1. Deconstruction and removal of selected portions of the building(s) or structure for reuse as identified in the construction documents.
2. Demolition and removal of selected portions of the building or structure for disposal as identified for demolition in the construction documents.
3. Salvage of building materials and equipment as identified in the construction documents.
4. Surplus of building materials and equipment as identified in the construction documents.

B. Related Sections:
1. Section 01 11 00 – Summary of Work
2. Section 01 74 19 - Construction Waste Management and Disposal
3. Section 01 76 00 – Protection of Existing Facilities
4. Section 07 52 16 – SBS Modified Bitumen Roof System
5. Section 07 62 00 – Sheet Metal Flashing and Trim

1.02 DEFINITIONS

A. Full Deconstruction: Removal by disassembly of a building in the reverse order in which it was constructed.

B. Selective Deconstruction: Disassembly and removal of selected portions of building or structure.

C. Salvage: Removal of disassembled building materials for the purpose of reuse or recycling.

D. Demolish: Remove and legally dispose of off-site.

E. Surplus: Remove and return item(s) to Owner. Coordinate surplus item storage with Owner.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable Federal, State and Anchorage code for demolition work, safety of structure, occupants and pedestrians, and dust control.

B. Obtain required permits from authorities.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Do not close or obstruct egress width to exits.

E. Do not disable or disrupt building fire or life safety systems without 3-day prior written notice to the Owner.

F. Conform to procedures applicable when discovering hazardous or contaminated materials.

1.04 MATERIALS OWNERSHIP

A. Unless otherwise indicated, deconstruction waste becomes property of the Contractor.

1.05 SEQUENCING

A. Sequence work under the provisions of Division 01 for Summary of Work.

1.06 SCHEDULE

A. Perform noisy work to the hours permitted by local governing noise ordinances and the Owner.

B. Schedule work to comply with requirements of Division 01

1.07 SUBMITTALS

A. Qualification Data: For deconstruction firm.

B. Schedule of Deconstruction Activities: Indicate the following:
   1. Detailed sequence of deconstruction and removal work, with starting and ending dates for each activity.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Locations of proposed dust- and noise-control temporary partitions and means of egress.
   6. Means of protection for items to remain and items in path of material removal from building.

C. Inventory: After deconstruction is complete, submit a list of items that have been salvaged, recycled and disposed of and documentation (receipts/scale tickets/waybills) showing the quantities.

D. Deconstruction Photographic Documentation: Document general condition of materials to be salvaged prior to removal.

E. Submit deconstruction plan prior to start of work.

1.08 QUALITY ASSURANCE

A. Deconstruction Firm Qualifications: Company(ies) experienced and specializing in performing the Work of this Section with a minimum of two years and/or a minimum of five projects of documented experience in similar types of deconstruction work.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
   1. Comply with noise and dust regulations of authorities having jurisdiction.

C. Pre-Deconstruction Conference: Conduct conference at Project site. Review methods and procedures related to deconstruction including, but not limited to, the following:
   1. Inspect and discuss condition of building to be deconstructed.
   2. Review structural load limitations of existing structure.
   3. Review and finalize deconstruction schedule and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by deconstruction operations.
   5. Review areas where existing construction is to remain and requires protection.
   6. Review method for removing materials from the site.
   7. Review staging area for materials on the site.

1.09 PROJECT CONDITIONS

A. Hazardous Materials: It is unknown whether hazardous materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify the Consultant and the Owner. The Owner will remove hazardous materials under a separate contract.

B. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during deconstruction operations.
   1. Maintain fire-protection facilities in service during deconstruction operations.

1.10 DECONSTRUCTION PLAN

A. Material Identification: Indicate anticipated types and quantities of materials to be salvaged, recycled, and disposed of. Indicate quantities by weight or volume, but use same units of measure throughout.

B. Procedure: Describe deconstruction methodology, sequencing, and materials handling and removal procedures. Include the anticipated final destination of each material.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of deconstruction required.

C. Inventory and record the condition of items to be removed and salvaged.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or videotapes.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS:

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during deconstruction operations.

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems.

3.03 PREPARATION

A. Site Access and Temporary Controls: Conduct deconstruction operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to workers.
   1. Provide protection to ensure safe passage of workers around deconstruction area.
   2. Provide weather protection for all salvage materials (and items to remain) before, during and after deconstruction.

C. Protect existing materials, which are not to be demolished.

D. Prevent movement of remaining structure. Provide bracing propping, and shoring.

E. Mark location of utilities.

3.04 DECONSTRUCTION

A. General: Deconstruct and remove existing construction in accordance with the materials identified for removal in the deconstruction plan. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with deconstruction systematically, from higher to lower level. Complete deconstruction operations above each floor or tier before disturbing supporting members on the next lower level.
   2. 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, prying or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
   3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of

hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site in accordance with all federal, state and local regulations.
7. Remove structural framing members in such a way as to maintain their highest value.
8. Locate deconstruction equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during deconstruction activities. When permitted by Engineer, items may be removed to a suitable, protected storage location during deconstruction and cleaned and reinstalled in their original locations after deconstruction operations are complete.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, remove demolished materials from Project site and legally dispose of them.
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.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Division 01 for Waste Management & Disposal.

B. Burning: Do not burn demolished materials.

3.06 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by deconstruction operations. Return adjacent areas to condition existing before deconstruction operations began.

B. Any damage caused by demolition to the remaining or neighboring buildings, or on-site streets and public right-of-way shall be repaired.

3.07 SALVAGED MATERIALS FOR REUSE BY OWNER SCHEDULE

A. Salvage and reuse items as noted on the drawing documents.

END OF SECTION

PART 1 – GENERAL

1.01 SCOPE

A. This section covers the removal and disposal, or other impact, of asbestos-containing materials (ACMs) as necessary to accomplish the Work as defined by these Specifications. See Section 01 11 10, Summary of Hazardous Materials Work.

B. Materials to be removed require confirmation in the field. Coordinate with the Environmental Consultant to properly record materials removed in each separate regulated work area.

C. The Contractor shall refer to the Limited Hazardous Materials Survey Reports attached to these Specifications, which lists suspect materials in the areas of the Work. The Contractor shall ensure that copies of these reports are made available to and retained on the project site by all subcontractors.

1.02 RELATED WORK:

A. Work performed under this specification section shall be governed by all related specification sections, including, but not limited to, the following:
   1. Division 00 - Procurement and Contracting Requirements;
   2. Division 01 - General Requirements; Section 01 11 10 Summary of Hazardous Materials Work

1.03 DEFINITIONS

A. Authorized Visitor: The Owner or designated representative, or a representative of any regulatory or other agency having jurisdiction over the project, and having required training, medical, fit test, etc.

B. Environmental Consultant: Environmental consultant specializing in asbestos abatement -- PBS Environmental -- or any subcontractor designated by PBS.

C. Independent Testing Laboratory: A laboratory financially independent from and hired by the Owner or Contractor which is either AIHA-accredited for asbestos with demonstrated proficiency via the AIHA PAT program or has analysts proficient in the AIHA AAR program for air sample analysis.

D. Owner: Representatives designated by the Owner, or designated employees of the Owner.

E. Work Area: A regulated area where asbestos abatement activities are performed; isolated from non-work areas by negative pressure, containment barriers, decontamination enclosure systems and warning signs or demarcation tape with warning signs.

1.04 DOCUMENTS INCORPORATED BY REFERENCE

A. The current issue of each document shall govern. Where conflict among requirements or with these Specifications exists, the most stringent requirements shall apply.

B. U.S. Environmental Protection Agency National Emissions Standards for Hazardous Air Pollutants (NESHAPS). (Code of Federal Regulations Title 40, Part 61, Subparts A & B.)

C. U.S. Environmental Protection Agency Office of Toxic Substances Guidance Document, *Guidance for Controlling Friable Asbestos-Containing Materials in Buildings,* EPA Report Number 560/5-85-024 ("Purple Book").

D. U.S. Department of Labor Occupational Safety and Health Administration (OSHA):
   1. Title 29 Code of Federal Regulations Section 1910.1001--General Industry Standard For Asbestos.
   2. Title 29 Code of Federal Regulations Section 1910.134--General Industry Standard For Respiratory Protection.
   3. Title 29 Code of Federal Regulations Section 1910 *et al.*--Occupational Exposure to Asbestos; Final Rule.
   4. Title 29 Code of Federal Regulations 1926.1101--Construction Standard for Asbestos.
   5. Title 29 Code of Federal Regulations Section 1910.2--Access to Employee Exposure and Medical.
   6. Title 29 Code of Federal Regulations Section 1910.1200--Hazard Communication.

E. Environmental Protection Agency 40 CFR Part 763, AHERA, Asbestos-Containing Materials in Schools; Final Rule and Notice.

F. National Institute for Occupational Safety and Health (NIOSH), 30 CFR, Part II, Respirators.

G. American National Standards Institute (ANSI) NY; ANSI Standard Z 88.2-1980 *American National Standards Practice for Respiratory Protection*, latest edition.

H. CERCLA, Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601 et.seq.).

I. RCRA, Resource Conservation and Recovery Act.

J. Washington State General Occupational Health Standards, WISHA Chapter 296-62 Washington Administrative Code (WAC); Chapter 296-65 WAC Asbestos Removal & Encapsulation; Chapter 296-155 WAC Safety Standards for Construction Work.

K. Puget Sound Clean Air Agency Regulation III, Article 4 Asbestos Control Standard.

L. Washington Industrial Safety and Health Act (WISHA).

M. Uniform Building Code (U.B.C.), latest edition, and regulations as applicable.

N. Perform all electrical work in accordance with the National Electrical Code.

O. All local ordinances, regulations, or rules pertaining to asbestos, including its storage, transportation, and disposal.

1.05 SUBMITTALS AND NOTICES

A. No asbestos-related work will be permitted prior to submittals being processed by the Environmental Consultant. Allow fifteen (15) days for review prior to the commencement of abatement.

B. Additional requirements for submittals are also described in other sections of these specifications. The requirements in this section pertain to asbestos-containing materials removal.

C. Submit the "Contractor Acknowledgment of Asbestos Hazard Training, Respirator Training and Agreement to Undertake All Required Precautions", Form 028200-1 (attached to this Section). completed and signed by the Abatement Contractor in conjunction with pre-job submittals.

D. Contractor shall submit to the Owner the following information prior to beginning work on the project:
    1. Work Plan: Include a detailed plan of the procedures proposed for use in complying with the requirements for each site, including the following:
        a. A description of all special equipment, techniques, and methods to be used on the Project, including schematic drawings of work area layout(s) showing entries/exits, HEPA exhausts, decon units, and waste load-outs.
        b. A specific clearance monitoring schedule indicating proposed start dates/times and completion dates/times for individual regulated areas as configured in the proposed Work Plan.
        c. Specific information relating to handling, transport and disposal of asbestos-containing waste from each waste-generating site. Identify the designated proposed disposal site at which any waste material generated during the project will be disposed and furnish evidence of all necessary government approvals to dispose of the waste.
    2. Laboratory Qualification Information: Submit information pertaining to the proposed Air Monitoring Program for this project. Contractor’s air monitoring shall include employee exposure monitoring. This information shall include the name(s) of personnel collecting air samples, types of equipment, sampling schedule, sampling procedures, calibration record keeping, name and address of proposed Independent Testing Laboratory, and evidence of analyst's NIOSH 582 course completion and AIHA PAT program participation.
    3. Worker Certification: Submit written proof that all employees performing asbestos-related work will have completed all necessary asbestos-related training in compliance with WAC Chapters 296-62 and 296-65. Written proof may be in the form of a notarized letter stating such intent and signed by an owner or principal of the appropriate firm(s).
    4. Written Certification: Submit written proof that all employees performing asbestos-related work will have completed all necessary asbestos-related training in compliance with WAC Chapters 296-62 and 296-65. Written proof may be in the

form of a notarized letter stating such intent and signed by an owner or principal of the appropriate firm(s).

5. Notifications and Policies: Submit copy of all required notifications and permits obtained by the contractor (Washington State Department of Labor and Industries, and PSCAA) and copies of all types of specified bonds and insurance. Submit upon receipt any approved amendments to notifications or re-notifications for multi-phase activities. See Paragraph 1.11 - Permits and Notifications for additional requirements.
6. Certified Asbestos Supervisor (CAS): Submit the name, Asbestos Supervisor Certification and resume of experience of the assigned on-site CAS. At a minimum, the foreman shall have successfully completed a supervisor-training course in compliance with WAC Chapter 296-65-007. References and work on similar projects will also be reviewed. The Owner and/or the General Contractor and Environmental Consultant reserve the right to remove the CAS from the work at any time during the project. The Contractor shall then submit another on-site CAS for approval as described above.

E. Daily Job Submittals
   1. Personal Air Monitoring: Submit copies of all personal air monitoring data sheets, chain-of-custody and analytical results to the General Contractor and Environmental Consultant on a daily basis within 24 hours following sample collection.
   2. Daily Logs: Submit copies of daily logs to the General Contractor and Environmental Consultant daily prior to the end of the next work shift. Daily logs shall indicate the date, time, site location, identity, company or agency represented, and reason for entry of all persons entering the work area, and the type, amount and location(s) of all ACMs removed.
   3. Entry/Exit logs: Submit copies of regulated area entry/exit logs to the General Contractor and Environmental Consultant on a daily basis prior to the end of the next work shift

F. Periodic Submittals
   1. Asbestos Training: Upon verbal request, immediately make available to the Environmental Consultant proof of Asbestos Worker Certification or Asbestos Supervisor Certification. Provide copies of worker training certification to the Owner upon request.
   2. Work Plan modification/clarification: In the event that on-site activities will require departure from any and all aspects of the information outlined in the pre-approved Work Plan, submit written clarification/modification of proposed changes to the Owner and Environmental Consultant.

G. Post-Job Submittals shall be delivered to the General Contractor within 15-days of completion of asbestos-related work as specified by these Contract Documents and shall include the following:
   1. Certifications: Provide written certification from the Abatement Contractor's Project Manager or Supervisor that Contractor has fully inspected the work area and completed work in strict accordance with the Specifications.
   2. Air Monitoring: Submit documentation of all employee personal air monitoring results relative to OSHA and WISHA respiratory protection level compliance. Include

copies of all air monitoring data sheets, chain-of-custody documentation and analysis reports for sampling conducted at the site.

3. Project Record Documents: Provide project records including documentation of all contract changes, and copies of worksite entry logs, work area entry/exit logs, safety logs, safety meeting sign-in sheets, and supervisor's daily field reports.
4. Disposal Manifests: Submit copies of all asbestos waste transportation and disposal manifests including signed receipts from the landfill, and chain-of-custody.
5. Final payment will be issued by the Owner only with written approval, by the Environmental Consultant, of post-job submittals.

1.06 PERSONNEL PROTECTION

A. Training: All personnel accomplishing removal of asbestos-containing materials shall have received the minimum training as required by the Washington State Department of Labor and Industries for the work to be performed.
   1. At a minimum, the supervisor shall be the bearer of a current “Certified Asbestos Supervisor Certificate” issued by the Washington State Department of Labor and Industries. Prior to commencement of work, Contractor shall ensure all workers have been trained as a specified in WAC Chapter 296-65.
   2. Prior to commencement of work, Contractor shall ensure all workers have been trained as specified in WAC Chapter 296-65.
   3. The Contractor shall provide and post decontamination, respirator, and work procedures for abatement crew.

B. Personnel Protective Equipment for Asbestos Removal
   1. Provide protective clothing and equipment per WAC 296-62.

1.07 AIR MONITORING BY CONTRACTOR:

A. An Independent Testing Laboratory shall be retained by the Contractor for PCM sample analysis. All analysis shall be performed by an Industrial Hygienist. The Hygienist must be experienced and trained in asbestos sampling and analysis. At a minimum, documentation of prior asbestos sampling and analysis experience, plus satisfactory completion of the NIOSH 582 course or equivalent will be required. Air sample collection may be performed by an Industrial Hygienist or the Contractor's foreman at the Contractor's option. The Contractor shall perform sampling and analysis of air samples for asbestos in compliance with WAC Chapter 296-62-07735, Appendix A-WISHA reference method, or equivalent.

B. Sample Documentation: Documentation shall be kept for each filter sample procured as to worker sampled, social security number, activity, work area location, date and time taken, volume of air drawn through filter, pump identification number and calibration. Report all data on copies of *Asbestos Air Sampling Data Form* bound in these Specifications or similar approved form within 48 hours. Fill in all information on every form. Submit chain-of-custody records along with all samples.

C. Analysis Procedures: The samples shall be collected on 25 mm filters and analyzed within 12 hours using the membrane filter method at 400-500x magnification with phase contrast illumination--NIOSH Analytical Method No. 7400--for laboratory and field analysis. The

analyst shall sign and submit permanent records of all samples analyzed directly to the Environmental Consultant. The Independent Testing Laboratory shall seal the unused portion of all filters in airtight containers so that individual samples can be re-analyzed at a later date if necessary. The containers shall be clearly labeled with Project Name and Sample Number and shall become property of the Owner at work completion at the Owner's request.

D. Controls: The Contractor's testing laboratory shall submit sample analysis results, chain-of-custody and equipment calibration records to the Environmental Consultant within 24 hours of collection.

E. Contractor’s Sampling During Abatement
   1. Sample Collection: Air monitoring shall be performed to determine worker exposure during the period of asbestos abatement in each work area. Begin sampling when asbestos removal commences. Samples are to be taken where Class I or II work is being conducted during each 8-hour work shift.
   2. Most Contaminated Worker: The Contractor shall determine which worker(s) in each work area is probably experiencing the most severe exposure. This is the "Most Contaminated Worker(s)". 8-hour TWA and 15-minute excursion samples shall be collected on this worker(s). This worker shall wear a personal sampling pump and the sample shall be drawn from the breathing zone of this worker.
   3. The number of air samples collected shall be in accordance with the Contractor's approved work plan, however, collect a minimum of one sample per work area daily.

1.08 AIR MONITORING BY OWNER

A. Industrial Hygienist: The Owner will retain an experienced Industrial Hygienist/ Environmental Consultant to collect and analyze asbestos air samples prior to abatement, inside the work area, outside the work area, at HEPA exhaust and after visual inspection. Documentation of sample results will be forwarded to the Contractor as appropriate.

B. Sampling and analysis of asbestos samples shall be performed in compliance with WAC Chapter 296-62-07735, Appendix A--WISHA reference method, or equivalent.

C. The Owner reserves the right to monitor Contractor's performance via air samples on abatement workers in addition to the Contractor's air monitoring.

1.09 OWNER OCCUPANCY

A. The area of abatement shall be occupied only by properly trained workers and authorized inspectors during abatement activities. Coordinate phasing of abatement areas to comply with occupancy requirements as defined in Section 011110, Summary of Work.

1.10 WORKING HOURS

A. Submit proposed work schedule to Owner for approval in conjunction with submittals required by this Section. The Owner reserves the right to restrict and curtail any operations

which are considered, at the Owner's sole determination, to generate such noise or activities as to interfere with facility operations. Any revisions to the approved work schedule shall be submitted in writing to the Owner a minimum of 48 hours prior to the desired schedule change.

1.11 PERMITS AND NOTIFICATIONS

A. The Contractor is responsible for obtaining all permits and notifications as required for the completion of the work by the Washington State Department of Labor and Industries, the U.S. E.P.A., the Puget Sound Clean Air Agency and any other permitting agency involved with the completion of the work included herein.

1.12 Personnel Training

A. All personnel accomplishing removal of asbestos-containing materials shall have received the minimum training as required by the Washington State Department of Labor and Industries for the work to be performed. At a minimum, the supervisor shall be the bearer of a current "Certified Asbestos Supervisor Certificate" issued by the Washington State Dept. of Labor and Industries.

1.13 Liability

A. The Contractor is an independent contractor and not an employee of the Owner, Architect or Environmental Consultant. The Owner, Architect and the Environmental Consultant shall have no liability to the Contractor or any third persons for Contractor's failure to faithfully perform and follow the provisions of these Specifications and the requirements of the governing agencies. Notwithstanding the failure of the Owner, Architect or the Environmental Consultant to discover a violation by the Contractor of any of the provisions of these Specifications, or to require the Contractor to fully perform and follow any of them, such failure shall not constitute a waiver of any of the requirements of these Specifications which shall remain fully binding upon the Contractor.

1.14 Subcontractors

A. Subcontractors employed by the Contractor shall be bound to all the work and safety standards specified. Subcontractor's personnel shall meet requirements as specified and shall be supervised by the Contractor during performance of this work.

1.15 Quality Insurance

A. On-Site Observation
    1. Pre-Removal: Environmental Consultant shall perform observations regarding: demarcation of regulated area, installation of critical barriers, integrity of negative pressure enclosures, waste load-out facilities, and other conditions affecting abatement work. Contractor shall request pre-removal observations a minimum of two hours prior to desired removal commencing. No abatement work shall be performed prior to pre-removal observations by the Environmental Consultant.

2. Observation: Environmental Consultant shall perform observations regarding: integrity of isolation barriers, decontamination facilities, worker protection, Contractor's air monitoring program, performance of abatement operations, and conformance to the Specification, EPA, OSHA, WISHA and PSCAA regulations.
3. Post Removal: Environmental Consultant shall perform visual inspections after the removal of asbestos-containing materials is complete. Upon completion of asbestos-related activities, all work areas shall be free of all accumulations of dust, debris or three-dimensional residue. Schedule post-removal inspections a minimum of 24 hours in advance.
4. No visual inspections will be performed on wet flooring areas. Ensure adequate drying time when scheduling inspections.
5. Stop Work: Environmental Consultant shall notify the Contractor in writing to stop work if the Environmental Consultant determines that work practices are in violation of regulations, these Specifications or work is endangering workers or occupants of the building. The Contractor shall continue work when conditions and actions are corrected and when written authorization is received from the Environmental Consultant.

B. Air Monitoring
1. Notification: If, at any time during the work, analysis of an air sample taken by the Contractor, Owner, or Environmental Consultant from a non-isolated regulated work area or a non-regulated area indicates a fiber concentration in excess of the applicable Control Limit, the Industrial Hygienist who analyzed the air sample shall immediately notify the Contractor's Foreman, the Environmental Consultant: PBS Environmental, the Owner and other workers, employees, occupants, etc. in affected area(s).
2. Maximum Allowable Fiber Concentrations:
    a. Outside all Regulated Work Areas: 0.01 f/cc (fibers per cubic centimeter by PLM) or below pre-abatement;
    b. Inside Non-Isolated Regulated Work Area: 0.05 f/cc or below pre-abatement levels;
    c. Inside Isolated Regulated Work Area: 0.10 f/cc;
    d. Post- Abatement: 0.01 f/cc, or 70 s/mm^2 by TEM, as applicable.
3. Procedures: Immediately upon being notified of fiber concentration in excess of the Control Limit, the Contractor shall perform the following steps in the order presented, at no additional cost to the Owner:
    a. Stop abatement work and identify source of high fiber counts.
    b. Corrective Actions: Immediately correct containment breaches, pressure differential changes and potential cause of high fiber counts. The Environmental Consultant will determine the affected are considered to be contaminated. The Environmental Consultant will determine the actions to be taken by the Contractor at no additional cost to the Owner.
    c. Clean the affected area using wet methods and HEPA vacuuming.
    d. Re-sample air until fiber counts are determined to be below the specified maximum levels.
    e. Secure and repair containment barriers, repair or add equipment.
    f. Modify work procedures and make other changes to reduce fiber counts.

4. Complete every part of the "Fiber Count Above Control Limit Data Form" bound into these Specifications. Resume work and air monitoring.
5. Additional Costs: The Contractor shall be responsible for costs of any testing, cleanup, repair, down time loss, etc. that is a result of the Contractor's negligence, poor maintenance of isolated areas, failed post-abatement sampling and improper procedures.

C. Performance: Work shall be performed in a skillful manner representing industry standards. Environmental Consultant shall require Contractor to remove from the work site employees and subcontractors the Environmental Consultant deems incompetent, careless or objectionable.

PART 2 – PRODUCTS

2.01 PROTECTIVE CLOTHING AND EQUIPMENT

A. Protective Clothing: Provide approved clothing per WAC 296-62 for all workers and all official representatives of the Owner, State or other governmental entity, and the Environmental Consultant who may require such clothing.

B. Respirators: At a minimum, respiratory protection shall be approved by NIOSH/MSHA (National Institute for Occupational Safety and Health/Mine Safety and Health Administration), United States Department of Labor, and U.S. Department of Health, Education and Welfare, Centers for Disease Control, in accordance with WAC Chapter 296-62-071. Respiratory protection shall provide workers with a maximum calculated fiber level inside the mask of 0.01 f/cc.
   1. Selection: As part of the Contractor's Respiratory Protection Program, all workers shall be provided with a selection of brands and sizes of respirators to choose from. At a minimum, all workers shall be quantitatively or qualitatively fit-tested at the time of respirator selection per WAC Chapter 296-62-07715.
   2. Contractor shall supply replacement filter cartridges as required. Cartridges which have become wet or clogged shall be replaced immediately.
   3. Contractor shall provide personal protective equipment and supplies to the Environmental Consultant and authorized visitors for use on the site.

2.02 MATERIALS

A. Encapsulants (Sealants): Encapsulants shall be rated as "Acceptable" using the test method described in the EPA document published as National Technical Information Service report PB 88-113 329/AS [available from NITS, 5825 Port Royal Road, Springfield, VA 22161.] (The report is summarized in EPA publication EPA/600/S-87/091 [available from Center for Environmental Research Information, EPA 26 Martin Luther King, and Cincinnati, OH 45268].)

B. Plastic Sheeting: Plastic sheeting shall be flame-retardant polyethylene material, sized in lengths and widths to minimize the frequency of joints. Exterior applications require reinforced plastic sheeting. Plastic sheeting shall be minimum thickness of 6-mil for specific uses itemized by applicable codes and regulations. For other applications plastic sheeting shall be of adequate thickness to achieve the intended level of protection or functionality.

C. Warning Labels: Warning labels on plastic bags and disposal containers shall include the following information:

DANGER
CONTAINS ASBESTOS FIBERS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
DO NOT BREATHE DUST
AVOID CREATING DUST

D. Warning Signs: Warning signs shall be provided and displayed at each regulated area in accordance with WAC Chapter 296-62-07721. Warning signs shall include the following information:

DANGER
ASBESTOS
MAY CAUSE CANCER
CAUSES DAMAGE TO LUNGS
AUTHORIZED PERSONNEL ONLY

PART 3 – EXECUTION

3.01 WORK AREA PREPARATION

A. Worker Decontamination Facilities
   1. Modified Worker Decontamination Enclosure System
      a. At entrances to non-isolated work areas the Contractor shall construct a personnel decontamination enclosure system or area consisting of plastic sheeting barriers with a HEPA vacuum and water source and satisfying the requirements of WAC 296-62-07712. The system shall include a remote or adjoining decontamination area.
      b. Contractor shall not begin asbestos abatement work unless this system is functional, in good repair, and has been found acceptable for specification compliance by the Environmental Consultant.

B. Access to Work Areas by Others
   1. Except for emergency personnel, the Contractor shall limit access to the work area to authorized visitors.
   2. The Contractor shall provide protective clothing, respirators, and equipment for all authorized visitors, as specified.
   3. All authorized visitors shall be subject to the personnel protection provisions specified above and shall sign in and out on the Worksite Entry Logbook.

C. Personnel Protection during Work in Non-Isolated Work Areas
   1. Work clothes per 2.01-A, and respiratory protection per 2.01-B.
   2. Clothing: Workers shall wear two layers of coveralls after removal of street clothes. Worker decontamination will consist of personal decontamination in a regulated area over drop plastic sheeting with a HEPA vacuum and wet methods. The first layer of coveralls must be removed when exiting the work area.

3. Workers shall not eat, drink or chew gum at the worksite except in the established clean room. Smoking or using other tobacco products is prohibited.
4. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbance of asbestos-containing or contaminated material and until final cleanup is completed.

D. Emergency Precautions
1. Emergency Exits: The Contractor shall establish emergency and fire exits from the work area. Contractor shall ensure these exits are well marked and remain unobstructed.
2. First Aid: The Contractor shall be prepared to administer first aid to injured personnel after decontamination. Seriously injured personnel shall be treated immediately or evacuated without delay for decontamination.
3. Fire Department: Contractor shall notify the local fire department of the asbestos abatement project prior to beginning work area preparation.
4. Contractor shall provide fire extinguishers at all abatement work areas.
5. Emergency Clean-up: Contractor to submit to the Environmental Consultant for approval, an emergency control and cleanup plan to be followed in the event of asbestos contamination during work in non-isolated work areas. Contractor shall ensure all workers are thoroughly familiar with approved plan.

E. Building Security and Protection
1. The Contractor shall post adequate warning signs at all potential entrances to work areas.
2. Building Protection: Contractor shall protect all existing fixed equipment, existing building finishes that are to remain, and existing systems and functions from damage during the abatement process. Extra precautions are to be taken in protecting existing electrical panels, light fixtures, etc. Any damage to existing building, services, and/or equipment shall be remedied by the Contractor at his expense.
3. Power Failure: Contractor shall notify Environmental Consultant and Owner immediately when a power failure occurs. Asbestos abatement work will stop, and the work area will be misted with water. If power failure exceeds 15 minutes, workers shall use appropriate personnel decontamination procedures and shall seal the work area.
4. Contractor shall maintain access and use of existing fire lanes and maintain security measures to prevent unauthorized access, theft or vandalism.

3.02 NON-ISOLATED WORK AREA PREPARATION

A. Performance: Contractor shall perform the following procedures in the order in which they are presented for work in non-isolated work areas according to the approved work plan. Any alternative control measures considered for Class II asbestos abatement work involving the removal of ACM that is not TSI, surfacing or sheet flooring materials shall be approved by the Environmental Consultant and performed in accordance with 29 CFR 1926.1101.
1. Coordinate to ensure shut down and isolation of any HVAC equipment near work areas**.** Coordinate with Owner regarding all electrical, safety and other service

connections, requirements and equipment. Contractor is responsible to detect operation of systems intended to be shut down during abatement.

2. Install critical barriers at any HVAC openings, adjacent doors, windows and other openings to work areas.
3. Completely pre-clean visible accumulation of any debris in work area using HEPA vacuum equipment or wet cleaning methods.
4. Set up a modified worker decontamination enclosure system as described above. Once this system is installed and abatement commences, it shall be utilized in the specified manner for decontamination of only personnel. All personnel shall sign the Worksite Entry Logbook each time they enter or exit the work area. Work performed outdoors in excavated areas shall be performed wearing two disposable suits.
5. Cover horizontal surfaces and other objects below work area with plastic sheeting.
6. Have emergency cleanup equipment and supplies, including HEPA vacuum, amended water, disposal bags, buckets, towels and sponges, on hand prior to start of abatement work.

B. Compliance: No asbestos abatement work shall occur unless the work area has been found acceptable for Specification compliance by the Environmental Consultant. Notifications to perform asbestos abatement and the Hazardous Materials Inspection Summary shall be posted at the work site.

3.03 ISOLATED WORK AREA PREPARATION (NEGATIVE PRESSURE ENCLOSURE)

A. Coordinate to ensure shut down and isolation of any HVAC equipment near work areas. Contractor shall coordinate all electrical, safety and other service connections, requirements and equipment. Contractor is responsible to detect operation of systems intended to be shut down during abatement.

B. Remove all uncontaminated removable equipment, fixtures, and supplies from the Work Area before commencing Work. Completely pre-clean and cover all unmovable furnishings or equipment with two layers of polyethylene sheeting, securely taped in place with duct tape. Such fixtures and equipment shall be considered outside the Work Area unless plastic or seal is breached. Contractor is responsible for any damage to these items while working in these areas.

C. Install critical barriers as follows:
   1. Individually clean and seal all ventilation openings (supply and exhaust), doorways, lighting fixtures, floor drains and all other openings into the Work Area with two layers of reinforced polyethylene sheeting, taped securely in place with duct tape. Maintain seal until all Work is completed. Provide scaffolding and rigid post as necessary for proper structure integrity when negative pressure is applied.
   2. Clean and seal all lighting fixtures and HVAC diffusers with duct tape, and plastic sheeting to provide an airtight and watertight seal. Take care to avoid wrapping plastic sheeting on light fixtures, which may generate heat. Ensure that all electrical conduit connections and other electrical devices inside the Work Area that are exposed to moisture are sealed.
   3. Use duct tape to seal all seams of HVAC ductwork or other system components that

extend through Work Area.

4. Completely pre-clean visible accumulation of any debris in work area using HEPA vacuum equipment or wet cleaning methods.
5. Seal all openings through the floor at columns and piping risers with a fire-stop sealant to provide an airtight and watertight separation between the Work Area and the floor below.
6. Seal all doorways and openings into work areas with hard rigid barriers and cover with a layer of reinforced plastic sheeting for dust controls.

D. Construct separate Decontamination Units in compliance with EPA, OSHA, and WISHA guidelines concerning number, size and placement of airlocks, etc. Shower in worker Decontamination Unit shall open into airlock on both contaminated and uncontaminated sides. Construct Decontamination Units of appropriate materials (including black plastic sheeting). Shower in personnel Decontamination Unit shall contain both hot and cold running water. Supply sufficient shower units to comply with OSHA regulations. Post OSHA decontamination procedures in Change Room and Equipment Room for duration of Project. Water for the showers shall be plumbed from an Owner-designated source.

E. Trap shower wastewater using filters having a maximum pore size of 5.0 microns and drain into a sanitary sewer. Replace contaminated filters when they become clogged but not less than every third day. Dispose of filters as contaminated waste.

F. Submit the proposed route of exhaust of negative air pressure to Environmental Consultant prior to initiating its use. Place Work Area under negative air pressure utilizing negative air equipment. Allow no air movement system or air filtering equipment to discharge unfiltered air outside the Work Area. Maintain a negative pressure in the Work Area continuously (24 hours per day) from the start of removal of asbestos-containing material until the area is decontaminated and certified as such by the required air testing. Ensure that the air within the Work Area is changed at least once every 15 minutes and maintain a pressure differential of at least - 0.02 inches of water between the air within the Work Area and the air outside the Work Area. Provide manometer devise with paper read-out for all full enclosure/isolation Work Areas.

G. Notify Environmental Consultant for observation and acceptance of all critical barriers, HEPA filtration systems, and Decontamination Units before proceeding with installation of Primary Barrier.

H. Install Primary Barrier as Follows
    1. Clean all surfaces in Work Area using a HEPA filtered vacuum and by wet wiping prior to the installation of the Primary Barrier.
    2. Cover floor of Work Area with one layer of reinforced polyethylene sheeting, turned up walls at least 12 inches. Form a sharp right-angle bend at junction of floor and wall so that there is no radius that could be stepped on causing the wall attachment to be pulled loose. Use spray cement and duct tape to seal all seams in floor covering.
    3. Cover all walls in Work Area with one layer of polyethylene sheeting, mechanically supported and sealed with duct tape and spray cement. Seal all joints, including the

joining with the floor, with duct tape.

4. Notify Environmental Consultant for visual review and acceptance of Work Area preparation before proceeding with installation of Secondary Barrier.

I. Install Secondary Barrier as Follows:

1. Cover floor of Work Area with a second layer of polyethylene sheeting, turned up walls at least 12 inches. Form a sharp right-angle bend at junction of floor and wall so there is no radius of sheeting that could be stepped on causing the wall attachment to be pulled loose. Locate seams at least six feet from, or at right angles to, seams in Primary Barrier layer. Use spray cement and duct tape to seal entire length of all seams in floor covering.
2. Cover all walls in Work Area with a second layer of polyethylene sheeting. Support polyethylene sheeting on wall with duct tape; seal top of Secondary Barrier to Primary Barrier with duct tape so debris cannot get behind it.
3. Install sheeting so Secondary Barrier can be removed independently of the Primary Barrier.
4. Notify Environmental Consultant for visual review and acceptance of Secondary Barrier before proceeding with any abatement activities.

J. Maintain emergency and fire exits from the Work Areas, or establish alternative exits satisfactory to fire officials.

K. Ensure that all barriers remain effectively sealed and taped for the duration of abatement activities and subsequent cleaning. Repair damaged barriers and remedy defects immediately upon discovery. Visually inspect enclosure at the beginning of each Work period. Repair damaged barriers and remedy defects immediately upon discovery.

3.04 REMOVAL/IMPACT OF ASBESTOS-CONTAINING MATERIALS

A. Contractor shall remove all asbestos-containing materials as defined in these Contract Documents as necessary to accomplish the Work in accordance with procedures outlined in the Pre-Job Submittals and in accordance with all local, state, and federal regulations.

B. Contractor shall apply spray coat of amended water to asbestos materials to be removed. Keep material damp during entire removal process. A fine mist of water shall be continuously applied to all materials being removed using mechanical methods.

C. Immediately place asbestos-containing materials in properly labeled asbestos waste bags following removal.

D. Contractor shall maintain a safe and uncluttered work site including staging area, work area, worker decontamination system, and waste load-out area.

E. Contractor shall make available at all times all regulated areas for inspection by the Environmental Consultant. At no time shall access to regulated areas be restricted to any authorized personnel.

F. Contractor shall make penetrations of/attachments to asbestos-containing materials using proper work practices and engineering controls per applicable regulations and the pre-approved Work Plan.

G. Measurement and payment for removal of hard-mudded pipe fitting insulation will be one linear foot (LF) per single hard-mudded fitting.

3.05 SELECTIVE DEMOLITION TO ACCESS MATERIALS TO BE ABATED

A. Perform selective demolition as required to access asbestos materials to be removed.

3.06 DISPOSAL

A. Regulations: The Contractor shall determine current waste handling, transportation, and disposal regulations for the work site and for each waste disposal landfill. The Contractor must comply with these regulations and U.S. Department of Transportation, PSAPCA Regulation II, Article 4 and EPA requirements. Double-bagged material in sealed containers shall be delivered to the pre-designated disposal site.

B. Waste Load-Out: Contractor shall coordinate activities to ensure that all asbestos-containing waste is properly containerized and removed from all work areas prior to the end of each work shift. Contractor shall prevent the accumulation of waste containers within work areas and shall ensure that all waste containers are stored in lockable, properly sealed storage container(s) approved by the Owner at the end of each work shift.
   1. Protect stored items and finishes located in areas of waste load-out and entry/egress.
   2. Utilize waste load-out routes and times as defined in the pre-approved Work Plan.

C. Transport: Contractor shall remove decontaminated containers from site within ten calendar days after collection for disposal at a waste disposal site operated in accordance with the provisions of 40 CFR 61.156. Notify disposal site in advance of delivery to ensure immediate disposal. Maintain chain-of-custody until accepted by the landfill.

D. Submit disposal receipts (or "letter of acknowledgement") and chain-of custody for waste as specified. Contractor shall make available all disposal manifests and receipts upon request from the Environmental Consultant or Owner.

END OF SECTION

DIVISION 03

Concrete

SECTION 03 01 23
EMBEDDED GALVANIC ANODES

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Installation of Anode Type IA Classic - galvanic anodes embedded within concrete repairs to provide corrosion control.

B. Galvanic anodes will be installed in concrete patch repair locations where rust and pitting on exposed reinforcing steel is present.

1.02 RELATED SECTIONS

A. Section 03 01 30 – Surface Preparation for Overlay.

B. Section 03 01 30.71 – Concrete Rehabilitation.

C. Section 03 20 00 – Concrete Reinforcement.

D. Section 03 30 00 – Cast-in-Place Concrete.

1.03 SUMMARY

A. This Section includes furnishing all labor, tools, materials, equipment and services necessary to properly install embedded galvanic anodes.

B. Embedded galvanic anodes are designed to provide localized corrosion protection. When placed at the appropriate spacing along the perimeter of concrete patches or along the interface between new/existing concrete, the anodes mitigate active corrosion and the formation of new corrosion sites in the adjacent existing concrete.

1.04 REFERENCES

A. ACI Guideline No. 222 – Corrosion of Metals in Concrete.

B. ACI Repair Application Procedure (RAP) Bulletin 8 – Installation of Embedded Galvanic Anodes (2010).

C. ACI 562 – Code Requirements for Evaluation, Repair, Rehabilitation of Concrete Buildings.

D. ICRI Guideline 310.1R Guide for Surface Preparation for the Repair of Deteriorated Concrete resulting from Reinforcing Steel Corrosion.

E. ASTM B418-12 – Standard Specification for Cast and Wrought Galvanic Zinc Anodes.

F. ISO 12696 – Cathodic Protection of Steel in Concrete.

G. ASTM C 309 Curing Compounds for Concrete.

1.05 MANUFACTURER EXTENDED LIMITED WARRANTY

A. Contractor shall provide a Limited Warranty with a notarized signature from a corporate officer of the anode manufacturer.

B. The Limited Warranty shall state the following:

1. The published anode spacing guidelines for anode size and spacing are based on an estimated 10–30-year anode service life.

2. The galvanic anodes will remain electrochemically active and produce galvanic current in relation to the environment in which it is installed for a minimum of 5 years from the date of anode installation.

3. The anode unit, including its constitutes, does not include substances that may cause adverse effects to concrete or reinforcing steel and will not contribute to reinforcing steel corrosion damage over the life of the structure.

4. The galvanic anodes meet all building and repair code requirements.

PART 2 – PRODUCTS

2.01 EMBEDDED GALVANIC ANODES

A. Embedded galvanic anodes in concrete patch repairs shall be Anode Type 1A Class P with the following nominal dimensions: 2.6 in. diameter by 1.2 in. deep. The anodes shall be pre-manufactured with a nominal 60 grams of zinc in compliance with ASTM B418 Type II cast around a pair of uncoated, non-galvanized steel tie wires and encased in a highly alkaline cementitious shell with a pH of 14 or greater.

B. Placed in drilled holes embedded galvanic anodes shall be Anode Type 2A Class C with the following nominal dimensions: 1 3/4 x 2 1/2 in. or 1 3/4 x 4 in. as indicated on the drawings. The anode units shall be pre-manufactured with zinc in compliance with ASTM B418 Type II cast around an uncoated, non-galvanized steel lead wire and encased in a highly alkaline cementitious shell with a pH of 14 or greater.

C. The anode unit shall contain no intentionally added chloride, bromide or other constituents that are corrosive to reinforcing steel as per ACI 222R. Embedded galvanic anodes shall be Galvashield® XP and CC available from Vector Corrosion Technologies (www.vector-corrosion.com) USA (813) 830-7566, Canada (204) 489-9611 or approved equal.

D. Application for galvanic anode approved equals shall include verification of the following information:

1. The zinc anode is alkali-activated with an alkaline cementitious shell with a pH of 14 or greater.
2. Contain no intentionally added constituents corrosive to reinforcing steel or detrimental to concrete, e.g. chloride, bromide, etc.
3. Field installations showing that the anodes have achieved a minimum of 10 years service.
4. A minimum of ten projects of similar size and application.
5. Anode units shall be supplied with solid zinc core (ASTM B418) cast around a uncoated non-galvanized, non-spliced steel wire and twisting to provide a durable stee-to-steel connection between the tie wire and reinforcement.
6. Third party product evaluation, such as from Concrete Innovations Appraisal Service, BBA, etc.

2.02 REPAIR MATERIALS

A. Use an ionically conductive, cement-based repair mortar or concrete. Non-conductive repair materials such as epoxy, urethane, or magnesium phosphate shall not be permitted. Insulating materials such as epoxy bonding agents shall not be used unless otherwise called for in the design.

B. If repair materials have a saturated bulk resistivity of 50,000 ohm-cm or greater, pack Galvashield® Embedding Mortar or another repair mortar with a resistivity of 15,000 ohm-cm or less between the anode and the substrate to provide an ionically conductive path to the substrate.

2.03 STORAGE

Deliver, store, and handle all materials in accordance with manufacturer's instructions. Anode units shall be stored in dry conditions in the original unopened containers in a manner to avoid exposure to extremes of temperature and humidity.

PART 3 – EXECUTION

3.01 EMBEDDED GALVANIC ANODES IN CONCRETE REPAIR

A. Concrete Removal

1. Remove loose or delaminated concrete.

2. Undercut all exposed reinforcing steel by removing concrete from the full circumference of the steel as per ICRI R310.1R. The minimum clearance between the concrete substrate and reinforcing steel shall be ¾ inch (19 mm) or ¼ inch larger than the top size aggregate in the repair material, whichever is greater.

3. Concrete removal shall continue along the reinforcing steel until no further delamination, cracking, or significant rebar corrosion exists and the reinforcing steel is well bonded to the surrounding concrete as per ICRI R310.1R.

B. Cleaning and Repair of Reinforcing Steel

1. Clean exposed reinforcing steel of rust, mortar, etc. to provide sufficient electrical connection and mechanical bond.

2. If significant reduction in the cross section of the reinforcing steel has occurred, replace or install supplemental reinforcement as directed by the engineer of record.

3. Secure loose reinforcing steel by tying tightly to other bars with steel tie wire.

4. Verify electrical continuity of all reinforcing steel, including supplemental steel, as per Section 3.01.D.6.

5. If the reinforcing steel is to receive a barrier coating, do not coat the reinforcing steel within 1 in. (25mm) of the anode and do not apply coating to any surface of the anode or the steel tie wires.

C. Edge and Surface Conditioning of Concrete

1. Concrete patches shall be square or rectangular in shape with squared corners per ICRI Guideline 310.1R.

2. Saw cut the patch boundary ½ inch deep or less if required to avoid cutting reinforcing steel.

3. Create a clean, sound substrate by removing bond-inhibiting materials from the concrete substrate by high pressure water blasting or abrasive blasting.

D. Galvanic Anode Installation

1. Install anode units and repair material immediately following preparation and cleaning of the steel reinforcement.

2. Galvanic anodes shall be installed along the perimeter of the repair and along the interface between new and old concrete.

3. Place the galvanic anodes as close as possible to the patch edge while still providing sufficient clearance between anodes and substrate to allow the repair material to fully encase the anode with a minimum concrete or mortar cover over the anode of 1 in. (25mm). If necessary, increase the size of the repair cavity to accommodate the anodes.

   a. Place the anode such that it is attached to a single bar or at the intersection between two bars and secure to each clean bar.

   b. If less than 1 in. (25 mm) of concrete cover is expected, place anode beneath the bar and secure to clean reinforcing steel.

4. The tie wires shall be wrapped around the cleaned reinforcing steel at least one full turn in opposite directions and then twisted tight to create a secure electrical connection and allow no anode movement during concrete placement.

5. If repair materials with resistivity greater than 15,000 ohm-cm are to be used or if the resistivity is unknown, pack Galvashield Embedding Mortar between the anode and the substrate concrete to create a conductive grout bridge ensuring no voids exist.

6. Electrical Continuity

   a. Confirm electrical connection between anode tie wire and reinforcing steel by measuring DC resistance (ohm Ω) or DC potential (mV) with a multi-meter.

   b. Electrical connection is acceptable if the DC resistance measured with the multi-meter is 1 Ω or less or the DC potential is 1 mV or less.

   c. Confirm electrical continuity of the exposed reinforcing steel within the repair area. If necessary, electrical continuity shall be established by tying discontinuous steel to continuous steel using steel tie wire.

   d. Electrical continuity between test areas is acceptable if the DC resistance measured with multi-meter is 1 Ω or less or the potential is 1 mV or less.

E. Concrete or Mortar Replacement

1. If the repair procedures require the concrete surface to be saturated with water, do not damage the anode nor allow the anode units to be soaked for greater than 20 minutes.

2. Complete the repair with the repair material, taking care not to damage, loosen or leave voids around the anode.

END OF SECTION

PART I - GENERAL

1.01 SECTION INCLUDES

A. For concrete partial depth patch repairs, overlays and new structural strengthening work to provide a sound surface profile preparation in conformance with the details indicated on the Drawings. This includes removal of all delaminated, sound and unsound concrete within the repair limit areas shown on the Drawings and the removal of unsound and weakened concrete surfaces and voids and the preparation of a sound cavity substrate to be filled over overlayed with cementitious repair materials.

1.02 RELATED SECTIONS

A. Section 02 41 00 – Demolition Work

B. Section 31 40 00 – Shoring and Underpinning

C. Section 03 20 00 - Concrete Reinforcement

D. Section 03 30 00 - Cast-In-Place Concrete

E. Section 03 01 30.71 - Concrete Rehabilitation.

F. Section 03 64 23 – Epoxy Injection Concrete Crack Repair.

1.03 REFERENCES

A. American Concrete Institute

1. ACI-301 - Specifications for Structural Concrete for Buildings.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 546R - Concrete Repair Guide

B. International Concrete Repair Institute

1. ICRI Guideline No. 310.1R-2008 - Guide for Surface Preparation for Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.
2. ICRI Guideline No. 320.1R-2019 - Guide for Selecting Application Methods for the Repair of Concrete Surfaces.
3. ICRI Guideline No. 301.2R-2013 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

C. Comply with the provisions of the above codes, specifications, and standards, except where more stringent requirements are shown on the drawings or specified herein.

PART 2 – PRODUCTS Not Used

PART 3 - EXECUTION

3.01 GENERAL

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 satisfactory conditions are corrected.

B. No concrete removal shall proceed within 60 lineal feet (min.) of new concrete placement areas until 72 hours of curing time has elapsed, unless otherwise approved by Engineer.

3.02 LOCATION AND MARKING OF WORK AREA

A. Existing Concrete Surface (Partial Depth) Removal
   1. As shown on the drawings, layout and mark the concrete areas to be removed. Use chain dragging, hammer sounding, visual identification of slab lift off cracks and other methods to identify full areas of repair. Locations and areas shown on the Drawings are approximate; actual locations and layout shall be verified by the Engineer at the time the work is to be performed.
   2. The Engineer may define and mark additional unsound concrete areas for removal, if required.
   3. Areas to be removed shall be as straight and orthogonal as practical to encompass repair areas and to provide neat, straight overlay patch joints.

3.03 CONCRETE REMOVAL AND CAVITY PREPARATION

A. Verify that shoring has been fully completed and secured to support those areas under repair prior to concrete removal.

B. As designated on the drawings, concrete to be removed shall have its marked boundaries sawcut to a depth of 1/2 inch unless otherwise noted. All edges and overlay joints shall be straight. Do not overcut or leave sawcuts in the concrete to remain.

C. All concrete shall be removed to the minimum depth limits shown on the drawings. The maximum size and chipping angle of pneumatic hammers used for concrete removal is as indicated on the drawings.

D. Where embedded reinforcement is exposed by concrete removal, extra caution shall be exercised to avoid damaging it during removal of additional unsound concrete. If bond between exposed embedded reinforcement and adjacent concrete is impaired by the Contractor's removal operations the Contractor shall perform additional removal around and beyond the perimeter of the reinforcement along the entire affected length.

E. If rust is present on embedded reinforcement where it enters sound concrete, then additional removal of concrete along and beneath the reinforcement will be required. Such additional removal shall continue until nonrusted reinforcement is exposed or removal may be terminated as the

Engineer directs.

F. Following completion of concrete removal by pneumatic jack hammers and electric chipping tools to the limits and depth shown on the drawings the remaining concrete cavity surfaces shall be thoroughly water blasted (4,000 psi minimum) or sand blasted to remove concrete and aggregate loosened by chipping hammer removal.

G. Concrete removal by conventional (jackhammer) removal methods may be performed by power chipping or hand tools except that pneumatic hammer heavier than 15 lb. class will not be permitted within 2” of final demolition or cavity limit of surfaces to be prepared for overlay. Such tools may be started in a vertical but must be immediately tilted to a maximum of 60-degree operation angle. Pneumatic hammers heavier than 15 lb. class will not be permitted for removals within 2” of demolition limit, or in areas directly above the top longitudinal reinforcing steel, or around primary girder reinforcing.

H. At small spall areas and cracks where repair limit depths will be less than 1" deep, use needle scales, grinders and sawcuts as necessary to prepare a sound substrate, surface profile and detailed opening to receive and bond with repair material fill.

3.04 INSPECTION OF CAVITY SURFACES AND EXPOSED REINFORCING

A. After concrete removal is complete but prior to final cleaning, the cavity and exposed reinforcement shall be inspected by the Contractor and verified by the Engineer for sound undamaged concrete surfaces. Where the Engineer can detect unsatisfactory cavity preparation the Engineer may direct the Contractor to perform additional removals. The Engineer will verify that additional removals have been performed as directed.

B. The Contractor shall inspect embedded reinforcement exposed within the cavity for defects due to corrosion or damage resulting from removal operations.

C. Replacement of damaged or defective reinforcement shall be performed according to this Section and as directed by the Engineer.

3.05 REINFORCEMENT IN REPAIR AREA

A. All embedded reinforcement exposed during surface preparation that has lost more than 15% of the original cross-sectional area due to corrosion shall be considered defective. All nondefective exposed reinforcement that has lost section (to the extent specified above) as a direct result of Contractor's removal operations, shall be considered damaged.

B. Supplement defective or damaged embedded reinforcement with a reinforcement of equal diameter having a Class "B" tension lap splices, minimum splice (ACI-318) beyond the damaged portion of the reinforcement. Secure the new reinforcement to the existing reinforcement with wire ties and/or approved anchors.

C. Loose reinforcement exposed during surface preparation shall be securely anchored to the

prepared substrate prior to patch placement. Loose reinforcement shall be adequately secured by wire ties to bonded reinforcement or shall have drilled-in anchors installed to the original deck. The Engineer shall determine adequacy of wire ties and approve other anchoring devices prior to their use.

D. Concrete shall be removed to provide a minimum of 3/4 inch clearance on all sides of exposed embedded reinforcement that is left in place unless otherwise noted on the drawings.

3.06 CLEANING OF EXPOSED REINFORCING

A. All exposed reinforcing steel shall be cleaned of all rust, oil, dirt, concrete fragments, laitance, scale and other coatings that inhibit bond by sandblasting, waterblasting, needle scalers or other acceptable methods.

B. Cleaning of reinforcing steel shall be completed immediately before overlay placement to ensure that the base metal is not exposed to the elements and further rusting for extended periods of time.

3.07 PREPARATION OF EXPOSED SOUND CONCRETE FOR OVERLAY PLACEMENT

A. Concrete demolition limits and cavities will be examined prior to commencement of overlay or patching operations. Sounding the surface shall be part of the examination. Any delamination noted during the sounding shall be removed as specified in this Section.

B. Cavities shall be waterblasted or sandblasted. Airblasting is required as a final step to remove all loose debris. All debris shall be removed from the site prior to the start of patching or placement of overlay.

C. Concrete surfaces shall be cleaned to remove all traffic membrane materials, asphalt, tar, oil stains and all other substances detrimental to concrete bond. Shotblast followed by waterblast all surfaces to receive the new concrete overlay slab. Provide minimum 1/8” inch surface profile conforming to ICRI CSP5. Provide SSD conditions on substrate immediately prior to concrete placement.

END OF SECTION

PART 1 - GENERAL

1.01 **SECTION INCLUDES**

A. Preparation of Concrete and Application of Repair Materials.

B. Restoration of Concrete Surfaces.

C. Repair of Unsound and Delaminated Concrete.

1.02 RELATED SECTIONS

A. Section 03 01 23 – Embedded Galvanic Anodes.

B. Section 03 01 30 – Surface Preparation for Overlay

C. Section 03 30 00 – Cast-In-Place Concrete.

D. Section 03 64 23 – Epoxy Injected Concrete Crack Repair.

E. Section 07 92 00 – Joint Sealants.

F. Section 09 91 14 Exterior Concrete Coating.

G. Section 09 91 15 – High Performance Exterior Concrete Coating.

H. Section 31 40 00 – Shoring and Underpinning

1.03 REFERENCES

A. ASTM International.

1. ASTM C-33 – Concrete Aggregates.

2. ASTM C-150 - Portland Cement.

3. ASTM C-39 - Compressive Strength.

4. ASTM C-109 - Modified Compressive Strength.

5. ASTM C-157 - Drying Shrinkage.

6. ASTM C-387 - Packaged, Dry, Combined Materials for Mortar and Concrete.

7. ASTM C-496 - Splitting Tensile Strength.

8. ASTM C-666 - Freeze Thaw Resistance.

9. ASTM C-881 - Epoxy-Resin-Base Bonding Systems for Concrete.

10. ASTM C-882 - Modified Bond Strength.

11. ASTM C-928 - Packaged, Dry, Rapid-Hardening, Cementitious Materials for Crack Repairs.

12. ASTM C-469 - Elastic Modulus.

A. American Concrete Institute.

1. ACI 201.2R - Guide to Durable Concrete.

2. ACI 223 - Standard Practice for the Use of Shrinkage-Compensating Concrete.

3. ACI 308 - Standard Practice for Curing Concrete.

4. ACI 318 - Building Code Requirements for Structural Concrete.

5. ACI 335.1R - State-of-the-Art Report on Anchorage to Concrete.

6. ACI 503.4 - Standard Specifications for Repairing Concrete with Epoxy Mortars.

7. ACI 504R - Guide to Sealing Joints in Concrete Structures.

8. ACI 548R - Polymers in Concrete.

9. ACI 548.1R - Guide for the Use of Polymers in Concrete.

10. ACI 548.3R - State-of-the-Art Report on Polymer Modified Concrete.

11. ACI 562 – Code Requirements for Evaluation Repair and Rehabilitation of Concrete Buildings.

B. International Concrete Repair Institute.

1. ICRI Technical Guideline No. 310.2R-2013 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

2. ICRI Concrete Surface Profile chips – set or 10.

3. ICRI Technical Guideline No. 210.3R-2013 – Guide for Using In-Situ Tensile Pull off Tests to Evaluate Bond of Concrete Surface Materials.

4. ICRI Technical Guideline No. 320.2R-2009 – Guide for Selecting Materials for Repair of Concrete Surfaces.

5. ICRI Technical Guideline No. 310.IR-2008 – Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion.

6. ICRI Technical Guideline No. 310.3-2004 – Guide for the Preparation of Concrete Surfaces for Repair Using Hydrodemolition Methods.

1.04 SUBMITTALS

A. Submit product data under provisions of Section 01 33 00 – Submittal Procedures.

B. Submit substitutions under provisions of Section 01 60 00 – Product Requirements.

C. Submit product data indicating product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

D. Identify the intended use of each product material submitted.

1.05 PRODUCT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01 70 00 – Execution Requirement and Closeout Requirements.

B. Accurately record actual locations of structural concrete and reinforcement repairs, and type of repairs on Record Document Plans.

1.06 QUALITY ASSURANCE

A. Materials Manufacturer: Company specializing in manufacturing the products specified in this Section with a minimum of ten (10) years of experience.

B. Work people: Supervisor and lead technician with minimum of ten (10) years of specialized experience in concrete repair.

C. Applicator: Company specializing in concrete repair with a minimum of eight (8) years documented experience, approved by materials manufacturer.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site under provisions of Section 01 60 00 – Product Requirements.

B. Store and protect products under provisions of Section 01 60 00 – Product Requirements.

C. Comply with instructions for storage, shelf life limitations, and handling.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Cementitious Concrete Repair Materials.
   1. BASF, Products: Master Emaco T415, T430.

2. Sika, Products: Sika Repair 222, Sika Repair 223 and Sika Repair SHB.
3. Mapei: Planitop 15, Planitop 18, Planitop X.
4. Substitutions in accordance with Section 01 60 00 – Products Requirements.

B. Ready Mix Concrete – See Section 03 30 00 – Cast-In-Place Concrete.

C. Concrete Repair Mortars, concrete and bonding agents shall be Portland Cement based materials with suitable electrical conductivity of less than 15,000 ohm-cm. Non-conductive repair materials such as epoxy, urethane, latex polymers, or magnesium phosphate shall not be permitted.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Surfaces shall be sound concrete which exhibits a minimum of 125 psi pullout strength when tested in accordance with Appendix A of ACI 503 - Use of Epoxy Compounds with Concrete.

D. Surfaces shall be free of any deleterious materials such as the residues, laitance, dust, dirt, and oil.

E. Beginning of installation means installer accepts existing substrate.

3.02 PREPARATION

A. Clean concrete surfaces of dirt, laitance, corrosion, or other contamination; wire brush using water.

B. Flush out cracks and voids with air and/or water blasting to remove laitance and dirt.

C. See Specification Section 03 01 30 – Surface Preparation for Overlay for demolition and surface preparation requirements.

D. Refer to manufacturer's product data sheets for SSD or dry surface condition requirements at the time of concrete rehabilitation material placement on substrate.

E. Wire brush, sand blast or needle scaler clean the exposed reinforcement steel surfaces to remove all laitance and expose white metal. Notify Engineer of any damaged portions of reinforcing steel for review prior to patching.

3.03 REHABILITATION WORK

A. Place rehabilitation concrete as indicated on the Drawings.

B. Insure surfaces to receive rehabilitation have been prepared in strict accordance with Section 03 01 30 - Surface Preparation for Overlay.

C. Prepare repair of spall and delaminated areas as indicated on the Drawings and specifications. Fill voids flush with adjacent surface.

3.04 APPLICATION

A. Apply mortar, grouts and concrete materials in strict accordance with Manufacturer's instructions.

B. At the time of application, the substrate shall be saturated surface dry (SSD) with no standing water, unless otherwise noted by the Product Manufacturer's instructions.

C. Hand applied mortar and/or concrete shall be scrubbed into substrate filling all pour and voids. Fill repair areas in accordance with Manufacturer's directions for the repair material specified.

D. Damp cure cementitious mortar, grout and concrete for four (4) days.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cleaning and preparing concrete surfaces for application of cold liquid applied treatments by mechanical shotblast, hydrodemolition, diamond planning or cold planner with shot flaps. Hydroblasting, shotblast, and equivalent methods are preferred.

1.02 RELATED SECTIONS

A. Section 03 01 30 - Concrete Rehabilitation.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. Section 03 90 10 – Corrosion Inhibitor Treatment.

D. Section 07 92 00 – Joint Sealants.

1.03 REFERENCES

A. ASTM International.
1. ASTM C 811 - Standard Practice for Surface Preparation of Concrete for Application of Chemical-Resistant Resin Monolithic Surfacing.
2. ASTM D4258 - Practice for Surface Cleaning Concrete for Coating.
3. ASTM D 4259 - Practice for Abrading Concrete.
4. ASTM D 4262 - Test Method for pH of Chemically Cleaned or Etched Concrete Surface.
5. ASTM D 4285 - Test Method for Indicating Oil or Water in Compressed Air.
6. ASTM D 4260 - Practice for Acid Etching Concrete.
7. ASTM D 4263 - Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

B. American Concrete Institute.
1. ACI 515.1R - A Guide to the Use of Waterproofing, Damp proofing, Protective and Decorative Barrier Systems for Concrete, 3.4 Surface Preparation.
2. ACI 546.1R - Concrete Repair Guide.
3. ACI 201.R - Guide for Durable Concrete.

C. International Concrete Repair Institute

1. ICRI Guideline 320-IR-2013 – Selecting and Specifying Concrete Surface preparation for sealers, coatings and polymer overlays.
2. ICRI Guideline 310 2R Bundle-Concrete Surface Profile Chips, set of 10.

1.04 DEFINITIONS

A. Clean: No foreign matter such as dust, dirt, loose surface material, grease, oil, oil based substances or other contaminants.

B. Dry: No free water present and no moisture vapor (ASTM D 4263).

C. Free of Laitance: Remove high water-cement ratio gel that comes to surface in a concrete pour. This gel has very poor integrity and adhesion to the parent concrete.

D. Surface Defects: Fins, ridges, projections, concrete droppings and variations in surface finish tolerance greater than 3/16 inch in 25 feet that may adversely affect coating application performance.

E. Deteriorated areas: Section 03 01 30 – Surface Preparation for Overlay.

F. Strength below surface of concrete: Ability of concrete to resist fractures due to stresses exerted on it by coating system. Because many coating systems and most protective barriers exert stresses on the concrete from shrinkage during curing or cooling after application, and when they undergo ambient temperature changes in service, the concrete itself must have strength to resist these stresses without failing.

G. Structural Concrete: Reinforced, 4000 psi minimum.

1.05 QUALITY ASSURANCE

A. Mockup: Provide mockup of typical preparation surface under provisions of Section 01 40 00 – Quality Requirements.
B. Provide area 20 feet long by 26 feet wide illustrating preparation surface.

C. Locate in area where directed and where it can remain as a reference throughout the project.

D. Coat 1/2 of preparation surface according to Section 07 18 16.1 – Elastomeric Traffic Deck Coating to verify acceptable adhesion.

E. Mockup may become part of the work at the completion of the project upon acceptance of the completed work.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Shotblast: Self-contained steel shotblasting unit.

1. Constant self-propelled speed capability.
2. 98% minimum steel shot recovery and containment.
3. Vacuum feature to retain dust, dirt and debris from shotblasting, leaving concrete pores open.
4. Steel shot propelled by airless centrifugal center fed blast wheels rotating perpendicular to direction of travel.
5. Blasts to 1/4 inch from walls, columns or other verticals.
6. Abrasive aggregate: ASTM 136.

B. High pressure water blast system (Hydrodemolition).

1. Rotary head machine capable of providing 9,000 psi minimum.

2.02 ACCESSORIES

A. Abrasive aggregate: ASTM C 136.

B. Stiff bristle brooms.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify substrate is structural concrete and adequate strength below surface exists to accommodate work in Division 07 00 00.

B. Verify “downtime” of area to be cleaned and submit to Owner.

C. Verify surface temperature at application time for cleaning chemicals and removal are within limits of method specified.

D. Verify surface conditions and required cleaning, profiling and removal are within limits of method specified.

3.02 PREPARATION

A. Protect adjacent surfaces with drop cloths and tape to control dust, overspray damage and erosion chemical staining or etching of surrounding surfaces.

B. Protection must be in place before application begins.

3.03 APPLICATION

A. ACI 515.1R - Surface Preparation.

B. Clean surfaces to receive coating in accordance with Manufacturer’s instructions for Section 07 18 16.1 – Elastomeric Traffic Deck Coating System.

C. Provide clean, dry surface, free of laitance and deteriorated areas.

D. Remove surface defects by mechanical grinding or impact method.

E. Clean corners, around columns, near drains and other areas not able to be reached by specified method with mechanical grinder, stiff wire brush, or other hand held portable mechanical means capable of producing surface profile similar to specified surface conditions.

F. Remove gum and other materials adhered to concrete surface.

G. Prevent debris from being incorporated into material being applied by the specified method.

H. Remove excess or rejected material from site promptly and properly to avoid damage, marring or staining existing surfaces.

3.04 APPLICATION - SHOTBLAST

A. ASTM C 136, ASTM D 4259, and ASTM D 4285.

B. Uniformly clean dry surface and profile.

C. Leave concrete pores open to allow maximum adhesion/penetration of the concrete protection system.

D. Remove 1/16 inch to 1/8 inch.

E. See 1.02 – Related Sections and Drawings for ICRI minimum concrete surface profile requirements for each coating system.

F. Magnetic sweep and then low pressure air blast surface to remove residual steel shot.

3.05 APPLICATION - AIR BLAST

A. ASTM D 4258 and ASTM D 4285.

B. Blast surface, cracks, and areas not reached by other methods with air.

C. Remove debris and dirt from site and dispose in accordance with local regulations.

3.06 FIELD QUALITY CONTROL

A. ACI 515.1R - Tests for Surface Quality Prior to Application.

B. Inspect surface for uniformity. Protrusions must be less than 1/16 inch and holes less than 1/8 inch in diameter.

C. Surface must be clean with no white powder appearing on a dark cloth wiped across the surface.

D. Conduct water droplet test to determine oily condition. Droplets should spread out on surface immediately. Droplets that bead up indicate oil or other agents present that will adversely affect coating adhesion.

E. Determine surface dryness ASTM D 4263.

F. Determine presence of laitance. No fine powder formed when knife scraped across surface.

G. Tensile strength test of concrete surface. See coating system manufacturer requirements - 200 psi minimum.

H. Perform adhesion test on coating applied to patch of prepared surface.

3.07 CLEANING

A. Clean residue and debris promptly. Remove from site and dispose properly in accordance with local regulations.

B. Clean site without damaging other surfaces.

C. Leave surfaces treated as part of the Work of this Section and other surfaces uncontaminated clean and dry.

3.08 PROTECTION

A. Protect cleaned surfaces from dirt, debris, dust, water and other contamination that will affect coating operation and overlays.

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
1. Formwork for cast-in place concrete.
2. Shoring, bracing, and anchorage.
3. Architectural form liners.
4. Form accessories.
5. Form stripping.

B. Related Sections:
1. Section 03 15 13 - PVC Waterstops.
2. Section 03 20 00 - Concrete Reinforcing.
3. Section 03 30 00 - Cast-In-Place Concrete.
4. Section 05 50 00 - Metal Fabrications: Product requirements for metal fabrications for placement by this Section.

1.02 REFERENCES

A. American Concrete Institute:
1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest and Paper Association:
5. AF&PA - National Design Specifications for Wood Construction.

C. The Engineered Wood Association:
1. APA/EWA PS 1 - Voluntary Product Standard for Construction and Industrial Plywood.

D. ASTM International:
1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

E. West Coast Lumber Inspection Bureau:
1. WCLIB - Standard Grading Rules for West Coast Lumber.

1.03 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing in accordance with ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line and dimension as indicated on Drawings.

1.04 PERFORMANCE REQUIREMENTS

A. Vapor Retarder Permeance: Maximum 1 perm when tested in accordance with ASTM E96, Procedure A.

1.05 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:
1. Submit formwork, shoring, and reshoring shop drawings.
2. Indicate the following:
a. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
b. Means of leakage prevention for concrete exposed to view in finished construction.
c. Sequence and timing of erection and stripping assumed compressive strength at time of stripping, height of lift and height of drop during placement.
d. Vertical, horizontal and special loads in accordance with ACI 347, Section 2.2 and camber diagrams, when applicable.
e. Notes to formwork erector showing size and location of conduits and piping embedded in concrete in accordance with ACI 318, Section 6.3.
f. Procedure and schedule for removal of shores and installation and removal of reshores.

C. Product Data: Submit data on void form materials and installation requirements.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. For wood products furnished for work of this Section, comply with AF&PA.

1.07 QUALIFICATIONS

A. Design formwork under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Washington.

1.08 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate this Section with other sections of work, requiring attachment of components to formwork.

PART 2 – PRODUCTS

2.01 WOOD FORM MATERIALS

A. Form Materials: At discretion of Contractor.

B. Plywood: Douglas Fir species; medium density overlaid one side grade; sound undamaged sheets with clean, true edges.

C. Plywood Forms:
1. Application: Use for exposed finish concrete.
2. Forms: Conform to PS 1; full size 4 x 8 feet panels; each panel labeled with grade trademark of APA/EWA.
3. Plywood where “Smooth Finish” is required, as indicated on Drawings: APA/EWA “HD Overlay Plyform Structural I Exterior” grade, minimum of 3/4 inch (19 mm) thick.

2.02 FORMWORK ACCESSORIES

A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, back break dimension of 1 1/4" inch, free of defects capable of leaving holes larger than 1inch in concrete surface.

B. Spreaders: Standard, non-corrosive metal form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch (25 mm) of concrete face. Wire ties, wood spreaders or through bolts are not permitted.

C. Form Anchors and Hangers:
1. Do not use anchors and hangers exposed concrete leaving exposed metal at concrete surface.
2. Symmetrically arrange hangers supporting forms from structural steel members to minimize twisting or rotation of member.
3. Penetration of structural steel members is not permitted.

D. Form Release Agent: Colorless mineral oil that will not stain concrete, or absorb moisture , or impair natural bonding or color characteristics of coating intended for use on concrete.
1. Manufacturers:
a. Arcal Chemical Corporation Arcal-80.
b. Industrial Synthetics Company Synthex.
c. Nox-Crete Company Nox-Crete Form Coating.

E. Corners: Chamfer, wood strip type; 3/4 x 3/4 inch size; maximum possible lengths.

F. Vapor Retarder: Where indicated on Drawings, 8 mil (0.2 mm) thick polyethylene sheet.

G. Bituminous Joint Filler: ASTM D1751.

H. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength and character to maintain formwork in place while placing concrete.

PART 3 – EXECUTION

3.01 EXAMINATION

1. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
2. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.
3. When formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement before proceeding, request instructions from Architect/Engineer.

3.02 INSTALLATION

A. Earth Forms:

1. Earth forms are permitted for concrete under pool deck linear drains.
   a. Trench earth forms neatly, accurately, and at least 2 inches (50 mm) wider than footing widths indicated on Drawings.
   b.Trim sides and bottom of earth forms.
   c. Construct wood edge strips at top of each side of trench to secure reinforcing and prevent trench from sloughing.
   d. Form sides of footings where earth sloughs.
   e.Tamp earth forms firm and clean forms of debris and loose material before depositing concrete.

B. Formwork - General:

1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Camber forms where necessary to produce level finished soffits unless otherwise shown on Drawings.
4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete.
5. Complete wedging and bracing before placing concrete.

C. Forms for Smooth Finish Concrete:

1. Use steel, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Use full size sheets of form lines and plywood wherever possible.
4. Tape joints to prevent protrusions in concrete.
5. Use care in forming and stripping wood forms to protect corners and edges.
6. Level and continue horizontal joints.
7. Keep wood forms wet until stripped.

D. Framing, Studding and Bracing:

1. Space studs at 16 inches (400 mm) on center maximum for boards and 12 inches (300 mm) on center maximum for plywood.

2. Size framing, bracing, centering, and supporting members with sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum of 2 inches (50 mm) thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement or accidental impact.

E. Erect formwork, shoring, and bracing to achieve design requirements, in accordance with requirements of ACI 301.

F. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

G. Obtain Architect/Engineer's approval before framing openings in structural members not indicated on Drawings.

H. Install chamfer strips on external corners of beams, joists, columns and walls.

I. Do not reuse wood formwork more than 6 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.03 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces are indicated to receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

D. Reuse and Coating of Forms: Thoroughly clean forms and reapply form coating before each reuse. For exposed work, do not reuse forms with damaged faces or edges. Apply form coating to forms in accordance with manufacturer's specifications. Do not coat forms for concrete indicated to receive "scored finish". Apply form coatings before placing reinforcing steel.

3.04 INSTALLATION - INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Locate and set in place items required to be cast directly into concrete.

C. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

D. Install accessories straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install water stops continuous without displacing reinforcement. Heat seal joints watertight.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

H. Form Ties:
1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
2. Place ties at least 1 inch (25 mm) away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. Space form ties equidistant, symmetrical and aligned vertically and horizontally unless otherwise shown on Drawings.

I. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

J. Construction Joints:
1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
3. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
4. Arrange joints in continuous line straight, true and sharp.

K. Embedded Items:
1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Obtain installation and setting information for embedded items furnished under other Specification sections.
4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
5. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

L. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Perform cutting and repairing of concrete required as result of failure to provide required openings.

M. Screeds:

1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms. Remove freestanding water.

N. Screed Supports:
1. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
2. Staking through membrane is not be permitted.

O. Cleanouts and Access Panels:
1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris and waste material.
2. Clean forms and surfaces against which concrete is to be placed. Remove chips, saw dust and other debris. Thoroughly blow out forms with compressed air just before concrete is placed.

3.05 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.06 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads and removal has been approved by Architect/Engineer.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.

D. Leave forms in place for minimum number of days as specified in ACI 347.

3.07 ERECTION TOLERANCES

A. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances specified in ACI 117.

3.08 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

C. Notify Architect/Engineer after placement of reinforcing steel in forms, but prior to placing concrete.

D. Schedule concrete placement to permit formwork inspection before placing concrete.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. These adhesive anchors are to be used for reinforcing steel dowels for concrete repair and strengthening with concrete reinforcement anchored in beams, slabs, walls and columns.

1.02 RELATED WORK

A. Section 03 20 00 – Concrete Reinforcement.

B. Section 03 30 00 – Cast in Place Concrete

C. Section 03 01 30.71 – Concrete Rehabilitation

D. Section 05 50 00 – Miscellaneous Fabrication.

1.03 REFERENCES

A. ASTM A36 - Structural Steel

B. ASTM A307 - Bolts, Nuts and Washers

C. ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

D. ASTM A706 - Low-Alloy Steel Deformed Bars for Concrete Reinforcement

E. ASTM E1512 - Standard Test for Testing Bond Performance of Adhesive Anchors

F. ICBO ICC– ESR-3187.3814

1.04 SUBMITTALS

A. Shop Drawings and Product data: Submit shop drawings and product data sheets for the approval of the Engineer as per Section 01 33 00 - Submittal Procedures.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with manufacturer's instructions.

1.06 PRODUCT DATA

A. Submit product data under provisions of Section 01 33 00 - Submittal Procedures.

B. Provide product data for specified products.

C. Submit manufacturer's instructions under provisions of Section 01 60 00 – Product Requirements.

D. Submit Evaluation Report from International Conference of Building Officials (ICBO).

E. ICBO Evaluation Report submitted shall be for wind and seismic in cracked and un-cracked concrete conditions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. HILTI HIT- RE 500 V3 Epoxy Anchoring System as manufactured by HILTI, P. O. Box 21148, Tulsa, Oklahoma 74121; Tel: #1-800-879-8000

B. Submit documents for substitution as per Section 01 60 00 – Product Requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Adhesive Epoxy Anchoring System will be used for installation of all reinforcing steel dowels or threaded anchor rods or inserts into existing concrete. Adhesives will be used only as per manufacturer's instructions. Injection adhesive will be formulated to include resin, hardener, cement and water to provide optimal curing speed as well as high strength and stiffness. Maximum curing time will be as per manufacturer's instructions.

3.02 INSPECTION

A. Adhesive Anchor Installation.

B. All special inspections shall be according to ICBO ES, Evaluation Report for specified product.

C. All tests to be carried out according to ASTM E1512, Standard Test for Testing Bond Performance of Adhesive Anchors.

3.03 STORAGE OF MATERIALS

A. All materials to be mixed by Contractor shall be stored in a clean, dry place, free of contaminating substances.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Provision of waterstops embedded in concrete and spanning control, expansion and/or construction joints thus creating a continuous diaphragm, thus preventing fluid migration.

B. Non-metallic PVC waterstops for use in concrete joints subject to water, chlorinated water, seawater and many waterborne chemicals.

1.02 RELATED SECTIONS

A. Section 02 41 13 – Selective Demolition.

B. Section 03 01 30.71 – Concrete Rehabilitation.

C. Section 03 10 00 – Concrete Forming and Accessories.

D. Section 07 14 10 – Reinforced Hot – Applied Membrane Waterproofing.

1.03 REFERENCE

A. PVC WATERSTOP
   1. U.S Army Corp of Engineers: CRD-C 572-74
   2. American Society of Testing Materials (ASTM)
   3. Bureau of Reclamation: C-902
   4. Canadian General Standards Board: 41-GP-35M Type 1 & 3
   5. Section 03 10 00-Concrete Forms and Accessories
   6. Section 03 30 00-Cast In Place Concrete

1.04 QUALITY ASSURANCE

A. Waterstop manufacturer demonstrates five years (minimum) continuous, successful experience in production of PVC waterstops.

1.05 SUBMITTALS

A. Comply with Section 01 33 10 – Submittals.

B. Submit manufacturer product data with physical properties and instructions for installation.

C. Submit manufacturer 6-inch sample of each PVC Waterstop profile.

D. Submit certification from manufacturer that materials comply with specifications.

E. Submit warranty from manufacturer

1.06 DELIVERY, STORAGE AND HANDLING

A. Store PVC waterstop in storage containers or under tarps to protect from oil, dirt, and sunlight/ultraviolent exposure.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Provide flexible Polyvinyl Chloride (PVC) waterstop profile (s) as manufactured by BoMetals, Inc.: RCB-4316.

B. The PVC waterstop shall be extruded from an elastomeric plastic material, of which the basic resin is prime, virgin polyvinyl chloride. The PVC compound shall not contain any scrapped or reclaimed material or pigments whatsoever.

C. Performance Requirements as follows:

Typical Properties	Minimum Value	ASTM
Water Absorption, %	0.15	D-570
Tear Resistance, lb/in (kg/cm)	300 (53.5)	D-624
Specific Gravity (±0.05)	1.38	D-792
Shore A Hardness (±10 sec delay)	80	D-2240
Tensile, psi (kg/cm²)	2000 (140.6)	D-638, Type IV
Elongation, %	350	D-638, Type IV
100% Modulus, psi (kg/cm²)	725 (50.75)	D-638, Type IV
Brittle Point (Tb), ºF(ºC)	-35 (-37)	D-746
Stiffness in Flexure, psi (kg/cm²)	600 (42.1)	D-747
Ozone Resistance	No Failure	D-1149

Accelerated Extraction, CRD-C 572

Tensile, psi (kg/cm²)	1600 (112.4)	D-638, Type IV
Elongation, %	300	D-638, Type IV

Effect of Alkali, CRD-C 572

Weight Change, %	-0/+0.25	-------
Change in Hardness, Shore A	±	D-2240

2.02 ACCESSORIES

A. Provide factory made waterstop fabrications for all changes of direction, intersections and transitions leaving only butt joint splicing for the field.

B. Provide hog rings, grommets, or eyelets spaced at 12 inches on center along the length of the waterstop.

C. Provide thermostatically controlled Teflon covered waterstop splicing irons for field splicing as provided by BoMetals, Inc.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Field butt splices shall be fused welded using thermostatically controlled Teflon PVC waterstop iron 350-380 degree Fahrenheit. Follow the Manufacturers recommended methods for welding. This will form a continuous watertight diaphragm. Lapping, gluing or use of adhesives shall not be permitted.

B. Center waterstop in the joint and secure waterstop in correct position using hog rings, grommets, or eyelets spaced 12 inch on center along the length of the PVC waterstop and wire tied to reinforcing steel.

C. Always place the center bulb in the center of the expansion joint. Do not embed the center bulb in concrete.

D. Vibrate concrete around waterstop thoroughly to prevent honeycombing and to ensure contact between concrete and waterstop.

3.02 PREPARATION

A. Uncoil waterstop 24 hours prior to installation for ease of fabrication and handling.

B. Position waterstop to ensure proper distance from steel reinforcing bars.

C. Clean concrete joint after first pour to remove dirt and debris.

D. Protect waterstop from damage during progress of work.

3.03 EXAMINATION/ INSPECTION

A. Waterstop splicing defects which are unacceptable include, but, are not limited to the following:

1. Tensile strength is less than 80% of parent section.
2. Misalignment of center bulb, ribs and end bulbs greater than 1/16”.
3. Bond failure at joint deeper than 1/16” or 15% of material thickness.
4. Misalignment that reduces waterstop cross section more than 15%.
5. Visible porosity in the weld.
6. Bubbles in the welds
7. Inadequate bonding.
8. Visible signs of splice separation when cooled splice is bent at a sharp angle using hand pressure.
9. Charred or burnt splices.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Summary.
   1. Reinforcing steel bars, welded steel wire fabric for cast-in-place concrete.
   2. Support chairs, bar supports, and spacers for supporting reinforcement.
   3. Concrete Accessories.

1.02 RELATED SECTIONS

A. Section 03 01 23 – Embedded Galvanic Anodes.

B. Section 03 01 30 – Surface Preparation for Overlay.

C. Section 03 15 00.01 – Concrete Accessories: Adhesive Anchors.

D. Section 03 30 00 - Cast-In-Place Concrete.

1.03 REFERENCES

A. American Concrete Institute.
   1. ACI 301 - Specifications for Structural Concrete.
   2. ACI SP-66 - American Concrete Institute - Detailing Manual.
   3. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International.
   1. ASTM A82 - Standard Specification for Cold Drawn Steel Wire for Concrete Reinforcement.
   2. ASTM A184/A184M – Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
   3. ASTM A497 – Standard Specification for Steel Welded Wire Fabric, Deformed for Concrete Reinforcement.
   4. ASTM A615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   5. ASTM A706M – Standard Specification for Low Alloy Steel Deformed Bars for Concrete.

C. Concrete Reinforcing Steel Institute.
   1. CRSI - Manual of Standard Practice.
   2. CRSI – Placing Reinforcing Bars.

D. American Welding Society.
   1. AWS D1.4 – Structural Welding Code – Reinforcing Steel.

1.04 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate bar sizes, spacing, locations, and quantities of reinforcing steel and welded wire fabric, bending and cutting schedules, and supporting and spacing devices.

C. Certificates: Submit AWS qualification certificate for welders employed on the Work.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
   1. Submit certified copies of mill test report of reinforcement materials analysis.

1.05 QUALITY ASSURANCE

A. Perform concrete reinforcement work in accordance with CRSI - Manual of Standard Practice.

B. Prepare Shop Drawings in accordance with ACISP-66.

C. Conform to ACI 301.

D. Installer Qualifications: Setting of all items shall be done by workers with experience in the trade.

E. Certification: All welding shall be done by State of Alaska Certified Welders.

1.06 QUALIFICATIONS

A. Welders: AWS qualified within previous 12 months.

1.07 INSPECTION AND TESTING

A. Inspection and Testing will be performed in accordance with the provisions of Section 01 40 00 – Quality Requirements.

B. The testing laboratory shall perform any or all of the following duties:
   1. Verify certification of welders.
   2. Verify size and accurate location of reinforcing.
   3. Inspect reinforcing bar welds.
   4. Perform tensile tests of sample welds of largest size bar for each type of welding.
   5. Verify condition of surfaces for bond integrity with concrete, locations and sizes of all items to be embedded, and anchorage for prevention of displacement.
   6. Receive and review certificates for tests of reinforcing steel for compliance with specifications.

C. Deficient welds will require Contractor to provide and pay for additional X-rays and tests as directed by the Engineer. Repair or replace defective welds to the satisfaction of the Engineer.

1.08 SHOP DRAWINGS

A. Submit shop drawings under provisions of Section 01 30 00 – Administrative Requirements.

B. Indicate sizes, spacing, locations and quantities of reinforcing steel, wire fabric, bending and cutting schedules, splicing, stirrup spacing, supporting and spacing devices.

1.09 CERTIFICATES

A. Submit mill test certificates of supplied concrete reinforcing indicating physical and chemical

analysis.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing Steel: ASTM A615, 60 ksi yield grade billet-steel deformed bars, uncoated and epoxy coated finish for slab top steel and ASTM 706, Grade 60 for welded reinforcing steel. Ultimate tensile stress shall not be less than 1.25 tensile yield stress nor shall actual yield strength exceed specified yield strength by more than 1800 psi.

B. Welded Steel Wire Fabric: ASTM A185 plain type; in flat sheets; uncoated finish.

2.02 ACCESSORY MATERIALS

A. Tie Wire: Minimum 16-gage annealed type. Use coated wire ties only for all epoxy coated reinforcing steel.

B. Chairs, Bolsters, Bar Supports, and Spacers: Sized and Shaped for Strength and Support of reinforcement during concrete placement conditions.

C. Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather Exposed Concrete Surfaces: Plastic tipped type; sized and shaped as required.

D. Barlock (MBT) Coupler Splice.

2.03 FABRICATION

A. Fabricate in accordance with CRSI Manual of Practice.

B. Form standard hooks for 180 and 90 degrees bends, stirrup and tie hooks and seismic hooks as indicated on Drawings.

C. Form reinforcement bends with minimum diameters in accordance with ACI 318.

D. Locate reinforcing splices not indicated on drawings at points of minimum stress. Indicate location of splices on shop drawings.

E. Weld reinforcing bars in accordance with AWS Dl.4.

PART 3 - EXECUTION

3.01 PLACEMENT

A. Before placing concrete, clean reinforcement of foreign particles or undesirable coatings.

B. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.

1. Do not weld crossing reinforcement bars for assembly.

C. Accommodate placement of formed opening.

E. Maintain concrete cover around reinforcement in accordance with ACI 318.

3.02 ERECTION TOLERANCES

A. Section 01 40 00 – Quality Requirements: Tolerances.

B. Install reinforcement within the following tolerances for flexural members, wall, and compression members:

Reinforcement Depth	Depth Tolerances	Concrete Cover Tolerances
Greater than 8 inches	Plus or minus 3/8 inch	Minus 3/8 inch
Less than 8 inches	Plus or minus 1/2 inch	Minus 1/2 inch

3.03 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements: Field inspection, testing, adjusting, and balancing.

B. Field inspection and testing will be performed by Owner's testing laboratory in accordance with ACI 318.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete for new pool deck slab, concrete restoration, and repair.
   1. Supported Slabs and Ramps.
   2. Slab-on-grade.

1.02 RELATED WORK

A. Section 03 01 23 – Embedded Galvanic Anodes.

B. Section 03 01 30.71 – Concrete Rehabilitation.

C. Section 03 20 00 - Concrete Reinforcement.

D. Section 03 90 10 – Corrosion Inhibitor Treatment.

E. Section 31 40 00 – Shoring and Underpinning.

F. Section 07 92 00 – Joint Sealants.

1.03 REFERENCES

A. American Concrete Institute.
   1. ACI 211.1 - Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
   2. ACI 301 - Specifications for Structural Concrete for Buildings.
   3. ACI 302 - Guide for Concrete Floor and Slab Construction.
   4. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
   5. ACI 305 - Hot Weather Concreting.
   6. ACI 306.1 - Standard Specification for Cold Weather Concreting.
   7. ACI 308 - Standard Practice for Curing Concrete.
   8. ACI 318 - Building Code Requirements for Reinforced Concrete.
   9. ACI 347 - Recommended Practice for Concrete Formwork.

B. ASTM International.
   1. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   2. ASTM C33 - Standard Specification for Concrete Aggregates.
   3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   4. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   5. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   6. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
   7. ASTM C150 - Standard Specification for Portland Cement.
   8. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
   9. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

10. ASTM C157 - Standard Specification for Length Change of Hardended Hydradic – Cement Mortar Concrete.
11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
14. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
15. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
17. ASTM C685/C685M - Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
18. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
19. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
20. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
21. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
22. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
23. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
24. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
25. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
26. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
27. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
28. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

1.04 SUBMITTALS

A. Section 01 30 00 – Submittal Procedures.

B. Submit mix designs in accordance with ACI 318.

C. Identifying mix ingredients and proportions, including admixtures.

D. Submit shrinkage performance data in accordance with ASTM C157 criteria.
1. Shrinkage Test Results: Topping slab design requires using materials with combined shrinkage characteristic of 0.035% maximum at 28 days when tested per ASTM C-157. Provide documentation that the proposed mix design, using actual aggregates, additives, and cement of the proposed mix for this project as called for in Specifications, meets this criteria. Submit results for at least three (3) specimens.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Acquire cement and aggregate from same source for all work.

C. Construct and erect concrete formwork in accordance with ACI 301.

D. Conform to ACI 305 when concreting during hot weather.

E. Conform to ACI 306.1 when concreting during cold weather.

1.06 TESTS

A. Testing and analysis of concrete will be performed in accordance with ACI 301 except as supplemented or modified by these Specifications.

B. Submit proposed mix design of each class of concrete to Engineer for review a minimum of seven (7) days prior to use on the job. Substantiate proposed mix design with test data.

C. Concrete test samples shall be obtained as near as possible to its final placement location. For pumped mixes, test samples shall be obtained at the hose discharge end.

D. Air content tests shall be performed at the point of discharge for each concrete batch delivered to the site.

E. Three (3) concrete test cylinders for strength tests of concrete placed each day shall be taken not less than once a day, nor less than once for each 7 cubic yards of concrete, nor less than once for each 250 square feet of surface area.

F. One (1) additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.

G. Extra cylinders taken at Contractor's request shall be paid for by Contractor.

H. One (1) slump test and a unit weight shall be taken from the same concrete sample as each set of compressive strength test cylinders cast.

I. Load Tests of Cores: Should concrete test cylinders fail to meet specified strength requirements. Contractor shall make load tests or core the section as directed by Engineer. Contractor shall cooperate with and furnish material to testing laboratory. The Contractor shall pay for all costs of load tests and core tests.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements: Environmental conditions affecting products on site.

B. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.

1.08 PRODUCT DATA

A. Submit product data under provisions of Section 01 33 00 - Submittal Procedures.

E. Provide product data for specified products.

C. Submit manufacturer's instructions under provisions of Section 01 33 00 - Submittal Procedures.

1.09 COORDINATION

A. Section 01 30 00 – Administrative Requirements: Coordination and project conditions.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150, Type IA - Air Entraining - or Type IIA – Air Entraining, use one brand throughout.

B. Fine and Coarse Aggregates: ASTM C33.

C. Light Weight Aggregate: ASTM C330

D. Water: Potable ACI 318: and not detrimental to concrete.

2.02 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical Admixture: ASTM C494, Type A - water reducing. Type D - water reducing and retarding, Type E - water reducing and accelerating, or Type F - high range water reducing admixture ("superplasticizer").

C. Fly Ash: ASTM C618, Class F.

D. Silica Fume: ASTM C1240.

E. Plasticizing: ASTM 1017/C1017M Type I, Plasticizing.

2.03 CONCRETE MIX

A. Mix concrete in accordance with ACI 301. Deliver concrete in accordance with ASTM C94.

B. The maximum water cement ratio by weight shall be 0.40.

C. Select proportions for normal weight concrete in accordance with ACI 301 field test data.

D. Select aggregate proportions for light weight concrete in accordance with ACI 301.

E. Provide concrete of the following characteristics.
   1. Normal Weight Concrete for new pool deck slab:
      Compressive Strength at 28 Days – 4000 psi.

F. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.

G. Use set-retarding admixtures during hot weather only when approved by Engineer.

H. Admixtures containing calcium chloride shall not be permitted.

I. Add air entraining agent to concrete mix for all concrete. Air content shall be 6% plus/minus 1%.

J. Maximum shrinkage: ASTM C157; 0.035% at 28 days.

2.04 CURING MATERIALS

A. Curing Paper: ASTM C17l, Type I, Regular.

B. Burlap: Thickness to provide continuous retention of water.

2.05 FORM MATERIALS

A. Plywood: PS-1, MDO grade, Class 1 on walls and slabs.

B. Lumber: Hem Fir species; #2 or better grade; with grade stamp clearly visible.

C. Steel: Per Manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 – Administrative Requirements: Coordination & Project Conditions.

B. Verify requirements for concrete cover over reinforcement.

C. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, held securely, and will not interfere with placing concrete.

3.02 PREPARATION

A. Prepare previously placed concrete surfaces to receive concrete in accordance with Section 03 01 30 – Concrete Surface Preparation for Overlay.

B. In locations where new concrete reinforcement is doweled to existing work, drill holes in existing concrete perform work in accordance with Section 03 15 00.01 – Concrete Accessories – Adhesive Anchors.

C. Remove debris and ice from formwork, reinforcement, and concrete surfaces.

D. Remove standing water from areas receiving concrete before concrete is placed.

3.03 STORAGE OF MATERIALS

A. All materials to be mixed by Contractor shall be stored in a clean, dry place, free of

contaminating substances.

3.04 FORMWORK

A. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.

B. The forms shall be held in place to prevent any offsets in panel edges. Panels shall be constructed to maintain a true aligned surface.

C. Construct formwork to maintain tolerances in accordance with ACI 301.

3.05 FORM REMOVAL

A. Do not remove forms and shoring until concrete has sufficient strength to support its own weight and construction and design loads which may be imposed upon it.

B. During cold weather, remove ice and snow from forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and construction proceed within heated enclosure. Use compressed air to remove foreign matter.

C. Do not damage concrete surfaces during form removal.

D. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.

3.06 PLACING CONCRETE

A. Notify Testing Agency minimum 24 hours prior to commencement of concreting operations.

B. Place concrete in accordance with ACI 301.

C. Hot Weather Placement: In accordance with ACI 301.

D. Cold Weather Placement: In accordance with ACI 301 and 306.1.

E. Install construction joint devises in coordination with the overlay slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

F. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

G. Temperature of concrete as placed shall not exceed 90 degrees F.

H. The concrete shall be manipulated and struck off slightly above final grade. The concrete shall then be consolidated and finished to final grade with surface-vibration devices. Consolidation equipment used shall be approved by the Engineer.

I. Deposit concrete at final position. Prevent segregation of mix.

J. All concrete shall be placed in continuous operation and terminated only at designated control

and pour joint predetermined locations.

K. Provide continuous water misting of the fresh concrete surface during finishing operations to prevent rapid drying and cracking of the finish surfaces.

L. Consolidate concrete.

M. Place concrete continuously. Do not break or interrupt successive pours such that cold joints occur unless noted otherwise on Drawings.

N. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Engineer upon discovery.

O. Maintain Records of concrete placement. Record date, location, quantity, air temperate, and test sample taken.

3.07 CONCRETE FINISHING

A. Slab Finish: Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials. Do not use dry cement to absorb bleedwater.

1. Floated:
   Use for surfaces to receive waterproofing membranes and exterior slabs where not otherwise specified. After the concrete has been placed, consolidated, struck off, and leveled, do not work the concrete further, until ready for floating. Whether floating with a wood, magnesium, or composite hand float, with a bladed power trowel equipped with float shoes, or with a powered disc, float shall begin when the surface has stiffened sufficiently to permit the operation. During or after the first floating, surface shall be checked with a 10-foot straightedge applied at no less than two different angles, one of which is perpendicular to the direction of strike off. High spots shall be cut down and low spots filled during this procedure to produce a surface level within 1/4 inch in 10 feet.
2. Broomed:
   Medium Broom Finish – Brooming texture to be approved by Engineer. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.

B. Place floor slabs in checker board pattern indicated.

C. Sawcut joints within 12 hours after placing. Use 3/16 inch wide blade. Cut into slab minimum ¼ slab thickness.

D. Screed floors maintaining surface flatness of maximum ¼ inch in 10 ft. Pitch surfaces uniformly to drains.

3.08 CURING AND PROTECTION

A. Concrete temperature shall be held above 50-degrees F and in a continuously moist condition

for at least the first seven (7) days after placement. Use moist burlap with plastic or curing blankets to assure retention of moisture. Sprinkle with water as necessary to avoid excessive moisture loss.

B. Curing and protection shall be in strict accordance with ACI 301.

C. Concrete areas over 15 square feet to be continuously water cured 7 days minimum. No curing compound substitutions allowed.

3.09 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required levels and lines, details, and elevations.

B. Repair or replacement of defective concrete will be determined by Engineer.

3.10 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed by Owner's testing laboratory in accordance with ACI 318.

END OF SECTION

PART 1 – GENERAL

1.01 S UMMARY

A. Section Includes:
1. Finishing concrete slabs.
2. Floor surface treatment.

B. Related Sections:
1. Section 03 30 00 – Cast-in-Place Concrete.
2. Section 03 39 00 – Concrete Curing.
3. Section 07 92 00 – Joint Sealants.
4. Section 09 30 19 – Swimming Pool Ceramic Tile.

1.02 REFERENES

A. American Concrete Institute:
1. ACI 117-10 - Specifications for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 302.1 - Guide for Concrete Floor and Slab Construction.

B. ASTM International:
1. ASTM E1155 - Standard Test Method for Determining Floor Flatness and of Levelness Using the F-number System.

1.03 SUBMITTALS

A. Relevant sections of Division 1.

B. Product Data: Submit data for curing papers and slip resistant treatment, compatibilities, and limitations.

1.04 CLOSEOUT SUBMITTALS

A. Relevant sections of Division 1.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301 and ACI 302.1.

B. Perform Work in accordance with 2015 Seattle Building Code.

C. Floor Finishers:

1.06 QUALIFICATIONS

A. Installer: Company specializing in performing the work in this section with minimum ten (10) years documented experience.

1.07 MOCK-UP

A. Section 01 45 00 – Quality Control: Requirements for mockup.

B. Construct mock-up area under conditions similar to those which will exist during actual placing, 20 feet long by 16 feet wide, with specified finishes and curing methods applied.

C. Locate as part of the pour schedule pattern(s) identified on the Drawings at location directed by the Architect/Engineer.

D. Incorporate accepted mock-up as part of the work.

1.08 COORDINATION

A. Coordinate the work with concrete floor placement and curing.

PART 2 – PRODUCTS

NOT USED.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Relevant sections of Division 1.

B. Verify floor surfaces are acceptable to receive the Work of this section.

3.02 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301-16 and ACI 302.1R-15.

3.03 TOLERANCES

A. Relevant sections of Division 1.

B. Measure for F_f and F_l tolerances for floors in accordance with ASTM E1155, within 48 hours after slab installation.

C. Finish concrete to achieve the following tolerances:
1. Floor surface classification: Flat.
2. Specified overall flatness: SOF_f 35.
3. Specified overall levelness: SOF_l 25.
4. Minimum local values for flatness (MLF_f) and levelness (MLF_l) shall equal 3/5 of SOF_f and Sof_l values, respectively.

D. Correct defects in defined traffic floor by removal and replacement of defective Work. Areas requiring corrective Work will be identified. Re-measure corrected areas by same process.

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes initial and final curing of horizontal and vertical concrete surfaces.

B. Related Sections:
1. Section 03 30 00 – Cast-In-Place Concrete.
2. Section 03 35 00 – Concrete Finishing.

1.02 REFERENCES

A. American Concrete Institute:
1. ACI 301 - Specifications for Structural Concrete.
2. ACI 302.1 - Guide for Concrete Floor and Slab Construction.
3. ACI 308.1 - Standard Specification for Curing Concrete.
4. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:

1. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

1.03 SUBMITTALS

A. Relevant sections of Division 1.

B. Product Data: Submit data on paper, compatibilities, and limitations.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with ACI 301.

B. Perform Work in accordance with 2006 Seattle Building Code with 2008 Amendments.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Relevant section of Division 1.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Product Manufactureres.
1. SIKA, Ultra Cure NCF.
2. SIKA, Ultra Cure DOT.
3. Reliable, Reliable Cure SOG.

B. Water: Potable, not detrimental to concrete.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Relevant sections of Division 1.

B. Verify substrate surfaces are ready to be cured.

3.02 INSTALLATION - HORIZONTAL SURFACES

A. Concrete shall be wet cured a minimum of 7 days after placement.

B. Cure concrete in accordance with ACI 308R-16.

C. Absorptive Mat: Spread cotton fabric over floor slab areas. Spray with water until mats are saturated and maintain in saturated condition for 7 days.

D. Absorptive Materials – West curing blanket capable of maintaining a saturated condition in place for 7 days.

3.03 INSTALLATION - VERTICAL SURFACES

A. Cure concrete in accordance with ACI 308R-16.

B. Concrete shall be wet cured.

C. Spraying: Spray water over surfaces and maintain wet for 7 days.

3.04 PROTECTION OF FINISHED WORK

A. Relevant section of Division 1.

B. Do not permit traffic over unprotected floor surface.

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes grout for hollow metal frames at concrete walls.

1.02 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.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as sell as sufficient production capacity to produce required units.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver in original unopened containers and store under cover.

1.05 SUBMITTALS

A. Product Data for grout.

1.06 QUALITY ASSURANCE

A. Obtain grout ingredients of a uniform quality, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

PART 2 – PRODUCTS

2.01 GROUT FOR HOLLOW METAL FRAME ASSEMBLIES

A. Grout for Hollow Metal Frames: perolized gypsum material - “Struct-O-Lite or approved equal.

B. Substitutions under provisions of Division 01.

PART 3 – EXECUTION

3.01 GROUTING HOLLOW METAL FRAMES

A. Fill joints, voids, pockets, etc. completely full. Finish surfaces smooth that are exposed to view.

B. Grout all hollow metal frames.

END OF SECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Repair of cracks in the concrete as indicated on the Drawings or as directed by the Engineer on a unit cost basis.

1.02 RELATED SECTIONS

A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Addenda, and Sections in Division 1 of these Specifications.

A. Section 03 01 30 - Surface Preparation for Overlay.

B. Section 03 01 30.71 - Concrete Rehabilitation.

C. Section 03 30 00 - Cast-In-Place Concrete.

D. Section 09 91 14 – Exterior Concrete Coating.

1.03 REFERENCES

A. American Society for Testing and Materials.
1. ASTM C881 - Standard Specification for Epoxy Resin-Base Bonding Systems for Concrete.
2. ASTM C882 - Bond Strength of Epoxy Resin Systems Used with Concrete.
3. ASTM D570 - Test Method for Water Absorption of Plastics.
4. ASTM D638 - Test Method for Tensile properties of Plastics.
5. ASTM D695 - Compressive Properties of Rigid Plastics.

B. American Concrete Institute.
1. ACI 503.2 - Standard Specification for Bonding Plastic Concrete to Hardened Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive.
2. ACI 503.4 - Standard Specification for Repairing Concrete with Epoxy Mortars.
3. ACI 503.7 – Specification for Crack Repair by Epoxy Injection.
4. ACI 504R - Guide to Joint Sealants for Concrete Structures.

C. International Concrete Repair Institute.
1. ICRI 110.2-2020 – Guide Specification for Epoxy Injection.
2. ICRI 210.IR-2016 - Guide for Verifying Field Performance of Epoxy Injection of Concrete Cracks.

D. American National Standards, Inc.
1. ANSI Z129.1 - Precautionary Labeling of Hazardous Industrial Chemicals.
2. K68.1 - Guide for Classifying and Labeling Epoxy Products According to their Hazardous Potentialities.

1.04 QUALIFICATION ASSURANCE

A. Applicator's Qualifications: Epoxy injection shall be performed by a certified Applicator. The Applicator shall have a minimum of five (5) years of documented experience in successful repair projects on concrete structural components. The Applicator's qualifications shall be submitted to the Engineer at least two weeks before commencement of epoxy injection work.

B. Workman's Qualifications: Applicator's workmen engaged in the epoxy injection process on concrete structural components shall have satisfactorily completed a program of instruction in the methods of restoring concrete structures utilizing the specific epoxy injection process indicated, or submit evidence of sufficient work experience in utilizing the process.

C. Workman's Experience: Applicator's workmen engaged in the actual operation of the equipment used shall have a minimum of three (3) years experience in the operation of the same equipment. Workmen shall have participated in a minimum of eight (8) documented concrete repair projects.

1.05 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality concrete repair products with a minimum of five (5) years experience.

B. Applicator: Company prequalified per Paragraph 1.04 of this Section.

C. Dispenser Manufacturer: Written instructions for maintaining equipment and the ratio accuracy.

1.06 REGULATORY REQUIREMENTS

A. Conform to all Federal, State and Local regulatory requirements.

1.07 SUBMITTALS

A. The Contractor/Subcontractor shall submit the following documentation for approval under provisions of Section 01330 Submittal Procedures.
   1. Applicator's Qualifications: A list of projects, dates, locations, contact and contact's telephone number as per Paragraph 1.04A. of this Section.
   2. Workman's Qualifications and Experience: Proof of completion of a program of instruction as per Paragraph 1.04B. and 1.04C. of this Section.
   3. Epoxy Injection Adhesive: Provide material certifications and test results per Paragraph 2.02B. of this Section.
   4. Dispenser Equipment: Written instructions for maintaining equipment and the ratio accuracy.

1.08 INSPECTIONS

A. Comply with the provisions of Paragraph 3.04 of this Section.

1.09 PERFORMANCE

A. Designated cracks will be injected with epoxy, filling all voids.

B. Following injection, all porting adapters and the cap shall be removed, leaving the surface of the concrete smooth with no epoxy or sealer materials showing outside of repaired crack width.

C. The Owner imposes no procedural requirements or restrictions, and therefore will not be influenced by their inclusion or absence in appraisal of unsatisfactory results. The procedures and equipment selected to obtain the specified results are the Contractor's option and the Contractor's responsibility.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Named products are used herein to establish quality and type. The following are acceptable manufacturers.

B. Injection Epoxy Resin Adhesive:
1. Sika Corporation.
2. BASF.
3. ChemCo Systems, Inc.
4. Substitutions in accordance with Section 01 60 00 – Product Requirements.

2.02 MATERIALS

A. Injection Adhesives.
1. Injection adhesives for cracks that can be sealed on all faces – Use an adhesive conforms to the requirements of ASTM C 881/C 881 M, Type IV, Grade 1, and any additional requirements as defined in the Project Specifications.
2. Injection adhesive for cracks that cannot be sealed on all faces – If all faces of the crack cannot be reached to apply a surface seal, use an injection adhesive that conforms to the requirements ASTM C 881/C 881 M, Type IV, Grades 1, 2 or 3, and has a viscosity that will allow it to achieve and maintain the penetration requirements specified in Section 1.5.7.1.

B. Primer - Primers shall be used as recommended by the manufacturer.

C. Epoxy Resin Adhesive for Injection for cracks that can be sealed all faces.

1. Epoxy adhesive used for impregnation shall be an epoxy resin, two-component, low viscosity adhesive containing no solvents or non-reactive dilutants. Acceptable standard for epoxy is BASF “Mater Inject 1500”.
   a. Epoxy shall be a two-part type, low viscosity epoxy adhesive material containing 100% solids and shall meet or exceed the following characteristics when tested in accordance with the standards specified.
   b. Performance Requirements of Cured Adhesive.

Characteristic	Test Method	Results
Bond Strength, Slant Shear	ASTM C882	2,000 psi

Tensile Strength (7 Day)	ASTM D638	7,500 psi
Elongation of Break	ASTM D638	1% min.
Compressive Yield Strength	ASTM D-695	11,000 psi
Heat Deflection Temperature	ASTM D-648	124° F
Compression Modulus	ASTM D-695	250,000 psi

C. Epoxy Injection Adhesive for cracks that cannot be sealed on all faces.
   1. Epoxy adhesive used for impegnation shall be an epoxy resin, two-component, low viscosity adhesive containing no solvents. Acceptable standard for epoxy is "MasterInject 1000" BASF.
      a. Epoxy shall be a two-part, low viscosity material containing 100% solids and shall meet or exceed the following characteristics when tested in accordance with the standards specified.
      b. Performance Requirements of Cured Adhesive.

Characteristic	Test Method	Results
Bond Strength, Slant Shear	ASTM C882	1,500 psi
Tensile Strength	ASTM D638	7,000 psi
Elongation	ASTM D638	1% min.
Compressive Yield Strength	ASTM D-695	10,000 psi
Heat Deflection	ASTM D-648	120° F min.
Flexural Strength	ASTM D-790	9,500 psi

D. Surface Seal:
   1. Description: The surface seal material is that material used to confine the injection adhesive in the joints or cracks during injection and cure.
   2. Properties: The surface seal material shall have adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection and not leave residue or damages on the surface it is removed from.

2.03 EQUIPMENT

A. Equipment for Injection: The equipment used to meter and mix the two injection adhesive components and inject the mixed adhesive into the crack shall be portable, positive displacement type pumps with interlock to provide positive ratio control of exact proportions of the two components at the nozzle. The pumps shall be electric or air powered and shall provide in-line metering and mixing.

1. Discharge Pressure: The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any preset pressure up to 200 psi plus/minus 5 psi and shall be equipped with a manual pressure control override.
2. Ratio Tolerance: The equipment shall have the capability of maintaining the volume ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of plus/minus 5 percent by volume at any discharge pressure up to 200 psi.
3. Automatic Shut-Off Control: The injection equipment shall be equipped with sensors on both the Component A and B reservoirs that will automatically stop the machine when only one component is being pumped to the mixing head.

2.04 QUALITY CONTROL

A. Certification and Test Report.
   1. Manufacturer shall certify that every batch of material supplied to this Specification meets all of the requirements listed in Paragraph 2.02 of this Section.

B. Label Information.
   1. The label shall include in a clear and distinct manner, the following information:
      a. Product Name, Lot Number and Manufacturer.
   2. ANSI Hazardous Classification (formerly SPI Classification) and appropriate recommended ANSI precautions for handling.
   3. Mix ratio by volume.

C. Storage
   1. The containers of the adhesive shall be stored at ambient temperatures below 100 degrees F.

D. Shelf Life
   2. The adhesive has a shelf life of 18 months counted by the date of manufacture. Material older than 18 months shall be tested at the Contractor's expense to establish conformance of the material with this Specification. At the time of re-test, a new shelf life, not exceeding 18 months, shall be established by the manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

A. Concrete crack repairs shall consist of pressure injection of a high strength, low modulus, low viscosity epoxy bonding material into cracks and construction joint voids where indicated on the Drawings. Both the injection pressure and the two-component epoxy mix ratio are critical to the success of the process repair. In process tests of injection pressure and mix ratio shall be completed as specified herein. Cracks requiring pressure injection shall be identified by the Engineer by markings adjacent to the crack. A paste gel cap seal is required on all exposed sides of the crack.

3.02 CLEANING

A. Surfaces adjacent to joints or cracks or other areas of application shall be cleaned of the rubber products, dirt, dust, grease, oil or other foreign matter detrimental to bond of epoxy injection surface seal system. Acids and corrosives shall not be permitted for cleaning.

B. The entire length of the cracks on each side shall be wire brushed cleaned or sanded to provide a clean, dry surface for application of the capping material.

C. Knife score, water flush, air blast and vacuum surface to remove all loose debris from cracks to be repaired.

3.03 REPAIR AREAS

A. At locations as indicated on the Drawings or as directed by Engineer. Lengths of cracks to be repaired shall be identified and directed by the Engineer.

3.04 EPOXY INJECTION

A. Preparation
1. Surfaces adjacent to and within cracks shall be cleaned to remove all foreign materials including dirt, dust, grease, oil, efflorescence, or other foreign matter and sealing materials detrimental to bond of the epoxy surface seal and epoxy adhesive surface seal and epoxy adhesive injection materials, respectively. Acids and corrosives shall not be permitted for cleaning.
2. Provide entry ports along the crack at intervals of not less than the thickness of the concrete member at that location nor more than 6 inches. Entry ports shall be placed in the capping material along the crack plane on one side of the crack. The entry ports shall be in accordance with epoxy injection material Manufacturer's recommendations. A rotary impact drill used to drill holes 1/4 in. to 3/8 in. larger than the entry port pin size. Allow for curing of the capping material.
3. Apply surface seal material to the face of the crack or end. For through cracks, apply surface seal to all exposed faces.
4. Allow enough time for the surface seal material to gain adequate strength before proceeding with the injection.

B. Epoxy Injection
1. Injection of epoxy adhesive shall begin at lower entry port and continue until there is an appearance of epoxy adhesive at the next entry port adjacent to the entry being pumped.
2. The mixed epoxy shall be continuously injected through a handheld mixing head and nozzle through an injection port and into the crack opening. To provide full penetration and filling of the crack when injecting from one side, the epoxy shall be injected into the first port at one end of the crack and allowed to rise into the injection tube of the adjacent injection port. At this point, the first injection tube shall be capped and injection continued at the second port until epoxy rises in the third injection tube. This process shall be continued in sequence along the entire length of the crack until all ports have been filled.
3. If port-to-port travel of epoxy adhesive is not indicated, the work shall immediately be stopped and the Engineer notified.

C. Finishing.
1. When cracks or joints are completely filled, epoxy adhesive shall be cured for sufficient time to allow removal of injection or port sealing devices. After the epoxy has cured,

the capping material and injection ports shall be removed from both sides of the crack and the adjacent concrete surfaces restored to their original condition.

D. Field Quality Control.
   1. Pressure Test Method. The mixing head of the injection equipment shall be disconnected and the two-component adhesive delivery lines shall be attached to the pressure check device. The pressure check device shall consist of two independent valved nozzles capable of controlling flow rate and pressure by opening or closing the valve. There shall be a pressure gauge capable of sensing the pressure build-up behind each valve. The valves on the pressure check device shall be closed and the equipment operated until the gauge pressure on each line reads 160 psi. The pumps shall be stopped and gauge pressure shall not drop below 150 psi within 3 minutes.
   2. Ratio Test Method. The mixing head of the injection equipment shall be disconnected and the two adhesive components shall be pumped simultaneously through the ratio check device. The ratio check device shall consist of two independent valved nozzles capable of controlling back pressure by opening or closing the valve. The discharge pressure shall be adjusted to 180 psi for both adhesive components. Both adhesive components shall be simultaneously discharged into separate calibrated containers. The amounts discharged into the calibrated containers simultaneously during the same time period shall be compared to determine if the volume discharge conforms to the manufacturer's recommendations.
   3. Frequency of Testing: The pressure and ratio test for each injection unit shall be run every four (4) hours of operating time of each piece of equipment.
   4. Proof of Pressure and Ratio Test.
      a. At all times during the course of the work the Contractor shall keep complete and accurate records available to the Engineer of the pressure and ratio tests specified above.
      b. In addition, the Engineer, at any time without prior notification of the Contractor, may request the Contractor to conduct the tests specified above in the presence of the Engineer.

3.05 QUALITY ASSURANCE - TESTING AND INSPECTION

A. Contractor shall provide resin samples from dispenser whenever the Engineer requests them during the course of injection. Sample sizes shall not exceed three (3) fluid ounces.

B. Contractor shall submit concrete cores taken at cracks repaired by injected epoxy resin adhesives where directed by the Engineer to determine if the specified results are being obtained. The results as evidenced by the cores shall be the sole criteria in determining compliance with this specification.

   1. Taking cores and repairing their core sockets by the Contractor is considered incidental with the work. Contractor shall assume a minimum of three (3) cores will be required.
   2. Unless otherwise indicated by the Engineer, cores shall be taken at locations indicated on the drawings. Cores shall be 3 inches in diameter and a minimum of 8 inches in depth. Verify with Engineer prior to taking cores whether reinforcing steel encountered in the coring process can or cannot be cut. The Contractor shall index cores and core locations for future reference.

3. Core Frequency: Epoxy injection shall not proceed beyond the first 200 L.F. of exposed crack until the Engineer has examined and approved 3 cores. After this initial approval, one core for every 250 L.F. is required.
4. Core Inspection and Testing: The Engineer will inspect cores to confirm penetration requirements are met. This review includes wetting cores and examining them carefully as they dry. Fissures not filled with resin will remain damp, and therefore dark after the core surface has dried. Unfilled cracks will be detected in this manner. After reviewing fill of specified voids, demolish the core and inspect the fragments. If no breaks occur on the glue lines, the epoxy injection work performed is acceptable.

END OF SECTION

PART 1 – GENERAL

1.01 SCOPE

A. Furnish all labor, materials, tools and equipment, and perform all operations necessary for embedded in slab metal electrical conduit plus concrete crack and joint water leakage fix with injection grouting work.
B. Operation joint profile preparation, saturated oakum and closed cell backer rod placement and the injection grouting shall proceed as indicated in the sequence of work.
C. Injection of grout is for filling voids in embedded metal electric conduit and concrete and for the repair of water leaking cracks.
D. Holes will be drilled as required and grout injected at cracks. Grout shall be injected under low pressure so as not to damage the existing structure.

1.02 RELATED WORK UNDER OTHER SECTIONS:

A. Section 03 01 30.71 – Concrete Rehabilitation.

B. Section 03 15 00.01 – Concrete Accessories – Adhesive Anchors.

C. Section 03 30 00 – Cast-in-Place Concrete.

D. Section 07 92 00 – Joint Sealants.

E. Division 16 – Electrical Work.

1.03 SUBMITTALS

A . General: Submit in accordance with General Conditions

B. Product Data: Submit manufacturer's product data sheets and description of recommended uses and installation procedures for each component used in chemical grouting the pool slab joints.

PART 2 – PRODUCTS

2.01 CHEMICAL GROUT

A. FOR CONCRETE CRACKS AND JOINTS
The sealing materials shall be a polyurethane grout and accelerator system marketed under the names of GCP De Neef Hydro-Active Flex LV with accelerator Hydro-Active Flex Cat supplied by Grace Construction Products, Inc. or approved equal. All materials shall be delivered to the site in undamaged, unopened containers bearing the manufacturer's original labels. Grouting shall be performed in accordance with manufacturer's recommendations. Grouts shall be non-flammable and non-toxic.

B. FOR EMBEDDED METAL ELECTRICAL CONDUIT IN CONCRETE SLABS.

The fill and sealing of metal electrical conduit pipe shall be by polyurethane grout and accelerator system marketed under the names of GCP DeNeef CFL PURe with accelerator Flex Cat PURe as supplied by Grace Construction Products, Inc or approved equal. All materials shall be delivered to site in undamaged, unopened containers bearing the manufacturers original labels. Grouting shall be performed in accordance with manufacturer's recommendations. Grouts shall be non-flammable and non-toxic.

C. CHEMICAL GROUT

The grouting compound shall be a hydrophobic polymer of the isocyanate type which is applied to a defective joint by use of a packer or injection port. When the grout is mixed with 1.0% of accelerator, the mixture will react when it comes in contact with moisture. Take into consideration the expansion factor of the chemical grout with lower pressure pumping into the joint to be filled.

D. ACCELERATOR

This shall be based on teriary amines, and be able to control the reaction time from one (1) minute to thirty (30) minutes depending on the amount of accelerator and the temperature of the grout.

E. Deliver, store, and handle all materials in strict accordance with manufacturer's instructions.

PART 3 – EXECUTION

3.01 PREPARATION

A. Rout and clean existing slab expansion joints to profile shape shown on the Drawings. Provide joint concrete nosing repairs where required as shown on the Drawings.

3.02 GROUT SEALS FOR CRACKS AND JOINTS

A. Saturated oakum in DE NEEF Hydro Active Flex LV followed by submerging in water. Immediately place saturated oakum in the bottom of the prepared joint and allow to cure 40 minutes.

B. Place closed cell backer road in the top of the joint. Set top of backer rod approximately 3/8" below the slab surface.

C. Insert ¼" inch injection needles through the upper backer rod seal.

3.03 CHEMICAL GROUT

A. STORAGE

Store all chemical grouting materials shall be stored in a secured, dry, weather-tight structure. All basic chemical grout shall be furnished in containers acceptable for use in the work. A sufficient quantity of basic chemical grout and other components shall be stored at or near the site of the work to insure that grouting operations will not be delayed by shortages.

B. MIXING AND HANDLING

Mixing and handling of the chemical grout and the accelerator shall be in accordance with the recommendations of the manufacturer and all applicable safety codes and shall be performed in such a manner as to minimize hazard to personnel. It is the responsibility of the contractor to provide appropriate protective measures to ensure that the chemical or foam produced by said chemical are under control of the contractor at all times. Plastic or metal mixing tanks shall be used. Tanks of concrete or wood should not be used.

C. INSTALLATION

1. For concrete Cracks and Joints.
    a. Provide saturated surface dry (SSD) condition on the exposed concrete sides in the joint immediately prior to grouting.
    b. Pump De Neef Hydro Active Flex LV accelerated with 1 percent Flex Cat under low pressure taking into account the expansion of 3 to 5 times for the grout.
2. For embedded metal electrical conduit.
    a. Remove light pole on level 4 and canopy light on level 3.
    b. Remove all existing conductors from conduit.
    c. Clean conduit to remove mineral deposit and dirt.
    d. Plug conduit at a low point in conduit system.
    e. Install injection ports and/or zerk fittings.
    f. Mix CFL PURe resin and Flex Cat PURe accelerator to account for the rapid expansion of 15 times for the grout.
    g. Inject resin and allow to cure.
    h. Use injection needles and accelerator mixing to insure a minimum 8 inch length of fill inside conduit.

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Surface applied concrete steel reinforcement corrosion inhibitor:

1.01 RELATED SECTIONS

A. Section 03 01 30 – Surface Preparation for Overlay.

B. Section 03 01 30.71 – Concrete Rehabilitation.

C. Section 03 01 40 – Concrete Cleaning and Surface Preparation for Liquid Applied Treatment.

D. Section 03 30 00 – Cast-in-Place Concrete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise indicated. Substitution requests must be submitted 14 day prior to bid date.

B. Product Data: Manufacturer's specifications and technical data including the following:
   1. Detailed specification of construction and fabrication.
   2. Manufacturer's installation instructions.
   3. Certified test reports indicating compliance with performance requirements specified herein
   4. Corporate Letter of compliance to section

C. Quality Control Submittals:
   1. Statement of qualifications.
   2. Statement of compliance with Regulatory Requirements.
   3. Field Quality Control Submittals as specified in Part 3.
   4. Manufacturer's field reports.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualification: Not less than 5 years experience in the actual production of specified products, plus the following:
   1. Manufacturing facility has achieved ISO 9001 Quality and ISO 14001 Environmental certifications.

B. Installer's Qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this Project, plus the following:
   1. Acceptable to or licensed by manufacturer.
   2. Not less than 3 years experience with systems.
   3. Successfully completed not less than 5 comparable scale projects using this system.

C. Product Performance Qualifications:
   1. Surface Appearance - No change in the surface appearance or texture.
   2. Will not leave a residue on non porous surfaces (i.e.: windows, aluminum framing, etc…)
   3. Color: Slightly amber (fugitive dye to be added)
   4. Density: 7.3 to 7.4 lbs/gallon
   5. Nitrite content: less than 1%
   6. Chloride content: less than 20 ppm
   7. Material must reduce total corrosion of heavily corroding concrete rebar by an average of 90%, at an internal concrete relative humidity of 75% or greater.
   8. Must reduce corrosion by 90% or greater using FHWA RD-98-153 test protocol on crack slab black bars subjected to 48 weeks of cyclic salt water ponding.
   9. Must increase the resistance of chloride ions using AASHTO T277 “Rapid Determination of the Chloride Permeability of Concrete” by 90% minimum
   10. Must reduce corrosion by 80% when the presence of chlorides is over 10 lbs/yd^3 of concrete at the top level of reinforcing steel.

Note: A qualified independent laboratory must perform all corrosion and chloride testing.

D. Regulatory Requirements: Products shall comply with State and local regulations concerning AIM (Architectural, Industrial and Maintenance) coatings regarding Volatile Organic Content (VOC).

1.04 DELIVERY STORAGE AND HANDLING

A. Packing and Shipping: Deliver products in original unopened packaging with legible manufacturer’s identification.

B. Storage and Protection: Comply with manufacturer’s recommendations.

1.05 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Maintain ambient temperature above 20 degrees F during and 24 hours after installation.
   2. Do not proceed with application on materials if ice or frost is covering the substrate.
   3. Do not proceed with application if ambient temperature of surface exceeds 100 degree F.
   4. Do not proceed with the application of materials in rainy conditions or if heavy rain is anticipated with 4 hours after application.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Inhibitor shall be ready-to-use, non-water-borne, surface applied product manufactured in an ISO 9002 certified facility, meeting or exceeding the physical and performance characteristics of the following approved product:
   1. Protectosil® CIT
      Evonik Corporation: 299 Jefferson RD; Parsippany NJ 07054; 800-282-091
   2. Others as they provide a Corporate Letter stating that they comply with all the requirements of Section 1.03 C. Product Performance Qualifications.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protection:
   1. Unless inhibitor does not affect adhesion of sealants, paints and patching materials all adjacent surfaces shall be protected as necessary in accordance with the manufacturer's recommendations.
   2. Follow the manufacturer's recommendations regarding condition of concrete surfaces before, during and after application.

B. Surface Preparation:
   1. Remove all paint coatings and line striping from concrete slab surface in application area(s).
   2. All caulking, joint sealants, repairing, and patching of concrete surfaces shall be installed and cured before application of inhibitor. Apply corrosion inhibitor to all newly routed cracks prior to application of sealant. Confirm with Inhibitor Manufacturer compatibility of materials.
   3. Prior to application of corrosion inhibitor, concrete surfaces shall be dry and cleaned of all dust, dirt, debris, grease, oil, grout, mortar, and other foreign matter. Concrete patches and all existing surfaces shall be prepared as recommended by the corrosion inhibitor manufacturer and acceptable to the Engineer.
   4. Shotblast surface to a CSP 3 (min.) surface profile.

3.03 FIELD QUALITY CONTROL

A. Test Applications: Before application of inhibitor will be accepted, a test panel will be applied to the concrete to verify performance under the warranty provisions.

3.04 APPLICATION

A. Product shall be applied as supplied by the manufacturer without dilution or alteration.

B. Corrosion inhibitor shall be applied in accordance with the use of either spray, brush, or roller as per manufacturer's recommendations. Corrosion inhibitor shall be applied at a net coverage rate of 75 to 100 ft^2/gallon in two equal coats with a minimum one hour dry time between coats.

E. Follow manufacturer's recommendations concerning protection of glass, metal and other non-porous substrates. Contractor will be responsible to clean all surfaces that are contaminated by the corrosion inhibitor.

F. Follow manufacturer's recommendation concerning protection of plants, grass and other vegetation. Contractor will be responsible for replacing all plants, grass or vegetation damaged by the corrosion inhibitor.

3.05 CLEANING

A. While Work Progresses: Clean spillage and overspray from adjacent surfaces using materials and methods as recommended by water repellent manufacturer.

B. Remove and dispose of all materials used to protect surrounding areas and nonmasonry surfaces, following completion of the work of this section.

C. Clean site of all unused water repellents, residues, rinse water, wastes, and effluents in accordance with environmental regulations.

D. Repair, restore, or replace to the satisfaction of the Architect, all materials, landscaping, and non-treated surfaces damaged by exposure to corrosion inhibitor.

3.06 COMPLETION

A. Work that does not conform to specified requirements shall be corrected and/or replaced as directed by the Owners Representative at contractor's expense without extension of time.

END OF SECTION

DIVISION 05

Metals

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Non-structural, non-load bearing metal framing systems as indicated.
   2. Blocking for surface mounted equipment.

B. Related Sections:
   1. Section 06 10 00 Rough Carpentry

1.02 DEFINITIONS

A. Conform with requirements of the following Specifications, except as modified and supplemented herein.
   1. North American Specification for the Design of Cold-Formed Steel Structural Members (2001 Edition), American Iron and Steel Institute.
   2. AISI “Standard for Cold Formed Steel Framing - General Provisions”
   3. Cold-Formed Steel Design Manual, American Iron and Steel Institute.
   4. AWS D1.3 “Structural Welding Code – Sheet Steel”

B. Manufacturer's published specifications and installation instructions shall apply where more stringent than the requirements described herein or on the drawings.

1.03 SUBMITTALS

A. Make submittals in accordance with Section 01 33 10 - Submittals.

B. Shop Drawings: Submit for approval; show materials, sizes, thicknesses, welds, type and location of mechanical fasteners, and accessories or items required of other work for complete installation.

C. Submit manufacturer's instructions for securing studs to tracks and for other framing connections.

D. Product Data: Submit manufacturer's published literature for specified products and accessories as applicable, including manufacturer's specifications, physical characteristics, and performance data. Submit as a supplement, manufacturer's instructions and directions for application if not included in manufacturer's published literature.

PART 2 – PRODUCTS

2.01 MANUFACTURER & TYPE

A. US Gypsum, Steeler, or approved equal; channel type structural framing.

2.02 MATERIALS

A. Studs: Formed of galvanized steel conforming to ASTM A653 (ASTM A36 at 8 and 10 gage), coating weight G-60; size and thicknesses as indicated. Provide with factory cut-outs for wiring and plumbing as necessary, unless noted otherwise on plans. Where “light gauge" called for (non-structural, non-load bearing), use 25-gauge minimum unless stronger material required.

B. Track, Bridging and Accessories: Formed of galvanized steel conforming to ASTM A653, coating weight G-60.

C. Fasteners: Self-drilling, self-tapping steel screws; types and sizes as indicated.

D. Blocking: 16-gauge galvanized steel channel sections by stud sizes indicated. Wood blocking and bracing is specified elsewhere. Provide metal blocking and bracing in framed partitions as required for rigidity and stability including wall stops for doors and other surface mounted items.

E. Hot Dip Galvanized: All framing members within exterior insulated walls or adjacent to shower rooms or other wet areas shall be hot dip galvanized.

2.03 FABRICATION

A. Fabricate assemblies of sizes and profiles required, with joints fitted, and secured, reinforced, and braced to suit design requirements.

B. Fit and assemble in largest practical sections for delivery to site and installation.

C. Cut right angle connections to framing components to fit squarely against abutting members. Torch cutting of load bearing members shall not be permitted.

D. Fastening of components shall be with self-drilling screws or welding. Screws shall be of sufficient size to insure the strength of the connection. Wire tying of components shall not be permitted. All welds shall be touched up with zinc-rich paint.

E. Insulation equal to that specified elsewhere shall be provided in all doubled jamb studs and doubled headers not accessible to insulation contractors.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Align floor and ceiling tracks, locating to wall layout. Secure in place.

B. Place studs at 16" o.c., unless otherwise indicated, and not more than 2" from abutting walls and at each side of openings. Position ends against the inside runner of web prior to fastening. Connect studs to tracks using welding or self-drilling screws.

C. Place joists at 16" o.c., unless otherwise indicated. Terminate joists in C-closure sections, and weld or screw connect to channel over studs below. Joists to align with studs, unless noted otherwise on plans.

D. Construct corners using minimum 3 studs. Double studs at door jambs. Install intermediate studs above and below openings to match wall stud spacing.

E. Attach cross studs or furring channels to studs for attachment of wall-hung equipment, accessories and other items anchored to partitions or walls.

F. Install framing between studs and joists for attachment of electrical boxes and other mechanical and electrical items.

G. Install bracing straps per manufacturer's recommendations.

H. Provide horizontal stiffeners in stud system, spaced at 48" o.c. maximum (vertical dimension). Weld or screw attach at each intersection.

I. Erect load bearing studs and joists one-piece full length. Splicing and wire tying of framing components is not permitted.

J. Erect load bearing studs and joists, brace, and reinforce to develop full strength to meet design requirements.

K. Make provision for erection stresses. Provide temporary alignment and bracing. Touch-up field welds and scratched or damaged galvanizing.

L. Ensure framing provides true and flat surfaces, ready to receive finishing materials.

M. Install framing and bracing consistent with approved, fire-rated systems where required for rated walls.

END OF SECTION

DIVISION 06

Wood, Plastics, and Composites

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Manage work site and materials to eliminate potential contamination of surrounding site with screws, nails, scrap metal, wood splinters, paints or solvents, or other detrimental materials used for this work.

B. Construct parapet blocking of dimensional lumber and galvanized steel hardware.

C. Miscellaneous rough carpentry work including work not specified as part of other sections and which is described below:
   1. Framing at clerestory panels.
   2. Nailers at roof parapets.
   3. Structural floor, wall, and roof framing, built-up structural beams and columns; floor, wall, and roof sheathing; sills, miscellaneous framing and sheathing, and concealed wood blocking.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to the work of this section.

B. Section 02 41 19 – Selective Demolition

C. Section 07 20 00 – Building Insulation

D. Section 07 52 16 – SBS Modified Bituminous Roof System

E. Section 07 62 00- Sheet Metal Flashing and Trim

1.03 GENERAL NOTES

A. Dimensions, as contained in these Specifications or as scaled from the Detail Drawings shall be presumed to be approximate. In the event that site conditions uncovered during the work require modification to, or alteration of those dimensions to accomplish the work in accordance with the intent of these Specifications, the Contractor shall make the adjustments as required to comply with that intent.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Arrange for installation of miscellaneous carpentry by a firm that can demonstrate successful experience in installing carpentry items similar in type and quality to those required for this project.

B. Conform to requirements of the following Reference Standards or as modified and

supplemented within this specification.

1. 2018 International Building Code (IBC)

C. Conformance with Standards and Tests: Materials and handling shall conform to the following organizations' standards for materials testing and handling. Each standard is hereafter referred to by its organizational designation only. All materials and handling techniques shall conform to the appropriate standard.
   1. Lumber Grading Agency: Certified by DOC PS 20.
   2. Wood Structural Panel Grading Agency: Certified by EWA – the Engineered Wood Association.
   3. Lumber: DOC PS 20.
   4. Wood Structural Panels: DOC PS 1 or DOC PS 2.
   5. ASTM A 123 - American Society for Testing and Materials Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.
   6. ASTM A 153 - American Society for Testing and Materials Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   7. ASTM A 307 - American Society for Testing and Materials Carbon Steel Externally Threaded Standard Fasteners
   8. ASTM A 563 - American Society for Testing and Materials Carbon and Alloy Steel Nuts
   9. C2 - American Wood Preservers Association Lumber, Timbers, Bridge Ties, and Mine Ties Preservative Treatment by Pressure Process
   10. M4 - American Wood Preservers Association Standard for the Care of Pressure Treated Wood Products

1.05 PRODUCT HANDLING

A. Delivery and Storage: Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar material stacks. Store in a safe location, out of pedestrian and vehicular traffic and protected from weather. Repair or replace any damaged components before installation. Do not store materials directly in contact with the ground.

1.06 PROJECT CONDITIONS

A. Environmental Conditions: Obtain and comply with rough carpentry materials manufacturer's and installer's recommendations for optimum temperature and humidity conditions for rough carpentry during its storage and installation.

B. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit.

C. Safety Requirements: Commencement of the work of this Section implies an absolute commitment to managing the materials used in the execution of the

work to avoid loss into the surrounding site. Contamination of the surrounding landscape with loose nails, screws, wood and metal scraps, splinters, and spilled paints or solvents will be avoided by covering adjacent areas with protective tarps or other approved means. Loose materials will be collected on a daily basis to avoid unintentional loss

PART 2 – PRODUCTS

2.01 STANDARDS

A. Latest Standard Grading Rules for West Coast Lumber, by West Coast Lumber Inspection Bureau (WCLIB) or Western Woods Products Association (WWPA).

B. National Design Specifications for stress grade lumber and its fastenings, latest edition.

C. Plywood: US Product Standard PS 1-83 of Construction and Industrial Plywood.

D. Preservative Treatment: American Wood Preserver's Association (AWPA) Standard TT-W-571.

E. APA Engineered Wood Association.
   1. ANSI/APA PRP210-08 – Standard for Performance – Rated Engineered Wood Siding.
   2. APA PDS-12 – Panel Design Specification.

F. American Wood-Preservers' Association:
   1. AWPA C1 - All Timber Products - Preservative Treatment by Pressure Process.
   2. AWPA C20 - Structural Lumber - Fire-Retardant Treatment by Pressure Processes.

G. ASTM International:
   1. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing.
   2. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
   3. ASTM D5456 - Standard Specification for Evaluation of Structural Composite Lumber Products.
   4. ASTM F1667 – Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

H. U. S Department of Commerce National Institute of Standards and Technology:
   1. DOC PS 1 - Construction and Industrial Plywood.
   2. DOC PS-2 – Performance Standard for Wood Based Structural-Use Panels.
   3. DOC PS 20 - American Softwood Lumber Standard.

I. West Coast Lumber Inspection Bureau:
   1. WCLIB - Standard Grading Rules for West Coast Lumber.

J. Western Wood Products Association:
   1. WWPA G-5 - Western Lumber Grading Rules.

2.02 STRUCTURAL WOOD MEMBERS:

A. All wood used shall be Hem-Fir, Select Structural or better, unincised, Pressure Treated to AWPA Quality Standard C2, retaining a minimum of 0.25 lbs / cf ACQ or CBA preservative.

2.03 LUMBER, GENERAL

A. Nominal sizes are indicated, except as shown by detail dimensions.

B. Provide dressed lumber S4S, unless otherwise indicated.

C. Inspection Agencies: Inspection agencies and the abbreviation used to reference them with lumber grades and species include the following:
1. WCLIB - West Coast Lumber Inspection Bureau
2. WWPA - Western Wood Products Association

D. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

E. Provide seasoned lumber with 19% maximum moisture content at time of dressing shipment for sizes 2” or less in nominal thickness, unless otherwise indicated.

2.04 DIMENSION LUMBER

A. For framing, nailers, curbs, and etc.: (2" to 3" thick), #2 and btr. DF-L graded under WCLIB rules.

B. For framing members 4 x and larger, #1 and BTR, DF-L graded under WCLIB rules.

2.05 PLYWOOD SHEATHING

A. All wood structural panel sheathing shall be APA rated sheathing: Grade C-D or Structural II; Exterior Glue, Exposure I Durability Classification; 48”x96” sized sheets.

B. Span Ratings:
1. Roof sheathing shall be 5/8” (19/32”) with span rating 32/16.
2. Wall sheathing shall be 1/2" (15/32”) with span rating 24/0.

C. Thickness:
1. New Roof Sheathing: 5/8" (19/32).

D. Fasteners: For Nailing New Plywood Sheathing: 8d or 10d (minimum), common

galvanized nails, per APA (formerly American Plywood Association) fastening schedule for high wind uplift resistance.

2.06 FINISHES

A. Wood Finishes: Following acceptance of all wood construction, an approved water-based commercial sealer shall be applied to the manufacturer's written specifications.

B. Preservative-Treated Materials: Labeled by an inspection agency approved by ALSC's Board of Review. Materials kiln-dried after treatment, lumber to 19 percent moisture content, and plywood to 15 percent.
   1. Standards: For lumber, AWPA C15 as applicable to the specific use or C2 where C15 does not apply; for plywood AWPA C9.
   2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
      a. ACZA-treated lumber is not acceptable for foundation sill plates.
      b. Coordinate preservative-treatment chemical types with corrosion-resistance requirements for metal framing hardware and fasteners specified elsewhere in this section. Provide only preservative-treated materials for which compatible hardware and fasteners are available.
   3. Treat indicated items, items required by codes in effect, and the following:
      a. Wood members used in connection with roofing, exposed exterior flashing, and waterproofing membranes.
      b. Concealed members in contact with masonry or concrete.
      c. Wood framing members less than 18 inches above grade.
      d. Wood floor plates installed over concrete slabs directly in contact with earth.

2.07 MISCELLANEOUS MATERIALS

A. Corrosion-resistant metal: Where stainless steel or galvanizing are indicated, comply with the following:
   1. Stainless Steel: Type 304.
   2. Galvanized Steel:
      a. Mechanically Galvanized Steel: Use for threaded galvanized fasteners; ASTM B698, coating Class 55 or greater coating weight.
      b. Hot-Dip Galvanized Steel: Use for all other galvanized fasteners and hardware; ASTM A 153, coating weight as indicated in this Section, or where not otherwise indicated, standard coating weight.

B. Metal Framing Anchors: Of structural capacity, type, and size indicated, material types as follows:
   1. In contact with ACQ-C, ACQ-D, CBA-A, or CA-B treatment lumber: HD Galvanized, G-185 coating weight.
   2. In contact with ACZA-treated lumber: Stainless steel.
   3. In contact with untreated or borate-treated lumber: HD Galvanized, G-60 coating

weight.

4. Other preservative treatments not listed above: Comply with recommendations of treatment and framing anchor manufacturers.

C. Fasteners: Size and type indicated. For fasteners of any type to remain exposed in completed work, provide types as accepted by Architect through submittals.
   1. Minimum corrosion-resistant materials requirements:
      a. For fastening metal framing anchors: Use the same material as the framing anchor, i.e., galvanized fasteners for galvanized anchors, and stainless steel fasteners for fastening stainless steel.
      b. In contact with ACZA-treated lumber: Stainless steel.
      c. In contact with other lumber materials: HD Galvanized.

D. Specifications for nails, screws, bolts, nuts, washers, and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails. Do not use explosive fasteners into masonry.
   1. Bolts, Nuts, Washers shall be galvanized steel, SAE, sized per the Contract Drawings.Bolts, nuts, and washers shall conform to the applicable requirements of specification FF-B-571 and FF-B-575.
   2. Wire nails shall be hot-dipped galvanized and conform to specification FF-N-105.
   3. Screws (countersunk or bugle head) Philips, stainless steel for all exterior and interior uses.
   4. Steel Plate connectors shall be 3 gauge with 7 gauge strap anchors where applicable, galvanized after fabrication, factory primed finish gray, Strong-Tie Connectors as manufactured by Simpson Strong-Tie Company, Inc., (800) 999-5099, or approved equal.

E. Adhesive for Field Gluing Panels to Framing: APA AFG-01. Adhesive for Field Gluing Panels to Framing: APA AFG-01., or approved equal.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Prior to commencing the work of this Section, verify existing conditions and report any discrepancies to the owner immediately.

B. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting installation and performance of finish carpentry. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. All wood assembly shall comply with construction documents.

B. Make provisions for erection loads and for sufficient temporary bracing to maintain

structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

C. Discard units of material with defects that might impair quality of work, and units that are too small to use in fabricating work with minimum joints or optimum joint arrangement.

D. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.

E. Securely attach carpentry work to substrate by anchoring and fastening as shown in construction drawings and as required by recognized standards.

F. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

G. Do not use carpentry materials that are unsound, warped, bowed, twisted, improperly finished, not adequately seasoned, or too small to fabricate with proper jointing arrangements.

H. Install carpentry plumb, level, true, and aligned with adjacent materials. Use concealed shims where required for alignment.

I. Scribe and cut finish carpentry to fit adjoining work.

J. Install to tolerance of 1/8 inch in 8 feet for plumb and level. Install adjoining finish carpentry with 1/16-inch maximum offset for flush installation and 1/8-inch maximum offset for reveal installation.

K. Coordinate finish carpentry with materials and systems that may be in or adjacent to standing and running trim. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of trim.

L. Assemble Arbor structures in conformance with the Contract Drawings.

M. All shop fabricated and field cuts and borings shall be treated with waterborne ACQ or CBA to APWA C2 quality standards.

N. All vertical supports shall be installed plumb unless otherwise noted. Allow additional height for adjustment of horizontal members in the event that post bases are not installed at exact, equal elevations.

O. Install all horizontal members to true level unless otherwise specifically noted by an indication of intended slope. Prior to making final connection, trim added height from vertical members to achieve the intent of the drawings.

P. Mechanical Connections
   1. Securely clamp and brace wood members to be connected to establish precise location and true level in bolt holes and lag screw pilot holes. Protect surfaces of permanent wood members from compression damage with scrap 1”x material. Do not use temporary nailing.
   2. Machine or Carriage Bolt connections shall be pre-drilled to 1/16” larger diameter than the specified connector.
   3. Lag Screw connections shall be pre-drilled to ¼” minimum under size of specified connector.
   4. Make countersink borings to accept washers ¼” over diameter of specified washer and depth to allow bolt or screw head to tighten to between flush and ¼” beneath lumber surface. Do not allow bolt heads or ends to protrude beyond wood surface, and do not reduce the thickness of the structural connection by over-boring.
   5. Make all connections tight without overly distorting or compressing wood surfaces or countersink borings.
   6. Wood-to-Steel connections shall be separated by standard, medium weight roofing felt. Trim excess as directed.

Q. Screw Connections
   1. Pre-drill all screwed connections to a 3/32” diameter pilot hole with an integral counter-sink bit.
   2. Apply standard wood glue to pilot holes prior to making connection.
   3. Counter-sink simple screwed connections so that screw-head is 1/8” to ¼” below surface.
   4. Fill all counter-sunk screw holes with weatherproof filler.

R. Sheathing.
   1. Fasten sheathing in accordance with construction documents.
   2. Secure roof sheathing with longer edge (strength axis) perpendicular to framing members and with ends staggered and sheet ends over bearing.
   3. Install solid edge blocking between sheets.
   4. Secure wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered.

S. Mechanical Connections
   1. Securely clamp and brace wood members to be connected to establish precise location and true level in bolt holes and lag screw pilot holes. Protect surfaces of permanent wood members from compression damage with scrap 1”x material. Do not use temporary nailing.
   2. Machine or Carriage Bolt connections shall be pre-drilled to 1/16” larger diameter than the specified connector.
   3. Lag Screw connections shall be pre-drilled to ¼” minimum under size of specified connector.
   4. Make countersink borings to accept washers ¼” over diameter of specified washer and depth to allow bolt or screw head to tighten to between flush and ¼” beneath lumber

surface. Do not allow bolt heads or ends to protrude beyond wood surface, and do not reduce the thickness of the structural connection by over-boring.

5. Make all connections tight without overly distorting or compressing wood surfaces or countersink borings.
6. Wood-to-Steel connections shall be separated by standard, medium weight roofing felt. Trim excess as directed.

T. Screw Connections
   1. Pre-drill all screwed connections to a 3/32” diameter pilot hole with an integral counter-sink bit.
   2. Apply standard wood glue to pilot holes prior to making connection.
   3. Counter-sink simple screwed connections so that screw-head is 1/8” to ¼” below surface.
   4. Fill all counter-sunk screw holes with weatherproof filler.

3.03 FINISHES

A. Moisture Testing on Exterior Wood Surfaces: Prior to painting, moisture reading shall be taken with an approved professional grade moisture meter. This reading shall not exceed 19%. If environmental conditions are not favorable and wood tested regularly over a period of days does not show a drying trend, finishing operations may, at the discretion of the architect, be suspended until such time as conditions become appropriate.

B. Following acceptance of moisture testing, apply sealer to approved manufacturers specifications.

C. All fabricated steel components shall arrive at the work site pre-galvanized and pre-primed. Following installation the architect may direct additional field galvanization or priming as necessary to correct damage that may have occurred during installation. Following acceptance of the prepared surface, apply 2 coats of approved Alkyd Enamel, following manufacturer’s written specification for cure time between coats.

D. Immediately clean all surfaces that receive incidental and/or unspecified finishes.

3.04 CLEAN UP

A. Remove all construction debris including loose nails, screws, sawdust, wood and metal scraps, splinters, and spilled paints or solvents from all adjacent and surrounding surfaces and landscape areas. Use magnets or metal detectors to verify for the owner than no loose nails or screws remain in surrounding soils.

3.05 ACCEPTANCE

A. Upon completion of the fabrication, assembly and finish work, and cleanup, the owner may require spot-tightening of various connection hardware. During the scheduled

final inspection, insure that all of the tools and equipment necessary for this task are on hand. Following this final adjustment the owner will consider the work complete.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 SUMMARY OF WORK

A. This Section includes
   1. Thermally Fused Laminate (TFL) Panels.
   2. Cabinet Interiors.
   3. Cabinet Doors.
   4. Decorative Edgebanding.
   5. Accessory Moldings.

B. Work in related Sections
   1. Section 06 10 00, Miscellaneous Carpentry for wood furring, blocking, shims and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
   2. Section 06 61 16 Solid Surface Countertops

1.03 REFERENCES

A. Reference Standards:
   1. ANSI: American National Standards Institute.
   2. ANSI A208.1: Particleboard.
   3. ANSI A208.2: Medium Density Fiberboard (MDF) For Interior Applications.
   4. ANSI/NEMA LD-3: High Pressure Decorative Laminates.
   5. ASTM: ASTM International.
   6. ASTM D1037: Standard Test Methods for Evaluating Properties of Wood-Based Fiber and Particl Panel Materials.
   7. ATCM: Airborne Toxic Control Measure.
   8. AWI: Architectural Woodwork Institute.
   9. AWS: Architectural Woodwork Standards.
   10. CARB: California Air Resources Board.
   11. CPA: Composite Panel Association.
   12. FSC: Forest Stewardship Council.
   13. ISO: International Organization for Standardization.
   14. ISO 4586: High Pressure Decorative Laminates (HPL, HPDL) – Sheets Based on Thermosetting Resings (Usually Called Laminates).
   15. NAF: No Added Formaldehyde.
   16. NEMA: National Electrical Manufacturers Association.
   17. ULEF: Ultra-Low-Emitting Formaldehyde.

1.03 DEFINITIONS

A. General: Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

B. Definitions specific to Cabinet Work:
   1. Exposed surfaces of casework: Surfaces visible when doors and drawers are closed, including visible surface in open cabinets behind glass doors.
   2. Semi-exposed surfaces of casework: Surfaces behind opaque door or drawer fronts, including interior faces of door and interiors and sides of drawer. Bottoms of wall cabinets are defined as “semi-exposed”.
   3. Concealed surfaces of casework: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as “concealed”.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01 33 00 - Submittals

B. Product Data: For each type of product indicated, including cabinet hardware and accessories, and finishing materials and processes, Safety Data Sheets (SDS).

C. Shop Drawings: Submit for approval fully dimensionsed shop drawings showing layouts and components, of all joints and other fabrication details including glue lines of all laminated members; edge conditions, terminating conditions, substrate construction. Include elevations, section details, and large scale details. Indicate color, pattern, finish selections, adhesives, and fasteners;
   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other sections.
   2. Show locations and sizes of cutouts and holes for electrical and/or plumbing work, and other items installed in architectural woodwork.

D. Samples for verification
   1. Plastic-laminate panel products, 8 inches x 10 inches, for each type, color, pattern, and surface finish with separate decorative-overlay panel product used for core.
   2. Thermoset decorative-overlay surfaced panel products, 8 inches x 10 inches, for each type, color, pattern, and surface finish.
   3. Corner pieces:
      a. Cabinet from frame joints between stiles and rail, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
      b. Miter joints for standing trim

E. Test Reports: Certified test reports showoing compliance with specified performance characteristics and physical properties.

F. Maintenance Data: Manufacturer’s published maintenance manual with closeout submittals.

1.05 REGULATORY REQUIREMENTS

A. Composite Wood Products: CARB ATCM for Composite Wood Products.

1.04 QUALITY ASSURANCE

A. Source Limitations for Cabinets: Obtain cabinets through one source from a single manufacturer.

B. Manufacturer Qualifications: TFL Panels produced by a manufacturer with documented quality management and environmental management practices and procedures in place to ensure compliance with specificed requirements. Panel core material producers are current members in good standing with the Composite Panel Association.

C. Installer Qualifications: Minimum of three years documented installation experience for projects similar in scope and complexity to this Project. An experienced installer who has completed cabinets 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.

D. Fabricator qualifications: Minimum of three years documented experience in fabricating thermally fused laminate panels similar in scope and complexity to thie Project.

E. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.

F. Quality Standard:
1. Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards", for grades of cabinetry, construction, finishes, and other requirements.
   a. Provide AWI certification labels or compliance certificate indicating that cabinetry woodwork complies with requirements of grades specified.
   b. National Electrical Manufacturer's Association (NEMA): Standard LD3 – High Pressure Decorative Laminates.

F. FSC- Certification: Provide architectural woodwork produced from wood obtained from forest certified by an FSC-accredited certification body to comply with FSC "Principles and Criteria."

G. Product Content: Provide products that comply with requirements for VOC levels and restriction of any added urea-formaldehyde.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration at all times, including during construction, up until acceptance of the work by the Owner. Store TFL Panels materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturers. Store materials flat on pallets or similar rack-type storage to avoid damage. Moisture content of TFL Panels not to exceed 6 percent to 8 percent.

B. Do not deliver finish carpentry materials until painting, wet work, grinding and similar operations, which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, finish carpentry materials only in areas meeting requirements specified for installation areas.

1.07 PROJECT CONDITIONS

A. Do not deliver woodwork until painting and similar operations that could damage cabinets have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in “Project Conditions”.

B. Environmental Limitations: Ensure appropriate acclimatization of TFL Panels prior to fabrication. Condition TFL Panels in the same environement for 48 hours prior to fabrication. Condition at approximately 75 deg F (24 deg C) and 45 percent to 55 percent relative humidity.

C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrications and indicated measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
   2. Provide fillers and scribes if necessary.

D. Field Measurements for Countertops: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.08 WARRANTY

A. Warranty for factory-applied finishes – 5 years from the date of Substantial Completion.

B. General Construction – one year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis of Design: Wilsonart

B. Or approved equal.

2.02 TFL PANEL PROPERTIES

A. Laminate Composition: Melamine saturated decorative layers thermally fused to both core face surface with heat and pressure. Stain resistant surface with wear and scratch resistance.

B. Panel Core material: Composite panel product composed primarily of cellulosic materials and a bonding system, resulting in a durable and dimensionally stable substrate suitable for decorative laminate overlays.

C. Sustainable Design Conformance Standards:
   1. CPA: Eco-Certified Composite (ECC) Sustainability Standard.
   2. CPA: Formaldehyde Emissions Grademark Certification Program. Certification attests compliance with applicable CARB ATCM Limitations.

2.03 TFL PANELS

A. Product: Wilsonart thermally Fused Laminate Panels. The LUJO Collection

B. Laminate Component:
   1. Laminate Conformance Standard: ANSI /NEMA LD 3, Grade VGL, and ISO 4586.
   2. Color, Pattern, Finish: provide manufacturer's full range of color/finish selection.

C. Moisture-Resistant Panel Core Material: Medium densithy fiber board
   1. Conformance Standard: ANSI 208.2, Grade 130, minimum 45lb density
   2. Product Type and Thickness: Type 880 – 3/4inch; 0.008 inch dimensional tolerance
   3. Panel Width: refer to drawing details for dimensions; 0.0336 inch dimensional tolerance
   4. Panel Length: refer to drawing details for dimensions; 0.080 inch dimensional tolerance

2.04 CABINET INTERIORS

A. Product: Wilsonart Thermally Fused Laminate Panels, Interiors _____Collection.

B. Laminate Component:
   1. Lainate Conformance Standards: ANSI/NEMA LD 3, Grade CLS, and ISO 4586.
   2. Design: selected from manufacturer's full range of color/finish selections.

2.05 CABINET DOORS

A. Product: Wilsonart Flat Panel Cabinet Doors. Comply with KCMA A161.1 and provide KCMA certification label on door.

B. Laminate Properties:
   1. Laminate Conformance Standard: ANSI/NEMA LD 3, Grade BGL, and ISO 4586.
   2. Laminate Thickness: 0.020 inch, nominal.
   3. Color, Pattern, and Finish: Selected from manufacturer's full range of available selections.

C. Core Material: Medium density fiberboard with no added urea formaldehyde.
   1. Conformance Standard: ANSI 208.2. Grade 130.
   2. Thickness, Stils and Rails: 3/4" inch with 0.008 inch dimensional tolerance.
   3. Thciness, inset Facer Panels: 1/4 inch with 0.008 inch dimensional tolerance.

D. Door Dimensions: As indicated on Drawings.

E. Flat Door Design: Flat Front.

F. Flat Drawer Design: Flat Drawer.

G. Door Design – indicated on Drawings.

2.06 DECORATIVE EDGEBANDS

A. Edgeband Products: Wilsonart Edgeband
   1. Composition: ABS/PVC extruded fabrication.
   2. Width: Equal to or greater than panel thickness.
   3. Finish: Match TFL Panels
   4. Color and Pattern: Match TFL Panels.

2.07 ACCESSORY MOLDINGS

A. Product Manufacturer: Wilsonart
   1. Composition: Medium density fiberboard
   2. Profile: Quarter Round
   3. Applications: as indicated on Drawings
   4. Color and pattern: match adjacent doors; coordinate with Architect

2.08 CABINET HARDWARE AND ACCESSORIES

A. Butt Hinges: (2) – 3/4 inch, 5-knuckle steel hinges made from 0.095 inch thick metal.
   1. semi-concealed for overlay doors: BHMA A156.9, B01521

B. Drawer Guides: Epoxy-coated metal, self-closing drawer guides designed to prevent rebound when doors are closed; with nylon-tired, ball bearing rollers, and complying with BHMA A156.9, Type BO5091.

C. Wire Pulls: 4 inches long, 5/16 inches in diameter.

D. Catches: Magnetic catches, BHMA A156.9, B03141

E. Drawer Slides: K.V. 1284 or equal.

F. Wall shelf standards: Heavy Duty – K.V. 83

G. Shelf Brackets: Heavy duty – K.V. 193.

H. Locks: (at cabinet and drawers):
   1. door lock (at lower cabinet): BHMA A156.11
   2. drawer lock: BHMA A156.11, E07041

I. Wire cable trays, 2” x 3”

J. hardware finishes: satin stainless steel.

2.09 FABRICATION, GENERAL

A. Fabricate TFL Panels in shop, to greatest extent practicable, in sizes and shapes indicated according to approved shop drawing sand manufacturer’s published fabrication requirements.
B. Provide holes and cutouts indicated on approved shop drawings. Use a router to create cutouts and complete by sanding all edges smooth.

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to the Project site. Dissemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance of scribing, trimming, and fitting.

D. Shop cut opening, to maximum extent possible, to receive hardware, appliance, plumbing fixtures, electrical work, and similar items. Locate opening accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.

2.10 SOLID SURFACE COUNTERTOPS

A. Refer to Section 06 61 16 Solid Surface Countertops.

PART 3 - EXECUTION

3.01 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION

A. Conformance Standard: Comply with AWI/AWAMAC/WI AWS and KCMA A161.1 as applicable to the Project.

B. Install TFL Panel components plumb, level ,and true according to approved shop drawings and manufacterer’s published installation instructions. Shim as needed during the installation process.

C. Attach TFL Panel components to substrates as indicated on Drawings and approved shop drawings.

D. Cabinet Doors: Install without distortion to ensure accurate alighment and proper fit. Adjust hardware for smooth nonbinding operation.

E. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

F. Anchors: Select material, type, size and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

G. Install woodwork level, plumb, true and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

H. Anchor casework to anchors or blocking built in or directly attached to substrate. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish.

I. Install standing and running trim with minimum number of joints possible, using full-length pieces to greatest extent possible. Do not use pieces less than 96 inches long, except where shorter single-length pieces are necessary.
   1. Fill gaps, if any between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base.
   2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

J. Anchor countertops securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Verify proper location of inserts with contractor.
   2. Align adjacent solid-surfacing material countertops and form seams to comply with manufacture's written recommendations using adhesive in color to match countertop.
   3. Install countertops with no more than 1/8 inch in 96 inches sag, bow or other variation from a straight line.
   4. Secure backsplashes and wall with adhesive.
   5. Caulk space between backsplash and wall with sealant specified in Section 07 92 00 – Joint Sealants.

K. Rails: Install rails with no more than 1/8 inch in 96 inches variation from a straight line.

L. Complete the finishing work specified in this Section to extent not complete at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer were applied in shop.

3.03 CABINET INSTALLATION

A. Install casework with no variations in flushness of adjoining surface; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings to finish in finish to match casework face.

B. Install casework without distortion so doors and drawers fit opening and are aligned. Complete installation of hardware and accessories as indicated.

C. Install casework and countertop level and plumb to a tolerance of 1/8 inch in 8 feet.

D. Fasten cabinets to adjacent units and to backing:
   1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inch o.c., with toggle bolts through metal backing behind gypsum board.

E. Furnish and install locks at all base cabinet doors.

F. Secure backsplashes to countertops with concealed metal brackets at 16 inch o.c. and to wall with adhesive.

3.04 ADJUSTING AND CLEANING

A. Repair damaged and defective casework, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Adjust casework and hardware so doors and drawers are centered and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

C. Clean casework on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled surfaces.

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY

A. This section includes the following:
   1. Countertops
   2. Countertops with drop in sinks

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to the work of this section.

B. Section 06 10 00 Miscellaneous Carpentry

C. Section 06 40 00 Interior Architectural Woodwork

D. Section 07 92 00 Joint Sealants

E. Section 22 00 00 Plumbing

1.03 DEFINITION

A. Solid surface is defined as nonporous, homogenous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.04 SUBMITTALS

A. Product data:
   1. For each type of product indicated.
   2. Submit manufacturer's product data on material characteristics, performance properties, fabrication instructions, installation instructions and maintenance instructions.

B. Shop drawings:
   1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
      a. Show full-size details, edge details, thermoforming requirements, attachments, etc.
      b. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.
      c. Fabrication details for brackets.
      d. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in solid surface.
      e. Type of sealant.
      f. Type of adhesive.

g. Seam locations.

C. Samples:
1. For each type of product indicated.
a. Submit minimum 6-inch by 6-inch sample in specified gloss.
b. Cut sample and seam together for representation of inconspicuous seam.
c. Indicate full range of color and pattern variation.
2. Approved samples will be retained as a standard for work.

D. Fabricator/Installer qualification: Provide copy of certification number.

E. Maintenance Data:
1. Submit manufacturer's care and maintenance data.
2. Include in project closeout documents.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Shop that 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.

B. Fabricator/installer qualifications:
1. Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

C. Allowable tolerances:
1. Variation in component size: ±1/8 inch (3 mm) over a 10 foot length.
2. Location of openings: ±1/8 inch (3 mm) from indicated location.
3. Minimum of 1/16 inch and a maximum of 1/8 inch (3 mm) clearance between quartz surfaces and each wall.

D. Applicable standards:
1. Standards of the following, as referenced herein:
a. American National Standards Institute (ANSI)
b. American Society for Testing and Materials (ASTM)
c. National Electrical Manufacturers Association (NEMA)
d. National Sanitation Foundation International (NSF)
2. Fire test response characteristics:
a. Provide with the following Class A (Class I) surface burning characteristics as determined by testing identical products per UL 723 (ASTM E84) or another testing and inspecting agency acceptable to authorities having jurisdiction:
1) Flame Spread Index: 25 or less.
2) Smoke Developed Index: 450 or less.

E. Coordination drawings:

1. Shall be prepared indicating:
   a. Plumbing work.
   b. Electrical work.
   c. Miscellaneous steel for the general work.
   d. Indicate location of all walls (rated and non-rated), blocking locations and recessed wall items, etc.
2. Content:
   a. Project-specific information, drawn accurately to scale. Use ½" scale for all fabricated items.
   b. Do not base coordination drawings on reproductions of the contract documents or standard printed data.
   c. Indicate dimensions shown on the contract drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.
   d. Provide alternate sketches to designer for resolution of such conflicts.
      1) Minor dimension changes and difficult installations will not be considered changes to the contract.

D. Product Content: Provide products that comply with requirements for VOC levels and no added urea-formaldehyde.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation.

B. Store components indoors prior to installation.

C. Handle materials to prevent damage to finished surfaces.
   1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.07 WARRANTY

A. Provide manufacturer's 10-year warranty against defects in materials.
   1. Warranty shall provide material and labor to repair or replace defective materials.
   2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

PART 2 – PRODUCTS

2.01 STANDARDS

A. Manufacturers
   1. Subject to compliance with requirements, provide products by one of the following:
      a. Corian Quartz surfaces from the DuPont company (Basis of Design)
      b. or approved equal.

2.02 MATERIALS

A. Solid surface quartz
   1. quartz material composed of 93% natural quartz with pigments and resin.
   2. Material shall have minimum physical and performance properties as specified.

B. Thickness: 2 cm (3/4 inch).

C. Edge Treatment: Exposed edge: rectangular, polished

D. Seam width: 1/16 inch nominal unless otherwise specified.

E. Sink mounting: Drop in.

F. Backsplash: applied

G. Endsplash: applied

H. Quartz countertop Performance Properties:

1.	Flexural Strength	> 5,300 psi	ASTM D790
2.	Flexural Modulus	5.3–5.7 X 106 psi	ASTM D790
3.	Compression Strength (Dry)	27,300 psi	ASTM C170
4.	Compression Strength (Wet)	24,400 psi	ASTM C170
5.	Hardness	7	Mohs Hardness Scale
6.	Thermal Expansion	1.45 x 10-5 meter/meter deg C	ASTM D696
7.	Thermal Expansion	2.61 x 10-5 inch/inch deg F	ASTM D696
8.	Colorfastness	Passes	NEMA LD 3-3.3
9.	Gloss (60° Gardner)	45–50	ANSI Z124
10.	Wear and Cleanability	Passes	CSA B45.5-11/IAPMO Z124-2011
11.	Stain Resistance	Passes	CSA B45.5-11/IAPMO Z124-2011
12.	Fungal Resistance	No observed growth on product	ASTM G 21
13.	Bacterial Resistance	No observed growth on product	ASTM G 22
14.	High Temperature Resistance	None to slight effect	NEMA LD 3-3.6
	a. Temperature, 356 deg F		
15.	Boiling Water Resistance	None to slight effect	NEMA LD 3-3.5
16.	Freeze-Thaw Cycling	Unaffected	ASTM C1026
17.	Point Impact	Passes	ANSI Z124.6.4.2
18.	Ball Impact Resistance	No failure at 164 inches	NEMA LD 3-3.8
	a. Slabs, No fracture,1/2 lb. ball – 2cm and 3 cm		
19.	Static Coefficient of Friction	0.89 (Dry), 0.61 (Wet)	ASTM C1028
20.	Abrasion Resistance	139	ASTM C501
21.	Density	2.4 g/cm3	ASTM D792
22.	Water Absorption, Long-term	0.12%	ASTM C373
23.	Water Absorption, Short	< 0.04%	ASTM C373
24.	Moisture Expansion	< 0.01% average	ASTM C370

25.	Flammability	Class A, all colors	NFPA 101® Life Safety Code
26.	Flame Spread Index	FSI 0 for 3 cm	UL 723
27.	Flame Spread Index	FSI ≤ 5 for 2 cm	UL 723
28.	Smoke Developed Index	SDI ≤ 40 for 3 cm	UL 723
29.	Smoke Developed Index	SDI ≤ 75 for 2 cm	UL 723

30. Nominal Weight per square foot for 2cm thickness is 10 pounds
31. Nominal Weight per square foot for 3cm thickness is 15 pounds

F. Quartz Certifications and Approvals: New York City Material Equipment Acceptance Number for DuPont™ Zodiaq® is 431-00-M.

2.03 ACCESSORIES

A. Joint adhesive:
1. Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.
2. Create color-coordinated seam.

B. Sealant:
1. Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.
2. 100 percent silicone sealant.

C. Sink/bowl mounting hardware
1. Manufacturer's approved sink setters, bowl clips and fasteners for attachment of sink/bowl.

2.04 FACTORY FABRICATION

A. Shop assembly
1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
2. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
   a. Reinforce as required.
3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
4. Rout and finish component edges with clean, sharp returns.
   a. Rout cutouts, radii and contours to template.
   b. Smooth edges.
   c. Repair or reject defective and inaccurate work.

2.05 FINISHES

A. Color: Cloud White

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General
   1. Install countertop materials in accordance with manufacturer's instructions.
   2. Additional weight from attached sink or lavatory will affect maneuverability of tops during transportation and installation.

B. Install components plumb and level, in accordance with approved shop drawings and product installation details.
   1. Tops:
      a. Flat and true to within 1/8 inch (3 mm) of a flat surface over a 10-foot length.
      b. Allow a minimum of 1/16 inch to a maximum of 1/8 inch (3 mm) clearance between surface and each wall.
      c. Form field joints using manufacturer's recommended adhesive (Corian® Joint Adhesive), with joint widths no greater than 1/8 inch (3 mm) in finished work.
      d. Keep components and hands clean when making joints.
      e. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
      f. Carefully dress joints smooth, remove surface scratches and clean entire surface.

C. Sink/Lavatory Bowls
   1. Adhere drop-in sinks/bowls to countertops using silicon sealant and manufacture recommended adhesives.

D. Provide backsplashes and endsplashes as indicated on drawings
   1. Adhere to countertops using silicone sealants.
      a. Keep components and hands clean when working with silicon sealant.

3.03 CONNECTIONS

A. Make plumbing connections in accordance with Division 22.

B. Make electrical connections in accordance with Division 26.

3.04 REPAIR

A. Repair or replace damaged work which cannot be repaired to architect's satisfaction.

3.05 CLEANING AND PROTECTION

A. Keep components clean during installation.

B. Remove adhesives, sealants and other stains in accordance with manufacturer's instructions.
   1. Clean exposed surfaces in accordance with manufacturer's instructions. Protect surfaces from damage until date of Substantial Completion.
   2. Components shall be clean on date of Substantial Completion.

3.06 SCHEDULE

A. Countertops:
   1. Location: Breakroom 104
   2. Quartz surface is adhesively joined with exposed seams.
      a. Color: Cloud White
      b. Vertical Thickness: ¾"
      c. Horizontal Thickness: ¾"
      d. Edge Details: straight
      e. Backsplash: yes
      f. Endsplash: yes
      g. Sink: drop-in; coordination with Section 22 00 00.

END OF SECTION

DIVISION 07

Thermal and Moisture Protection

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:
1. Rigid insulation at roof system (See Section 07 52 00)
2. Concealed building insulation
3. Acoustical insulation

B. Related Sections:
1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to the work of this section.
2. Section 06 10 00 – Rough Carpentry
3. Section 07 52 16 – SBS Modified Bitumen Roof System
4. Section 09 21 16 – Gypsum Board Systems

1.02 SUBMITTALS

A. General, submit in accordance with Division 01 requirements.

B. Product Data: For each type of insulation product specified.

C. Product test reports from and based on tests performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water-vapor transmission, water absorption, and other properties, based on comprehensive testing of current products.

1.03 QUALITY ASSURANCE

A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Surface-Burning Characteristics: ASTM E 84
2. Fire-Resistance Rating: ASTM 119
3. Combustion Characteristics: ASTM E 136

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by 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. Materials shall be delivered in original, unopened containers bearing name of manufacturer, product identification and reference to UL testing.

C. Protect liquid adhesive from freezing.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide insulation products by one of the following:
   1. Polyisocyanurate Rigid insulation board
      a. Dow Chemical Company
      b. Atlas
      c. RMax, Inc.
      d. Carlisle-CCW
   2. Mineral-Fiber insulation
      a. Roxul
      b. Certain Teed Corporation
      c. Owens-Corning Fiberglass Corporation
      d. Johns Mansville
   3. Spray Polyurethane Foam
      a. Hilti
      b. For adhesion of insulation panels at low-slope roof system see Section 07 52 00 – SBS Modified Bitumen Roofing
   4. Closed Cell Polyethylene Foam
      a. Sound Technology, LLC
      b. Or approved equal.

2.02 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.
   1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths

B. Polyisocyanurate Rigid Insulation Board (for roof cavity insulation installed between rafters under plywood roof deck): Closed cell polyisocyanurate foam core manufactured using glass facers (no organic or felt facers allowed).

C. Polyisocyanurate Rigid Insulation Board (for above deck low-slope roof insulation): See Section 07 52 00

D. Mineral-Fiber Insulation: Thermal insulation consisting of mineral fibers of type described below complying with ASTM C 665, Type I.
   1. Mineral-Fiber Type: Fibers manufactured from stone.

E. Closed Cell Spray Foam Insulation:
   1. Product: Hilti CF 812 WD (For sealing seams and gaps at new rigid foam boards installed in roof cavities.)

F. Face Mineral-Fiber Insulation: Thermal insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type III, Class A (blankets with reflective vapor-retarder membrane facing and flame spread of 25 or less); with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on 1 face.
   1. Mineral-Fiber Type: Fibers manufactured from glass.

G. Acoustical Insulation (Sound Control Batts): Unfaced Mineral Fiber Blanket Insulation. ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass, slag wool, or rock wool, with maximum flame-spread and smoke developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Closed Cell Spray Foam Insulation:
   1. Product: Versi-Foam System 50 Class I Disposable Foam Kits
   2. Density, per ASTM D 1622: Free Rise 1.75 lb/cubic foot, In Place 2.0 lb/cubic foot.
   3. R Factor at 1” thickness, ASTM C 518: 6.7.
   4. Compressive Strength, ASTM D 1621: 15.9 psi.
   5. Water Absorption, ASTM D 2127: 0.039 lb/square foot.
   6. Flamspread at 2” thickness, ASTM E84: 25
   7. Smoke Developed at 2” thickness, ASTM E84: 300

2.03 SAFING INSULATION AND ACCESSORIES

A. Slag-Wool-Fiber Board Safing Insulation: Semi rigid boards designed for use as fire stop at openings between edge of slab and exterior wall panels, produced by combining slag-wool fibers with thermosetting resin binders to comply with ASTM C 612, Type IA and IB; nominal density as required to meet UL Design indicated; passing ASTM E 136 for combustion characteristics; thermo resistivity of 4 deg F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).

B. Caulking Compound: Material approved by manufacturer of safing insulation for sealing joint between foil backing of safing insulation and edge of concrete floor slab against penetration of smoke.

C. Safing Clips: Galvanized steel safing clips approved by manufacturer of safing insulation for holding safing insulation in place.

2.04 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

B. Protection Board: Premolded, semi rigid asphalt/fiber composition board. ¼ inch (6 mm) thick, formed under heat and pressure, standard sizes.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements of Section in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of substances harmful to insulations, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

3.03 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instruction applicable to products and application indicated.

B. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Apply single layer of insulation to produce thickness indicated.

3.04 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal Joint between closed-cell (non-breathing) insulation units by applying spray polyurethane foam insulation at edges and voids of each unit to form a tight seal. Fill voids in completed installation with spray foam as recommended by insulation manufacturer.

C. Install mineral wool-fiber blankets in cavities formed by framing members according to the following requirements:
   1. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

D. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
   1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

E. Install glass-fiber blankets in cavities formed by framing members according to the following requirements:
   1. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

F. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. Ft. (40 kg/cu. M).

3.05 PROTECTION

A. General: Protect installed insulation 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 immediacy after installation.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Water Resistive Barrier/Air Barrier – Sheet
   2. Water Resistive Barrier – Liquid Applied
   3. Liquid Applied Flashing
   4. Self-Adhesive Membrane Flashing

B. Related Sections:
   1. Section 07 20 00 – Building Insulation
   2. Section 07 62 00 – Sheet Metal Flashing and Trim

1.02 SUBMITTALS

A. General, submit in accordance with Division 01.

B. Membrane System Product Data: Provide current standard printed product literature indicating characteristics of membrane materials, flashing materials, components, and accessories product specification and installation.

C. Product Samples: Submit product samples of membrane and flashing materials showing color, texture, thickness and surfacing representative of the proposed system for review and approval by the Architect.

D. Submit sample copies of both the Manufacturer and Applicator warranties for the periods stipulated. Each specimen must be a preprinted representative sample of the issuing company's standard warranty for the system specified.

E. Submit copies of current Material Safety Data Sheets (MSDS) for all components of the work.

1.03 REFERENCES

A. National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual.

B. ACI-308 - Recommended Practice for Curing Concrete

C. ASTM - D638 - Test Methods for Tensile Properties of Plastics

D. ASTM - D4258 - Standard Practice for Surface Cleaning Concrete for Coatings

E. ASTM - D4259 - Standard Practice for Abrading Concrete

F. ASTM - D4541 - Method for Pull-Off Strength of Coatings using Portable Adhesion Tester

G. ASTM - E96(A) - Test Methods of Moisture Transmission of Material

H. ASTM E-108, ANSI/UL 790 for fire resistance.

I. International Concrete Repair Institute Guideline 03732 Concrete Surface Preparation

1.04 QUALITY ASSURANCE

A. Evaluate moisture content of substrate materials. Contractor shall determine substrate moisture content throughout the work and record with Daily Inspection Reports or other form of reporting acceptable to the Owner or designated Representative, and Membrane Manufacturer.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect WRB materials from physical damage and from deterioration by 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. Materials shall be delivered in original, unopened containers bearing name of manufacturer, product identification and reference to UL testing.

C. Store solvent-bearing solutions, resins, additives, inhibitors or adhesives in accordance with the MSDS and/or local fire authority.

1.06 WARRANTY

A. Manufacturer's Standard Warranty: Provide 10 year manufacturer's standard warranty under provisions of this section. This warranty provides for cost of labor and materials for loss of watertightness, limited to amounts necessary to effect repairs necessitated by either defective material or defects in related installation workmanship, with total expenditure limited to the original cost to the Owner.

B. Submit (2) executed copies of both the manufacturer and applicator warranties for the periods stipulated, starting from the date of substantial completion. Each warranty must be signed by an authorized representative of the issuing company.

PART 2 – PRODUCTS

2.01 MEMBRANE, SHEET

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Air-Infiltration Barrier (noted as "Water Resistive Barrier" on the drawings): Triple-layered heat-bonded polypropylene fabric sheets with a middle layer of spun-bonded polypropylene fabric, equal to VaproShield WrapShield Water-Resistive Vapor- Permeable Air Barrier Sheet.
   1. Referenced Standards:

a. AATCC 127 Test Method for Water Resistance: Hydrostatic Pressure Test
b. ASTM D 882 Test Method for Tensile Properties of Thin Plastic Sheeting
c. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials.
d. ASTM E 96/ E96 M Test Methods for Water Vapor Transmission of Materials
e. ASTM E 283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
f. ASTM E 21780 Standard Test Method for Air Permeance of Building Materials

2. Accessories:
   a. Fasteners to secure Wrapshield: Vapro Caps and bugle head screws.
   b. Sealant to seal vertical laps in the Wrapshield: Dow 758 sealant.

2.02 SHEET MEMBRANE FLASHINGS

A. "ICE AND WATER SHIELD" BY W.R. GRACE (SELF-ADHERING SBS MEMBRANE WATERPROOFING).
   1. For use with sheet metal roofing assembly only. Sheet membrane flashing not to be in contact with PVC roofing membrane or flashings.

B. Substitutions under provisions of Division 01 requirements.

2.03 WATER BASED PRIMER FOR RAW GYPSUM BOARD EDGES AT FLUID APPLIED WRB

A. Acceptable product: PROSOCO R-GUARD® GypPrime
   1. Substitutions under provisions of 01 25 00

B. Description: (for use with liquid applied flashing assembly) GypPrime consolidates and seals the cut edges of gypsum wallboards where they are exposed in rough openings for windows and doors. The sealed edge makes a compatible surface for easy application of R-GUARD Joint & Seam Filler fiber-reinforced fill coat and seam treatment for through-wall components. GypPrime brushes or sprays on easily and is usually dry in 30 minutes.

C. Characteristics:
   1. Form: milky blue liquid, mild odor
   2. Specific Gravity: 1.01
   3. pH: 8.5
   4. Weight per Gallon: 8.41 pounds
   5. Active Content: 18 percent
   6. Total Solids: 18 percent ASTM-D-2369
   7. Volatile Organic Content (VOC): less than 100 grams per Liter
   8. Flash point: greater than 212 degrees Fahrenheit (greater than 100 degrees Celsius) ASTM-D-3278
   9. Freeze Point: 32 degrees Fahrenheit (0 degrees Celsius)
   10. Shelf Life: 1 year in tightly sealed, unopened container

2.04 JOINT & SEAM FILLER FIRE REINFORCED FILL COAT AND SEAM FILLER AT FLUID APPLIED WRB

A. Characteristics:

1. Thickness: Apply according to manufacturer's instructions. See product data sheet.
2. Hardness: Shore A, 45-50 when tested in accordance with ASTM C661.
3. Water vapor permeability: Minimum 14 perms when tested in accordance with ASTM E-96.
4. Tensile strength: 225 psi when tested in accordance with ASTM D412.
5. Lap shear strength: 275 psi when tested in accordance with ASTM D1002.
6. Elongation at break: 275% when tested in accordance with ASTM D412.
7. Peel strength: 30 pli when tested in accordance with ASTM D1781.
8. Shrinkage: None.
9. Form: pale red, gun-grade sealant
10. Specific gravity: 1.40 to 1.50
11. pH: not applicable
12. Weight per gallon: 11.8 pounds
13. Active content: 99 percent
14. Total solids: 99 percent
15. Volatile organic content (VOC): 30 grams per Liter, maximum
16. Flash point: no data
17. Freeze point: no date
18. Shelf life: 1 year in tightly sealed, unopened container

2.05 LIQUID-APPLIED FLASHING MEMBRANE at fluid applied wrb

A. Acceptable product: PROSOCO R-GUARD® FastFlash®
   1. Substitutions under provisions of 01 25 00

B. Description: (for use with liquid applied flashing assembly) FastFlash® is a gun-grade waterproofing, adhesive and detailing compound that combines the best of silicone and polyurethane properties. This single component, 99% solids, Silyl-Terminated-Poly-Ether (STPE) is easy to gun, spread and tool to produce a highly durable, seamless, elastomeric flashing membrane in rough openings of structural walls.

C. Characteristics:
   1. Thickness: Apply according to manufacturer's instructions.
   2. Water vapor permeability: Minimum 14 perms when tested in accordance with ASTM E96.
   3. Water penetration (cyclical static air pressure difference): No uncontrolled water penetration when tested in accordance with ASTM E547.
   4. Hardness: Shore A, 40-45 when tested in accordance with ASTM C661.
   5. Tensile strength: 180 psi when tested in accordance with ASTM D412.
   6. Elongation at break: 400% when tested in accordance with ASTM D412.
   7. Peel strength: 25 pli when tested in accordance with ASTM D1781.
   8. Form: Brick Red, Gun Grade Sealant.
   9. Specific gravity: 1.45 to 1.60
   10. pH: not applicable
   11. Weight per gallon: 12.5 pounds
   12. Active content: 99 percent
   13. Total solids: 99 percent
   14. Volatile organic content (VOC): 30 grams per Liter, maximum

15. Flash point: no data
16. Freeze point: no data
    Shelf life: 1 year in tightly sealed, unopened container

2.06 FLUID APPLIED WATER RESISTIVE BARRIER SYSTEM

A. Fluid applied, waterproofing and air and water barrier membrane (for use over concrete substrates). Noted as 'Weather Resistive Barrier, Fluid Applied' on the drawings.

B. Acceptable product: PROSOCO R-Guard Cat 5.
   1. Substitutions under provisions of 01 25 00

C. Description: Cat 5® Air & Water-Resistive Barrier is a fluid applied, waterproofing and air barrier that combines the best of silicone and polyurethane properties. This single component, 98% solids Silyl-Terminated-Poly-Ether (STPE) is roller applied to produce a highly durable, seamless, elastomeric weatherproofing membrane on structural sheathing and back-up CMU walls.

D. Characteristics:
   1. Thickness: Apply in accordance with manufacturer's instructions. See product data sheet.
   2. Air infiltration: Less than 0.004 cfm per square foot (0.02 L/s/sq m) when tested in accordance with ASTM E2178 or ASTM E283.
   3. Water vapor permeability: Minimum 23 perms when tested in accordance with ASTM E96.
   4. Structural performance: Air and water-resistive barrier system shall withstand positive and negative wind pressure loading when tested in accordance with ASTM E330.
   5. Water penetration (static pressure): No uncontrolled water penetration when tested in accordance with ASTM E331, with differential static pressure not less than 6.24 psf.
   6. Water penetration (cyclical static air pressure difference): No uncontrolled water penetration when tested in accordance with ASTM D547.
   7. Hardness: Shore A, 20-25 when tested in accordance with ASTM C661.
   8. Tensile strength: 110 psi when tested in accordance with ASTM D412.
   9. Elongation at break: 300% when tested in accordance with ASTM D412.
   10. Peel strength: 30 pli when tested in accordance with ASTM D1781 or C794.
   11. Shrinkage: None.
   12. Form: adobe brown heavy liquid
   13. Specific gravity: 1.5 to 1.7
   14. pH: not applicable
   15. Weight per gallon: 13.312 pounds
   16. Active content: 98 percent
   17. Total solids: 98 percent
   18. Volatile organic content (VOC): 30 grams per Liter, maximum
   19. Flash point: greater than 200 degrees Fahrenheit (greater than 93 degrees Celsius)
   20. Freeze point: not applicable
   21. Shelf life: 1 year in tightly sealed, unopened container

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. All surfaces must be sound, clean and free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of the water resistive air barrier flashings. Fill voids, gaps in substrate to provide an even surface. Strike masonry joints full-flush.

C. Minimum application temperature self-adhered membrane flashings to be above 20 degrees F (minus 6.0 degrees C).

D. Ensure all preparatory Work is complete prior to applying primary water-resistive weather barrier membrane.

E. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing and fastened into solid backing.

3.02 SURFACE PREPARATION

A. Air, water-resistive and waterproofing membrane and accessories may be applied to green concrete 16 hours after removal of forms.

B. Refer to manufacturer's product data sheets for requirements for condition of and preparation of substrates.
   1. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions.
   2. Remove contaminants such as grease, oil and wax from exposed surfaces.
   3. Remove dust, dirt, loose stone and debris.
   4. Use repair materials and methods that are acceptable to manufacturer of the air and water-resistive barrier system.

C. Exterior sheathing:
   1. Ensure that sheathing is properly installed with ends, corners and edges properly fastened.
   2. Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing, fastened and spotted with Joint & Seam Filler and fastened into solid backing.
   3. Consolidate and seal the cut edges of gypsum wallboards exposed in rough openings with Gyp Prime for windows and doors at corners. The treated edge provides a suitable surface for application of Joint & Seam Filler fiber-reinforced coat and seam treatment.

D. Masonry and concrete substrates:
   1. Masonry head and bed joints should be fully filled and tooled.
   2. Mechanically remove loose mortar fins, mortar accumulations and protrusions, and debris.

E. Metal Studs:
   1. Cover knockouts in metal studs with flat stock sheet metal mechanically attached with pan head screws to provide substrate for the liquid flashing.

3.03 INSTALLATION OF JOINT TREATMENT (PREPARE):

A. Apply Joint & Seam Filler for seams, joints, cracks, gaps, primed rough gypsum edges at sheathing, rough openings:
   1. Fill or repair cracks larger than one-half inch.
   2. Fill surface defects and over driven fasteners with Joint & Seam Filler.
   3. Using a dry knife, trowel or spatula, tool and spread the product. Spread one inch beyond seam at each side to manufacturer's recommended thickness. See product data sheet.
   4. Allow to skin before installing other waterproofing or air barrier components.
   5. Apply in accordance with manufacturer's Application Guideline illustrations.

3.04 FLASHING AT WINDOWS, DOORS, OPENINGS AND PENTRATIONS (PREPARE):

A. Apply liquid flashing membrane over surfaces prepared with Joint & Seam Filler to seal and waterproof rough openings:
   1. Apply a thick bead of liquid flashing membrane over any visible gaps in the prepared rough opening.
   2. Immediately press and spread the wet product into gaps.
   3. Allow treated surface to skin.
   4. Starting at the top, apply a thick bead of liquid flashing membrane in a zigzag pattern to the structural wall surrounding the rough opening.
   5. Spread the wet product to create an opaque, monolithic flashing membrane which surrounds the rough opening and extends 4 to 6 inches over the face of the structural wall. Apply and spread additional product as needed to create an opaque, monolithic flashing membrane free of voids and pin holes.
   6. Apply additional product in a zigzag pattern over a structural framing inside the rough opening.
   7. Apply liquid flashing membrane within temperature and weather limitations as required by manufacturer.
   8. Apply liquid flashing membrane perimeters, sills and adjacent sheathing and building face, in accordance with manufacturer's product data sheet and R-GUARD Installation Guidelines illustrations.
   9. Extend flashing onto building face 4 to 6 inches.
   10. Install preparation products in accordance with manufacturer's Application Guideline illustrations.

3.05 AIR & WATER-RESISTIVE BARRIER INSTALLATION (PROTECT):

A. Apply appropriate air and water-resistive barrier to a clean, dry substrate (clean, dry, and/or damp substrates –waterproofing air-barrier membrane), within temperature and weather limitations as required by manufacturer.
   1. Apply to recommended thickness. Proper thickness is achieved when coating is opaque.
   2. Allow product to cure and dry.

3. Inspect membrane before covering. Repair any punctures, translucent or damaged areas by applying additional material.
4. Specifier Note: If air or surface temperature exceed 95 degrees Fahrenheit (35 degrees Celsius), apply to shaded surfaces and before daytime air and surface temperatures reach their peak.
5. On CMU wall construction back roll as necessary to ensure there are no pinholes, voids or gaps in the membrane. R-GUARD Cat 5® is roller applied.

3.06 FLASHING TRANSITIONS (TRANSITION)

A. Apply Joint & Seam Filler and liquid flashing membrane as a liquid flashing membrane to waterproof the transitions in rough opening and between dissimilar materials.
   1. Fill any voids between the top of the flashing leg and the vertical wall with Joint & Seam Filler. Tool to direct water from the vertical wall to the flashing.
   2. Apply a generous bead of liquid flashing membrane to the top edge of the flashing leg.
   3. Spread the wet products to create a monolithic “cap-flash” flashing membrane extending 2 inches up the vertical face of the structural wall and 1 inch over the flashing membrane. Apply additional product as needed to achieve a void and pinhole free surface. This “liquid termination bar” helps secure the flashing and ensures positive drainage from the wall surface to the flashing.
   4. Allow coated surfaces to skin before installing other wall assembly, waterproofing or air barrier components.

3.07 AIR AND WEATHER BARRIER SEALANT FOR WINDOWS AND DOORS INSTALLATION

A. Install sealant with professional grade caulking gun in continuous beads without air gaps or air pockets.
   1. Apply sealant to a clean, dry or damp surface
   2. Install Backer rod: Compressible, closed cell rod stock as recommended by manufacturer for compatibility with sealant. Provide size and shape of rod to control joint depth
   3. Install sealant to provide uniform, continuous ribbons without gaps or air pockets, with complete wetting of the joint bond surfaces.
   4. Tool sealant immediately to ensure complete wetting of joint bond surface and to produce a smooth, concave joint profile flush with the edges of the adjacent surfaces. Where horizontal and vertical surfaces meet, tool sealant to create a slight cove so as to not trap moisture or debris.
   5. Do not allow materials to overflow onto adjacent surfaces. Prevent staining of adjacent surfaces.
   6. Remove excess and misplaced materials as work progresses. Clean the adjoining surfaces to remove misplaced materials, without damage to adjacent surfaces or finishes.

3.08 SHEET PRODUCT WEATHER RESISTANT BARRIER INSTALLATION (WRAPSHIELD)

A. Install per manufacturer’s instructions taping and/or sealing all lap joints.

B. Apply sheet product horizontally, and in shingle fashion.

C. Where lapping liquid flashing over sheet membrane, sandwich sheet membrane between layers of liquid flashing.

D. Horizontal laps must be 6” minimum and sealed with Integral Tape at joint. Vertical laps must be 12” minimum and sealed with Dow 758 Sealant. Vertical laps are to be staggered a minimum of 24” and should not directly occur above or below windows or doors.

3.09 PROTECTION

A. Protect wall areas covered with primary water-resistive vapor permeable air barrier from damage due to construction activities, high wind conditions, and extended exposure to inclement weather.

B. Review condition of water-resistive weather barrier prior to installation of cladding. Repair, or remove and replace damaged sections with new membrane.

C. Recommend to cap and protect exposed back-up walls against wet weather conditions during and after application of membrane, including wall openings and construction activity above completed primary water-resistive weather barrier installations.

D. Remove and replace water-resistive vapor barrier permeable air barrier affected by chemical spills or surfactants.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specifications sections, apply to work of this section.

1.02 SUMMARY

A. The Contractor shall furnish all materials, components, accessories, labor, equipment, permits, and services to safely and completely remove the existing three-ply built-up membrane roofing system, polyisocyanurate insulation and tapered insulation crickets.

B. Following installation of roof curbs, install thermal barrier board, a new heat fused SBS vapor retarder membrane, followed by fiberglass faced polyisocyanurate rigid foam insulation (equaling R-38) fully adhered in three equal layers with joints staggered, and tapered polyisocyanurate insulation crickets, followed by one layer of gypsum roof board fully adhered, 3-ply Styrene-Butadiene-Styrene (SBS) polymer-modified asphalt membrane roofing and flashing system, torch applied, watertight and weatherproof, including all associated membrane and metal flashings.

C. Provide and install all required components and accessories as described in this Specification, related Specifications and illustrated in the Project Drawings. New, complete SBS roof system shall qualify for a 20-year Full System, No Dollar Limit, Manufacturer's Guarantee.

1.03 RELATED SECTIONS

A. Section 02 41 19 - Selective Demolition.

B. Section 06 10 00 – Rough Carpentry.

C. Section 07 62 00 - Sheet Metal Flashing and Trim.

1.04 SECTION INCLUDES

A. SBS modified bituminous membrane roofing

B. SBS modified bituminous membrane flashings

C. Fiberglass-faced polyisocyanurate rigid foam insulation flat and tapered stock

D. Factory primed, gypsum cover board and thermal board

E. SBS modified bituminous membrane vapor retarder

F. Polyester fleece reinforced, liquid applied PMMA flashing membrane system

G. Roofing Accessories and Incidentals

1.05 DESCRIPTION OF WORK

A. Extent of SBS modified bituminous low-slope roof system work is to be installed at Building 406 “The Brig” only as indicated on drawings and by provisions of this section, and is defined to include the installation of a new SBS modified bitumen membrane roofing system and the detailing of the membrane at all roof penetrations, edges, through-wall scupper drains, and mechanical equipment.

B. Demolition of existing roofing assemblies that consist of the following layers:
   1. At Metal Deck:
      a. 3-ply Built-up roof membrane adhered in hot asphalt
      b. 1.9" polyisocyanurate rigid insulation adhered in hot asphalt
      c. 2-ply felt vapor barrier
      d. 1.25” polyisocyanurate rigid insulation mechanically attached

C. The SBS modified roof membrane installation work as follows (listed from top ply down):
   1. Metal Deck - Roof Membrane Type 1:
      a. 1 ply SBS granular cap sheet - torch applied.
      b. 1 ply SBS interply – torch applied.
      c. 1 ply SBS base sheet – torch applied.
      d. Factory primed, fiberglass faced ¼-inch gypsum cover board – fully adhered.
      e. R-38 Polyisocyanurate rigid foam insulation board, fiberglass faced, three layers with staggered joints and tapered insulation crickets as shown in Project Drawings – all components fully adhered.
      f. SBS vapor retarder / temporary roof – torch applied
      g. ½-inch Thermal barrier board - mechanically fastened to existing steel deck.
   2. Membrane Base Flashings:
      a. 1 ply SBS top ply – torch applied.
      b. 1 ply SBS interply sheet – torch applied.
      c. Factory primed, fiberglass faced 1/2-inch gypsum cover board - mechanically attached to existing plywood or new wood curbs.
   3. New stainless steel through-wall scuppers

1.06 REFERENCED STANDARDS

A. Work shall conform, at a minimum, to the requirements of the 2015 Seattle Building Code derived from the 2015 International Building Code (IBC).

B. FMRC – Factory Mutual Research Corporation, Approvals Guide and/or RoofNav Approval(s) Data, Loss Data Sheets for Roofing Contractors, and other applicable FM standards and requirements.

C. Conform to the guidelines and recommendations of NRCA Roofing and Waterproofing Manual, and NRCA Architectural Sheet Metal and Roofing Manual (4th Edition, 1996, and/or 5th Edition, 2006, whichever is most conservative), published by the National Roofing Contractors Association (NRCA).

D. National Roofing Contractors Association (NRCA) Membrane Roof Systems, published in 2015, as applicable to styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.

E. The Asphalt Roofing Manufacturer's Association (ARMA) and National Roofing Contractors' Association (NRCA) Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing, published in 2004 or most current edition, as applicable to styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.

F. National Roofing Contractors Association (NRCA) Architectural Metal Flashing, Condensation and Air Leakage Control and Reroofing, published in 2014, as applicable to architectural sheet metal work.

G. Architectural Sheet Metal Manual, 7th Edition, Published 2012, Architectural Sheet Metal Manual (3rd Edition, 1979, and 5th Edition, 1993, whichever is most conservative), published by the Sheet Metal and Air Conditioning Contractors National Association (SMACNA), as applicable to architectural sheet metal.

H. Sealants: The Professionals' Guide, published by The Waterproofing & Restoration Institute (SWRI) 1995 or most current edition.

I. ANSI/SPRI ES-1, Most recent Edition, where coping and other cap flashing is being replaced with new sheet metal coping/cap flashing.

J. UL - Underwriters' Laboratories Building Materials Directory, for class-A-fire rated roof assembly.

K. ASTM Standards (Most current editions)
   1. ASTM A 153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   2. ASTM C 1177 / C 1177M (Most Current Edition) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
   3. ASTM C 1289 (Most Current Edition) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   4. ASTM C1396/C1396M (Most Current Edition) Standard Specification for Gypsum Board.
   5. ASTM D 36 / D 36M (Most Current Edition) Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus).
   6. ASTM D 41 (Most Current Edition) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
   7. ASTM D 312 (Most Current Edition) Standard Specification for Asphalt Used in Roofing.
   8. ASTM D 1621 Standard Test Method for Compressive Properties of Rigid Cellular Plastics
   9. ASTM D 3746 Standard Test Method for Impact Resistance of Bituminous Roofing Systems
   10. ASTM D 4586 Standard Specification for Asphalt Roof Cement, Asbestos-Free
   11. ASTM D 4601 (Most Current Edition) Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing.

12. ASTM D 5147 (Most Current Edition) Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material.
13. ASTM D 6162 (Most Current Edition) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.
14. ASTM D 6163 (Most Current Edition) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
15. ASTM E 84 (Most Current Edition) Standard Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E 108 (Most Current Edition) Test Methods for Fire Tests of Roof Coverings.
17. ASTM E 119 (Most Current Edition) Standard Test Methods for Fire Tests of Building Construction and Materials.
18. ASCE-7 (Current Edition) – Minimum Design Loads for Buildings and Other Structures.
19. ANSI/SPRI, WD-1 (Most Current Edition) – Wind Design Standard Practice for Roofing Assemblies.
20. LTTR – Long Term Thermal Resistance, of polyisocyanurate roof insulation, as tested and passed using techniques from CAN/ULC S770 based on ASTM C1303.

L. Manufacturer’s Roofing Specification.

1.07 DEFINITIONS

A. Roofing Terminology: definitions in ASTM D 1079 and glossary of NRCA’s “The NRCA Roofing and Waterproofing Manual” apply to work of this Section.

1.08 QUALITY ASSURANCE

A. Prior to the work, the Contractor, as an authorized applicator, shall ascertain to his satisfaction that all aspects of these Specifications are workable as specified and that none conflict with the manufacturer's requirements for a twenty (20) year guarantee for low-slope SBS membrane roofing system portion of work. Upon commencement of the work, it will be presumed that these Specifications are satisfactory to both the Contractor and the Manufacturer in their entirety.

B. Dimensions, as contained in these Specifications or as scaled from the Detail Drawings shall be presumed to be approximate. In the event that site conditions uncovered during the work require modification to, or alteration of those dimensions to accomplish the work in accordance with the intent of these Specifications, the Contractor shall make the adjustments as required to comply with that intent.

C. Manufacturer Qualifications: Provide primary products, produced by a single manufacturer, which has produced that type product successfully for ten (10) years or more. Provide secondary products only as recommended by manufacturer of primary products for use with roofing system specified.

D. Manufacturer Field Quality Control: A technical representative of the materials manufacturer shall be available for consultation at site with a maximum of 24-hour notice.

E. Installer Qualifications: A single Installer ("Roofer") shall perform the work of this section; and shall be a firm with a minimum of 5 years of experience in installation of modified bitumen roofing systems similar to those required for this project and which is acceptable to or licensed by manufacturer of primary roofing materials.

F. Installer shall provide sufficient personnel trained in the application of the materials and systems and shall maintain supervision as specified elsewhere.

G. Testing: The Owner reserves the right to perform any testing as may be required to determine compliance with these Contract Documents. Costs for such testing will be the Owner's responsibility unless testing indicated non-compliance. Costs for such testing indicating non-complying work shall be corrected and testing will be repeated until the work complies with the Contract Documents.

H. FM & UL Listing:
   1. Provide insulated, polymer modified bituminous sheet roofing and flashing system, all associated components and materials that have been tested for application on slopes indicated and are listed by Factory Mutual Global (FM) and Underwriters' Laboratories, Inc. (UL) for Class A resistance to fire.
   2. Provide roof-covering materials bearing FM approval, and UL classification, markings on bundles, packages, or containers indicating that materials have been produced under FM and UL's classification and follow-up services.
   3. Provide polymer-modified asphalt sheet roofing system installed to comply with FM requirements for Class A fire resistance, FM 1-120 wind-uplift resistance, and FM's required hail resistance.

1.09 FIELD QUALITY CONTROL

A. Pre-Application Roofing Conference: Approximately two weeks prior to scheduled commencement of SBS low-slope roofing installation and associated work, a meeting at project site with Installer (Contractor) for each component of associated work, and other work in and around roofing which must precede or follow roofing work (including mechanical work, if any), Engineer, Consultant, Owner, roofing system manufacturer's representative, insulation adhesive manufacturer's representative, and other representatives directly concerned with performance of the work including (where applicable) Owners, insurers, test agencies, and governing authorities. Engineer will record discussions of conference and decisions and agreements (or disagreements) reached with process discussed to rectify disagreements. A copy of record will be furnished to each party attending. Meeting will consist of a review of foreseeable methods and procedures related to roofing work, including but not necessarily limited to the following:
   1. Tour representative roof areas, inspect and discuss condition of substrate, through-wall scupper drains, curbs, penetrations and other preparatory work performed by other trades.
   2. Review required submittals, both completed and yet to be completed.
   3. Review and finalize construction schedule related to roofing work and verify availability of materials, Installer's personnel, equipment and facilities needed to make progress and avoid delays.

4. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

B. General:
   1. Any deviation from the cleaning, installation, testing, and certification requirements herein shall be approved in writing by the Engineer.
   2. All materials and workmanship shall be subject to inspection and examination by the Engineer at any place where fabrication or erection occurs.
   3. The Engineer reserves the right to reject all or any part of the system that does not conform to the requirements herein. Rejected materials or equipment shall be returned at the Contractor's expense for re-cleaning and certification.
   4. The Engineer reserves the right to remove random samples of the installed work sufficient to establish the quality of materials and workmanship. If such samples indicate materials and workmanship do not meet the contract specification, the Contractor shall be required to replace or re-clean the installed work at no expense to the Owner. The Owner shall reimburse the Contractor on a time and materials basis for such work if the system proves to be installed to specification.
   5. All testing shall be done in the presence of the Owner Representative.
   6. Upon completion of this work, all systems shall be adjusted for use. Should any piece of apparatus or any material or work fail in any of the required tests, it shall be immediately removed and replaced by new materials. The defective portion of the work shall be replaced by new materials. The defective portion of the work shall be replaced by the Contractor in the presence of the Owner at no expense to the Owner.
   7. Test gauges shall be installed and test medium source connections shall be made to convenient process connections over a twenty-four hour (24 hr.) period in the roof drainage system. After completion of testing, the gauges and source connection shall be removed and the specified process attachments replaced.
   8. Any leaks found shall be repaired in the following manner:
      a. Welded joint – grind out defect and re-weld.
      b. Brazed joint – cut out and re-braze.
      c. Plastic joint – remove/re-weld.
      d. Screw joint – taken apart and re-do (do not use compound).

C. Test Preparation:
   1. Clean new through-wall scupper drains and existing leaders by flushing prior to application of leak test.
   2. Thoroughly flush piping with water under pressure, clear of foreign matter, and then drain before proceeding with testing.
   3. Leaks and Defects:
      a. Repair or replace as directed.
      b. Repair damage caused by test failure without additional cost.
      c. Retest repaired and/or damaged systems until test are accomplished successfully.
   4. Notify Engineer in writing one week before test.
   5. Maintain a log book of all tests showing dates, personnel performing test, test observer, and test results.
   6. Furnish written report and certification that tests have been satisfactorily completed.

D. On-Site Application Observation/Monitoring: The Owner reserves the right to retain a

Project Roof Consultant to perform observation/monitoring or special inspection of the roofing application. Such inspection will not relieve the Installer of responsibility for proper execution and completion of the work. The Application Monitor shall:

1. Perform application observation/technical monitoring to assist the Owner, by monitoring the quality and progress of the work performed by the Contractor(s), in general to see that the work is in compliance with the project specifications and Detail Drawings.
    a. Prepare Field Reports, documenting the progress of the work and any problems encountered with the work along with suggested solutions. Field Reports shall be distributed to Owner, Engineer, as well as Contractor(s).
2. Conduct a Pre-Completion Survey for the purpose of preparing a punch list of any outstanding items that need attention or correction.
3. Conduct a Completion survey with the Engineer to verify the punch list items are resolved.

1.10 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, installation instructions and recommendations for each type of roofing, roofing accessory and insulation. Include data substantiating that materials comply with requirements.

B. Approvals: Provide written certification from manufacturer of roofing system, stating that Installer is approved by manufacturer for installation of specified roofing system prior to bid.

C. Submit manufacturer's MSDS sheets for all products

D. Samples: Three (3) 12 x 12 inch samples of each sheet component of the roofing and flashing membranes and samples of fasteners.

E. Warranty: Copy of proposed warranties from the roofing membrane manufacturer.

F. Evidence of UL or other certified testing agencies and I.C.B.O. approvals.

G. Shop Drawings and Specifications: Describe all proposed details, which deviate from what is shown on plans with clear fully noted and drawn to scale details referenced to a roof plan (3 copies). Provide shop drawings where intent is shown in Project Drawings, but not all locations are depicted (i.e. Transition Saddles, etc.) Three copies of manufacturer's complete specifications.

1.11 JOB CONDITIONS

A. Weather Condition Limitations: Roofing materials shall not be applied when water in any form, i.e., rain, dew, ice, frost, snow, etc., is present on substrates.

B. Roofing Loading Limitations: Contractor shall not load or permit any part of the work to be loaded so as to endanger its safety or damage the roof deck. Do not exceed the design loads.

1.12 PROTECTIONS

A. Provide tarps or plastic sheeting, as required, to adequately protect opened roofs and flashings and to prevent entrance of moisture or rainwater into the existing structure until new materials have been applied and roof is in a watertight condition.

B. Do not open up any more roof surface at one time than can be adequately covered and protected in the event of sudden unexpected rainfall.

C. Have waterproof canvas or plastic sheeting readily available in case of emergency. Contractor will be held liable for any damage to building interior due to his negligence.

D. Deliver materials to job site in sealed, undamaged, original containers imprinted with manufacturer's name, product name, and pertinent identifying numbers or markings.

E. Protect from damage all exterior lighting, landscaped and paved areas.

F. All surfaces to receive new membrane or flashing shall be thoroughly dry. Should excessive surface moisture occur, the Contractor shall provide the necessary equipment to dry the surface prior to application.

G. All new and temporary construction, including equipment and accessories, shall be secured against wind blow-off or damage.

H. The Contractor shall provide all necessary protection and barriers to segregate the work area and to prevent damage to adjacent areas.

I. Prior to and during application, all dirt, debris, and dust shall be removed from surfaces either by vacuuming, sweeping, blowing with compressed air and/or similar methods.

J. All roofing, insulation, flashings and metal work removed for construction shall be taken off the site to a legal dumping area for disposal daily.

K. Temporary Fire Protection
   1. Comply with all governing laws, codes and regulations to maintain required protection at all times. Conduct operations in manner that is fire-safe for the work area and adjacent areas. Proper fire extinguishers shall be provided, identified and maintained. The premises shall be maintained clear of rubbish, debris, or another materials constituting a potential fire hazard. A proper fire separation shall be maintained.
   2. The following fire prevention procedures are required:
      a. 1 Hour minimum fire watch after the completion of day’s torch/heat welded roofing work.
      b. Provide two fire extinguishers (1A 40 BC) in the work areas for each torch in use.
      c. Maintain a charged ¾” water hose that will reach all work areas.
   3. Where significant or continued non-compliance with fire safety is noted, the Owner reserves the right to stop the work at no extra cost or extension of time pending remedial action. Furthermore, the Contractor shall be responsible for, and reimburse the Owner as appropriate, any fines or penalties levied by the Fire Department.

1.13 WARRANTIES

A. Contractor's Warranty Agreement: Submit two (2) executed copies of standard five-year "Roofing Guarantee" on form included at end of this section, covering work of this section including roofing membrane, flashings, roof insulation, sheet metal, and roofing accessories, signed and countersigned by Installer (Roofer) and Contractor.

B. For a five-year period from the date of Physical Completion, Contractor agrees to inspect and make necessary repairs to defects or leaks in the roof field and flashings. Emergency leaks will be attended to within twenty-four (24) hours from receipt of notice from the Engineer. As soon as weather permits, Contractor will restore affected areas to standards of this contract without voiding the manufacturer's guarantee and repair any damages from these leaks without cost to the Owner, except for leaks caused by abuse to roof by others or by abnormal weather conditions such as lightning, severe hail, or other unusual climactic phenomena. This Guarantee shall be submitted to the Engineer in writing and approved before final payment is released for the project.

C. Roof Membrane Manufacturer's Guarantee: Full-System, No-Dollar-Limit (NDL) Guarantee shall be issued so that the Manufacturer shall repair any and all defects, leaks, and/or other issues and problems for a minimum period of twenty (20) years commencing with the date of substantial completion.

D. Manufacture’s Guarantee document issued shall be the original, with all required corporate signatures and affixed embossed corporate seal. Copies of same shall be issued to the Project Engineer, Project Building Envelope Consultant, and the Owner’s Facilities & Maintenance Department.

E. The Guarantee shall be executed by manufacturer to cover all costs for repairs necessary to stop leaks which occur as a result of, but not limited to, the following:
   1. Deterioration of the roofing membrane or base flashing system resulting from ordinary wear and tear by the elements.
   2. Workmanship on the part of the Approved Roofing Contractor in application of the roofing membrane or base flashing system.
   3. Blisters, fishmouths, bare spots, ridges or wrinkles in the modified bitumen roof.
   4. Splits or cracks in the modified bitumen roofing not caused by structural movement.
   5. Slippage of the roofing membrane or base flashing.

F. If within 24 hours after notification of roof leakage Contractor has not responded, Owner shall have the right, without invalidating his Guarantees and at the expense of the Contractor, to make any emergency repairs that are required in order to protect the building and contents from damage due to roof leakage.

G. Should roof samples be required by manufacturer, and if for any reason deficiencies are found within the samples, Contractor will at his expense, make repairs as necessary to correct deficiencies and satisfy manufacturer's requirements.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

A. Provide materials complying with governing regulations, and which can be installed to comply with the following:
   1. Certified Laboratories and ICBO approved for a Class "A" rating. Provide documentation.
B. Warranty Requirements: Roof membrane manufacturer must approve the use of all accessory materials and include them in their Guarantee.

C. Source Limitations: Obtain components including roof insulation, roof membrane, membrane flashings, and polyester-fleece fabric reinforced PMMA for roofing system from same manufacturer as membrane roofing. Contractor shall furnish compatible and Manufacturer approved fabric-reinforced PMMA products for roof system manufacturers' that do not include PMMA based products in their product line.
D. Substitutions will be considered only after the award of contract. The Engineer will be the sole judge of what qualifies as "equal". To be approved as an "equal" system submit or respond to all items in "Quality Assurance" and "Submittal" sections of this specification. All submittals must be received in the Engineers office a minimum of ten (10) calendar days prior to bid.

2.02 SBS MODIFIED ROOF SYSTEM AND ADDITIONAL PRODUCTS

A. Approved Manufacturers:
   1. Siplast Inc.
   2. Soprema Inc.
   3. Or approved equal.

B. The SBS modified roof membrane work as follows (listed from top ply down):
   1. 1 ply SBS granular capsheet - torch applied
      a. Paradiene 30 FR TG
      b. Elastophene Flam FR GR
      c. Project Approved Equal
   2. 1 ply SBS interply – torch applied
      a. Paradiene 20 TG
      b. Elastophene SP 3.0
      c. Project Approved Equal
   3. 1 ply SBS base sheet – torch applied
      a. Paradiene 20 TG
      b. Elastophene SP 3.0
      c. Project Approved Equal
   4. 1/4" Cover board, fully adhered
      a. Densdeck Prime
      b. Project Approved Equal
   5. Crickets: Tapered polyisocyanurate rigid foam insulation, fiberglass faced to properly counteract existing built-in slope and direct water to the drains as

indicated. Set in Low-rise Polyurethane adhesive.
   a. Hunter Tapered H-Shield CG as manufactured by Hunter;
   b. Sopra-Iso Insulation Tapered as manufactured by Soprema;
   c. Paratherm Tapered Insulation as manufactured by Siplast;
6. R-38 polyisocyanurate rigid foam insulation, fiberglass faced, three layers with joints staggered, with no panel being greater than 2.4-inches in thickness or as required by membrane manufacturer. Each layer to be adhered in Low-rise Polyurethane adhesive.
   a. Hunter H-Shield CG as manufactured by Hunter;
   b. Sopra-Iso Plus as supplied by Soprema;
   c. Paratherm as supplied by Siplast;
7. Vapor retarder membrane ply, torch applied and/or heat welded:
   a. Irex 40
   b. Elastophene SP 3.0
   c. Project Approved Equal
8. 1/2” Factory primed, fiberglass-faced gypsum thermal barrier board, screw and 3”-plate fastened:
   a. Densdeck Prime
   b. Project Approved Equal

C. Membrane Base Flashings: Wood framed parapet and rising walls (Listed from Outside (Exposed)-to-in)
   1. 1 ply SBS top ply, torch applied and/or heat welded
      a. Parafor 30 TG
      b. Sopralene Flam 180 FR GR
      c. Project Approved Equal
   2. 1 ply SBS interply sheet – torch applied and/or heat welded
      a. Paradiene 20 TG
      b. Elastophene SP 3.0
      c. Project Approved Equal

2.03 MISCELLANEOUS ROOF MATERIALS

A. General Purpose Asphalt Roof Cement: Cut-back flashing cement compound fortified with non-asbestos fibers, fillers, and solvents and manufactured per ASTM D 4586, Type III;
   1. PA 1021 plastic roof cement as manufactured by Siplast;
   2. Sopralastic 110 plastic roof cement as manufactured by Soprema;
   3. Project Approved Equal

B. Vertical Surface Asphalt Roofing Cement
   1. PA-828 flashing cement as manufactured by Siplast
   2. Sopralastic 111 plastic roof cement as manufactured by Soprema;

C. Primer: Asphalt primer to comply with ASTM D-41
   1. PA 1125 Primer
   2. Elastocol 500 primer
   3. Project-Approved Equal.

D. Low Rise Polyurethane Foam Adhesive
   1. Olybond 500 Bag-in-Box Insulation Adhesive
   2. Soprema, Duotack Bag-in-Box Insulation Adhesive

E. Cant Strips:
   1. Provide new No. 2 or better Douglas Fir or Hem/Fir wood cant strip, cut at 45-degree angle, with 3-inch minimum face. Provide dry (14% max moisture content) and fully adhere in low-rise foam adhesive or fasten with approved expanding lead nail-in and/or screw fasteners. Heads to be countersunk to level plane of cant strip face.

F. Lead Flashing: ASTM B 749, Type L51121, copper-bearing sheet lead, minimum 4 lb/sq. ft (0.0625-inch thick) except not less than 6 LB/sq. ft (0.0937-inch thick) where welding is indicated.

G. Mineral Granules: Loose mineral granules same color as granular surfaced cap sheets.

H. Continuous Termination Bar: Aluminum, .125” x 1” x 120”, with 4-inch hole spacing.

I. Walkpad: walkway is made up of a non-woven polyester reinforcement and elastomeric bitumen. The upper face is covered with contrasting colored granules to roof field. The underside is lightly sanded. Walk pad is heat fused, in a spot application.
   1. Paratread walkway membrane as manufactured by Siplast
   2. Soprawalk walkway membrane as manufactured by Soprema
      a. Traffic panels are to be a contrasting color to the primary field of the roof to allow for differentiation.

J. Wood Members: Comply with requirements of Section 06 10 00 – Rough Carpentry

K. Sheet Metal Flashings: Comply with requirements of Section 07 62 00 – Sheet Metal Flashings.

L. Sealants: Comply with requirements of Section 079200 – Joint Sealants

2.04 MISCELLANEOUS ROOF SYSTEMS PRODUCTS

A. Wood Surfaces:
   1. Provide Manufacturer’s required self-adhering SBS membrane base membrane flashing over wood surfaces, which are pre-primed with specified Manufacturer required primer. Use of Hot-air welder to promote full adhesion is allowed. **NO TORCHES OF ANY KIND ARE TO BE USED IN DIRECT EXPOSURE TO WOOD OR OTHER FLAMMABLE MATERIAL.**

B. Sacrificial Plies:
   1. At Roof Locations/Areas Revealing Potential Signs of Being Low-Lying or Depressions Where Minor Water (i.e., “bird bathes”) Could Collect: Provide additional ply(s) of custom cut, specified, smooth-surfaced, SBS polymer-modified asphalt interply membrane sheets, each layer fully-adhered, at locations determined by Manufacturer’s Representative to alleviate collection of water.

2. At Roof Areas Surrounding Discharge of Cooking Grease and/or Animal Fats: Provide additional three (3) side-by-side courses (approximately 9-feet in area width) of System Compatible Aluminum clad membrane sheet, each layer fully-adhered, on all four sides of any kitchen exhaust or other ventilators that may exhaust contaminate onto the new roof membrane.

C. Nighttime Water Cut-offs at New Roof Membrane-to-Existing Deck and Tie-Off onto New Roof Membrane:
   1. Manufacturer's Compatible Asphalt Roof Cement and Base Sheet: With up-slope seam stripped in with specified asphalt-saturated cotton or polyester fabric and Specified asphalt roof cement or Project-Approved equal submitted through the Substitution Request and Approved by the Engineer.

D. Asphalt-Impregnated Cotton Reinforcing Fabric:
   1. Acceptable Manufacturer and Product: APOC®, "550 Asphalt Saturated Cotton" or Project-Approved equal submitted through the Substitution Request and Approved by the Engineer.

E. Fire Extinguishers: Provide specified minimum of five fully charged Type 10 ABC-rated fire extinguishers on the roof at location of work and three extinguishers of same specifications at hoisting area.

F. Hot-Air Welders: (Optional to hand-held propane-fueled roofing torches) Hand-Held Electron, 110 volt 34 watt 70 x 2 mm nozzle and/or automatic Verimat 107.49 with a 100 mm tip, both manufactured by Leister, Inc. or equal.

PART 3 – EXECUTION

3.01 GENERAL

A. Materials and methods used for roof and flashing project shall comply with these Contract Documents, Manufacturers' published recommendations, reference standards and best industry practice. Any conflict or disagreement between the reference standards, Specifications, and/or Drawings shall be brought to the attention of the Engineer for direction prior to submissions/bids, and performing any work. Generally, decisions rendered may be based on the strictest of the conflicting item(s), document(s) and/or standard(s).

B. Safety Precautions: Take all necessary safety precautions to protect Owner premises, staff, public, and workmen from any and all hazards related to this project. Safety precautions include, but are not limited to, the proper type and number of fully charged fire extinguishers, signage to warn of hazards, trained personnel to operate extinguishers, safety barricades, safety fences, early warning lines, required safety meetings, and "Fall Protection Work Plan".

C. Do not apply roofing unless correct insulation adhesive application temperatures can be maintained.

D. To avoid displacement of asphalt and interply voids, ensure that no heavy objects are placed on the membrane including walking on or over freshly laid plies. Work on plies from the side or in front of the roll while heat-welding.

3.02 FIELD MEASUREMENTS

A. Roofing Contractor shall verify all measurements, locations, areas, and conditions for material quantities, sizes, and coverage rates. If measurements differ substantially, request direction from the Engineer.

3.03 ENVIRONMENTAL REQUIREMENTS

A. Application of roofing materials shall not be performed when weather conditions interfere with good application practices. Materials shall not be stored or applied on wet or damp surfaces or in the presence of dew or precipitation (e.g., rain or snow). Any roofing materials applied under such adverse conditions would only be to protect applied insulation, building and/or surfaces; materials that have been exposed to adverse conditions shall be removed before application of the roof system continues, and shall not be incorporated into the finished roof.

B. Generally, the ambient temperature shall be 40º F minimum and rising during the application of roofing system materials. Do not apply adhesive-adhered (i.e., non-heat fused) materials when ambient and on-roof temperatures are within 5 degrees of the dew point. For specific requirements for cold weather roofing, see Manufacturer's cold weather application instructions and acquire approval from the Engineer for proposed procedures.

C. Ventilation and Discharge Protection: The Contractor shall perform his/her work with appropriate ventilation, and equipment to arrest discharge into the atmosphere, so as any smoke, dust, debris, or other air contaminants are not in violation of the air-quality laws, rules, and/or regulations of the governmental entities having jurisdiction.

D. Control of Spills and/or Fugitive Liquid Materials: Contractor shall provide all necessary equipment and materials and experienced personnel for controlling, capturing and containing any spills and/or fugitive fluid related materials during storage, transporting, and application of such materials while on-site.

E. Installed materials shall be protected from repetitive Contractor traffic with traffic panels/pads, plywood or other rigid materials, well ballasted and suitable for temporary on-roof use. Unfinished perimeters of the roof system shall be sealed and fully protected with temporary water cutoffs and nighttime seals made watertight at end of work shift and for days where work will not be performed. No organic felts shall be used in constructing temporary cutoffs, and membrane cutoffs shall be removed before the application of next sequential ply and finished assemblies.

F. Contractor shall coordinate Work under Section 01 50 00 Temporary Facilities and Controls with the Owner and building maintenance personnel prior to start of any tear-off and reroofing work.

3.04 GENERAL TEAR-OFF AND DISPOSAL

A. Tear-Off and Handling:
   1. Complete tear-off of existing roof membrane, insulation and associated adhesive, membrane base and wall flashings, and select sheet metal flashings to expose the underlying roof decking, curbs, select parapet walls, and perimeter blocking, etc.
   2. Tear-off shall not proceed when moisture is present, or if rain or other moisture source, or high-winds, are present or expected.
   3. Tear-off shall not proceed prior to coordination of interior protection work with Owner and building occupants.
   4. Care shall be exercised during tear-off to not exert excessive force, particularly hard pounding and dropping of heavy materials, which may cause interior or substrate damage.
   5. Tear-off and installation of new SBS polymer-modified asphalt membrane roof system, up through the new interply membrane in the areas where roof removal has taken place shall be completed in the same day, with perimeter edges flashed, fully adhered, sealed and nailed off or secured, watertight and protected from the weather. Contractor to coordinate daily roof system installation to allow for positive drainage of water to open and free-flowing roof drains. Contractor is to avoid blocking and/or impeding the flow of water drainage due to roof system installation progress.
   6. A pathway equal to eight (8) feet in width shall be constructed using protective layer (i.e. extruded polystyrene insulation covered in plywood or OSB to protect all existing roofing scheduled to remain and completed areas of new roof, where transportation or staging (landing)of materials is to occur (e.g. new or torn-off materials).
   7. All debris from roofing, flashing, and select cladding demolition shall be carefully removed from roof and immediately deposited, using a well secured, enclosed trash chute, routed into appropriate trucks or containers, which shall be removed from the premises and disposed of in a lawful manner. No overnight stockpiling of debris on the roof shall be permitted.
   8. Prevent materials from entering and clogging roof drains using clean rags or expanding roof-drain plugs. Remove roof-drain plugs (rags) at end of each shift or workday and when no work is taking place, and when precipitation is forecast or imminent. All roofs shall be left in watertight, well secured and positive draining condition at cessation of each day’s work.
   9. Contractor shall carefully protect (e.g., with breathable tarpaulins and/or plywood, etc.) walls, fences, shrubs, and other items that could be scratched, scared, or otherwise damaged by removal of debris from roof.
   10. Contractor shall carefully clean adjacent walls, sidewalls, structures, improvements, and grounds of debris caused by tear-off roofing and/or operations. Leave roof, grounds, sidewalks, and parking lot clean and free of debris, including fasteners related to the roofing work, at the end of each workday. Where necessary, use a rolling bar magnet to roll over the sidewalks and parking lot so vehicles do not incur a flat tire and no injury occurs.

B. Disposal:
   1. Carefully remove demolished roofing (i.e., tear-off) from site daily and dispose of legally. Do not store, burn or bury demolished materials on site.

2. Maintain tear-off area(s), grounds, and hauling routes clean and free from demolition materials.

3.05 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:

3.06 PREPARATION

A. Notify the Engineer for an inspection of substrates before covering.

B. Substrate shall be clean and dry, smooth, free of fins, sharp edges, existing nails and loose foreign materials. Repair deck deficiencies, and prepare any deck defects prior to application of new roof system.
   1. Verify the condition of the existing steel decking and repair areas of corroded, degraded decking per Section 05 30 00 “Steel Deck” including:
      a. Roofing Contractor shall thoroughly examine steel roof deck panels, which roofing system is to be applied over, in order to inspect, discover and mark panels revealing signs of rust/corrosion, deterioration, degradation, deformation or other detrimental condition(s).
   2. Lightly rusted, but sound panels shall be cleaned, prepared, primed, and painted/coated prior to commencement of roofing work.

C. 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 and when rain is forecast.

3.07 INSTALLATION, GENERAL

A. Comply with roofing system manufacturer's written instructions and these specifications.

3.08 REPLACEMENT OF WOOD BLOCKING AND NAILERS OR SUPPORTS

A. Carefully repair and/or Replace dimensional lumber used for blocking, nailers, supports, or portions thereof, that are determined to be decayed or deteriorated beyond suitability for their intended purpose shall be replaced with new lumber as specified.

B. Verify that wood blocking and nailers are securely fastened with no loose or degraded fasteners and with no adjacent blocking or nailers in excess of ¼-inch out of plane.

C. No. 2 and Better-Grade Douglas Fir shall be used for curb replacement or construction, including nailers. Fasten at 12-inches on center minimum, stagger pattern so as not to split wood. Countersink fastener heads flush with surface of wood to leave smooth surface for roofing and flashing.

D. New and existing wood nailers must be firmly fastened to the deck or building, and comply with ANSI/SPRI ES-1 “Wind Design Standard for Edge Metal Systems Used with Low Slope

Roofing Systems". (Sheet metal edge terminations, such as parapet copings must meet the current International Building Code (IBC), which states: Provide and install copings and roof edge flashings tested and complying with ANSI/SPRI ES-1, "Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems".)

E. Approval to Proceed with Work: Contractor shall notify the Engineer and they will review nailer condition where encountered, prior to the Contractor beginning membrane installation under this Section in affected areas

F. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place. Inspect, repair, and replace drain components to allow for reuse of existing drains. Existing curbs shall be retrofit to extend the height of the curb, as required, to accommodate the new insulated roofing system.

3.09 SUBSTRATE (Thermal Barrier) BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions and Project-specific requirements.
   2. No board edges shall extend over flutes without support, trim as necessary to assure all gypsum boards are supported by 50-percent of the metal deck ribs.
   3. Thermal boards to be extended up walls and curbs where torch applied materials are to be heat-welded

3.10 VAPOR-RETARDER INSTALLATION

A. General:
   1. Compliance: Comply with the membrane Manufacturer's instructions and these specifications for installation of vapor retarder.
   2. Thoroughly Cleaned Substrate Surface: Thoroughly sweep or compressed air blow-off surface of thermal barrier board to remove shavings, dust, all particulate and any other contaminants that may prohibit full primer application and smooth, fully adhered application of vapor retarder.
   3. Substrate Primer Application:
      a. Metal Roof Decks: Install specified fiberglass-faced gypsum thermal barrier board over properly repaired metal roof deck substrates. Prior to vapor retarder installation remove all dust and debris from gypsum surface by sweeping or blowing (i.e., with leaf blower).
   4. At all Roof Plumbing and Electrical Penetrations: Prior to installation of vapor retarder, install target plies of Project specified base sheet in asphalt roof cement, tightly fitted around all mechanical, plumbing and electrical conduit openings. Seal target ply-to-protrusion intersection with a fillet bead of asphalt roof cement, as illustrated in applicable Project Drawings, to prevent asphalt adhesive and/or flame from the heat-fusing equipment from entering the interior spaces below.
   5. Fully-Adhered Installation with Progressive Repairs: All vapor retarder sheets shall be installed free of voids/air pockets, wrinkles, buckles, fishmouths, tears and/or other

defects. Repair all fishmouths, wrinkles, buckles, blisters, and areas of defect and/or membrane damage such as tears, prior to application of the next sequential course of vapor retarder.

B. Installation of Vapor Retarder:
   1. Install vapor retarder in full (i.e., 39⅜-inch) width sheets. Lap each succeeding sheet not less than 3-inches at side seams, and not less than 6-inches at end laps. Offset end laps at least 36-inches apart.
   2. Applicator shall work from the side or in front of the roll being applied to avoid displacement of molten modified asphalt. All plies shall be broomed and seams rolled.
   3. Rolls of vapor retarder shall be unrolled and allowed to "relax" prior to installing. Starting at the low point in the roof, vapor retarder shall be installed perpendicular to the slope over the underlying gypsum thermal barrier-board substrate with propane-fueled roofing torches or hot air welding equipment. All vapor retarder sheets shall extend a minimum of 2-inches above the calculated top edge of cant strip at vertical wall and curb surfaces, and at select locations, such as horizontal expansion joint curb intersections. Vapor retarder shall envelope the roof insulation and coverboard as illustrated on Project Drawings.

C. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into new roofing system.

3.11 INSULATION INSTALLATION

A. General:
   1. Comply with specified roof insulation Manufacturer's instructions and published recommendations for storage, handling, installation, and adhering/bonding and anchorage of flat stock and tapered roof insulation to underlying substrates as well as these specifications.
   2. Install tapered insulation under area of roofing to conform to slopes indicated.
   3. Stagger the joints of each layer of roof insulation the maximum distance possible from the joints in the underlying layer of roof insulation.
   4. Full and cut portions of roof insulation boards shall be fit snug and neat, free of damage and not more than ¼-inch from all penetrations through the roof deck. Gaps shall be filled with polyurethane foam with over flow trimmed to provide an in plane surface.
   5. Flat stock and tapered roof insulation materials, including gypsum coverboard panels that have become damp, wet, or degraded in storage or during handling shall not be installed nor used in finished roof system. Roof Insulation and/or coverboard panels that have become damp, wet or damaged after installation shall be removed and replaced with new, dry roof insulation.

B. Installation of Flat Stock and Tapered Polyisocyanurate Roof Insulation and Cricket Stock:
   1. Layer(s) of flat stock polyisocyanurate roof insulation boards shall be adhered securely over installed vapor retarder, as specified below, in low-rise foam adhesive to successfully resist high-wind uplift.
   2. Install polyisocyanurate tapered and cricket panels in compliance with Contractor provided tapered roof insulation drainage plan, where tapered stock is needed to eliminate accumulations of standing water, and promote positive slope to drain. Adhere

tapered roof insulation securely, as specified below, over installed flat stock polyisocyanurate roof insulation in low-rise foam adhesive to successfully resist high-wind uplift.

C. Trim surface of insulation where necessary around through-wall scupper drain locations so completed surface is flush and does not restrict flow of water.

D. Install tapered edge strips at perimeter edges of roof crickets that do not terminate at vertical surfaces.

E. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   1. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and ballasting to maintaining insulation in place.
   2. Each layer of insulation shall be staggered maximum distance in both directions from previously set layer.
   3. All layers shall be ballasted to prevent shifting due to rising foam adhesive, until such time foam has stabilized and is no longer rising.

F. Gypsum Cover board:
   1. One layer of ¼-inch thick gypsum-based coverboard shall be installed over previously installed and well-secured polyisocyanurate roof insulation panels. Install, coverboard with all joints staggered from the joints of the underlying roof the insulation.
   2. 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 12 - inches in each direction. Butt cover boards together. Tape joints if required by roofing system manufacturer.
   3. Adhere coverboard securely, as specified below, over flat and tapered polyisocyanurate roof insulation in in low-rise foam adhesive to successfully resist high-wind uplift, apply ballast to maintain cover boards position until low-rise foam has sufficiently cured to prevent shifting of boards out of plane.
   4. Install perlite tapered insulation edge strips; fully-adhered securely in specified polyurethane low-rise foam adhesive.

G. Application of Polyurethane Low-Rise Foam Adhesive.
   1. Apply specified polyurethane low-rise foam adhesive in strict compliance to manufacturer's published recommendations and these specifications. Adhesive shall be applied using Pace Cart or equal bulk-applied equipment approved by Roof Consultant, primary Manufacturer, and the Engineer to apply bulk bag-in-box components over properly installed and prepared substrates at a rate according to Project requirements.
   2. Polyurethane low-rise foam adhesive shall not be applied over surfaces that are below 40° F, or when ambient temperatures are below 40°F, contaminated, damp or wet.
   3. Install polyisocyanurate roof insulation and gypsum coverboard in uniform beads of polyurethane low-rise adhesive spread in a serpentine pattern, with minimum 1-inch wide liquid beads, evenly spaced beads, with no gaps, globs, puddles or other inconsistencies. Spacing of applied liquid beads shall be as follows:
      a. Bead spacing for the low-rise foam adhesive shall meet the following requirements:
         (1) Apply at 6-inch on-center bead spacing at roof perimeters and corners areas;
         (2) Apply at 9-inch on-center in the field of the roof.

H. To ensure thorough embedment of the roof insulation and coverboard into beads of applied adhesive, uniform pressure shall be applied thoroughly soon after the boards are installed using Project-related ballast, such as 5-gallon pails of roof products, covered (with lids locked securely), membrane roll goods, or surplus buckets partially full of clean sand or washed gravel, or used tires and other non-damaging items to provide thorough and even pressure on the installed boards until the polyurethane adhesive has ceased rising and exhibits a stable set – generally 10-to-15-minutes dependent on weather conditions. CAUTION: Walking over roof insulation and coverboard panels immediately after placement into adhesive shall be minimized in order to not cause slippage/movement of the panels until the adhesive is set up.
   1. Consistent, continuous inspection of previously set cover boards, where overlying weighted ballast/containers have been removed, shall be performed by installers to assure expansion of foam is not continuing to occur resulting in an uneven plane with the edges of adjacent boards.
   2. Note: All roof insulation and coverboard shall be installed in a manner that results in a neatly flush plane with the edges of adjacent panels. Adjacent roof insulation or gypsum panels that are out of plane in excess of 1/8-inch shall be shaved to a relatively flush profile. Adjacent panels that are out of plane in excess of ¼-inch may require removal and replacement to promote a flush profile and smooth, well-draining surface.

I. All polyurethane foam adhesive that has exuded upward beyond the plane of the joints of adjacent gypsum boards shall be scraped off to relatively flush profile with the plane of the roof

3.12 WOOD CANT STRIPS

A. Cant strips shall be installed at all horizontal-to-vertical angle changes, such as at roof-to-wall and roof-to-curb intersections, etc.

B. Wood Cant Strip:
   1. Wood cant strips shall be installed at roof perimeters, seismic joints and as specified herein, and illustrated on applicable Project Drawings.
   2. New wood cant strips shall be secured with masonry screw-type mechanical fasteners or 12d galvanize nails. Wood cant strips shall be screw fastened, as necessary to penetrate minimum 1½-inches into solid masonry or wood blocking.

3.13 GENERAL ROOF MEMBRANE SYSTEM INSTALLATION REQUIREMENTS

A. Coordination with Other Trades: Roofing Contractor shall be responsible for coordinating with Owner's Representative for any required electrical disconnects and reconnects, as well as for natural gas, water, etc. as may be required to execute the work. Experienced, licensed and bonded, Contractor with trained and skilled journeymen-level workers shall perform the disconnection and reconnection work, as Project requires. Work required shall be included in Project Bid amount (i.e., Base Bid).

B. Roofing Contractor, crewpersons and sub-contractors shall cooperate with the Engineer, the Owner's Representative, the Manufacturer's Representative(s) and City or County inspectors, as well as test agencies that may be engaged for testing services.

C. Compliance: SBS modified bituminous membrane roof system shall be installed in compliance with roofing system Manufacturer's current published recommendations, the Project Specifications and Drawings as contained in the Contract Documents, as well as FM and Building Code requirements. Installation shall comply with applicable recommendations of NRCA/ARMA's "Quality Control Recommendations for Polymer Modified Bitumen Roofing". Contractor shall check all materials on-site to ensure that they are as specified. If materials are found on site that are not approved or do not meet the specification requirements, they shall be marked for rejection, and permanently removed from the job site. Do not re-stock or use rejected materials.

D. Fully Adhere and Construct a Watertight and Weatherproof Roof System: All roofing plies shall be thoroughly adhered to their underlying substrates, and shall provide for a 100% watertight installation, prior to and after flashing installation. Make necessary preparations, utilize recommended application techniques, and apply the specified materials, with offset side laps and staggered end laps. Apply all plies of roofing free of voids, wrinkles, buckles, creases, fishmouths, blisters, and other defects. Exert sufficient rolling/brooming pressure on the roofing plies/sheet and laps during application to ensure prevention of air pockets/voids and to promote thorough lamination of all plies and seams.

E. Protection: Carefully protect Building's interior and exterior from spillage of asphalt adhesives, roofing cement, and modified bitumen roofing materials, and prevent scraps, wrappers, and/or liquid materials from littering work area(s), and from entering or clogging drains, as well as from entering the interior of the building through substrate joint penetrations or other openings.
   1. Replace or restore, at Contractor's expense, Building components damaged by work.

F. Project Manual Availability: Contractor shall have one copy of the Manufacturer's installation instructions and one copy of the Project Manual, Project Drawings, and Project Approved Submittals available at the job site at all times during the roof replacement work.

G. Dry Conditions: Roofing application shall not proceed when moisture from dew is present, or if rain or other moisture source is present or expected. Coordinate installation of roof system components so roofing components that can be compromised by moisture are not exposed to precipitation or left exposed at the end of the workday or when inclement weather is forecast or imminent.

H. Dry Materials: Roof membrane system, including concrete roof deck, membrane materials, insulation and coverboard shall be kept dry before, during, and after installation. Roof membrane components shall not be applied over damp or wet substrates. Roof membrane components that have become damp or wet in storage shall not be installed. Gypsum coverboard and roof insulation system materials that have become damp or wet shall be replaced with new specified materials.

I. Material Loads: Material and equipment loads shall be carefully loaded, handled, distributed and disbursed by Contractor to prevent overloading of the structure and to prevent damage to materials, work, and construction already placed.

J. Phasing: Phasing of the roof system application will only be permitted with the cap sheet, and interply, after the interply membrane has been installed. Any area where loose or masonry is encountered, the base ply membrane flashing cannot be installed on parapet walls shall be night sealed with polyethylene sheeting and waterproof tape (e.g., EternaBond) and all terminating edges of installed membrane components on vertical surfaces shall be sealed with Project approved asphalt roof cement.

K. Protection of Installed Membrane Plies: Application shall be sequenced to avoid or minimize traffic over newly roofed areas.

L. Do Not Stack Lap/Seams: Stacked laps or seams shall not be allowed. Laps of base, interply and surfacing membrane materials shall not be installed to align directly over or above any of the laps of underlying materials. Side laps of all material shall be offset by a minimum of 12-inches. Stagger end laps uniformly in pattern, by a minimum of 36-inches (3-feet).

M. Temporary Seals (Nightly Tie-offs): Install temporary seals to prevent water from entering terminations of exposed insulation, membrane edges and base flashings at the end of each day's work. Construct temporary seals with at least one ply/course of membrane, fully “tie-off” and adhered, with all joints and edges sealed with approved Manufacturer’s asphalt roof cement and adhesive. Carefully remove and discard temporary seals before beginning work on adjoining roof area. All temporary seals/nightly tie-offs are to be made watertight and weatherproof at end of each work day.

N. Proper Drainage: Verify that all roof drains are free from debris at the completion of each workday. Leave roof in a watertight, thoroughly drainable condition at the end of each shift and workday. Prevent materials from entering and clogging roof drains, drain leaders, and from spills migrating onto surfaces of other construction. Remove any temporary roof-drain plugs at the end of each work shift, when no work is taking place, and before any inclement weather.

O. Safety: Fire extinguishers and all safety-related equipment shall be provided, used, and maintained in compliance with all applicable OSHA requirements, local codes and ordinances. Fire safety shall include having trained personnel on the roof, allowing no bare wood, insulation, or interior roof cavity to come in contact with flames from propane-fueled roofing torches. Take all precautions, including an experienced supervisor and/or delegated trained person to perform a minimum one hour (or longer period if required by local ordinance) fire watch after last torch work is performed, or as necessary to avoid fire and all other safety hazards.

P. Cleaning: Contractor shall carefully clean adjacent structures, improvements, and grounds of debris caused by roofing operations. Leave roof, grounds, sidewalks, driveways, alley and streets clean and free of debris, including fasteners related to the roofing work, at the end of each workday.

Q. Progressive Repair Methods: All specified membrane materials shall be applied free of fishmouths, wrinkles, blisters, voids, and other defects. If any wrinkles or fishmouths develop or voids/blisters are detected, they shall be cut open, inspected to ensure dry, then fully adhered, and promptly repaired with a patch of the same material or membrane being applied. Excessive number of fishmouths, buckling or other defects necessitating extensive patching may be cause for rejection of the entire roof system.

R. Membrane Repair Patches: All interply and cap sheet membrane material used as patches shall be fully heat-fused and terminating edges feathered. The membrane patch material shall be cut to extend beyond the edges of the affected areas approximately 6-inches in all directions, except for patches over cap sheet surface.
   1. Patches over the installed cap sheet shall extend upslope and terminate snugly against the downslope edge of the installed course above the affected area, so that water does not flow against any edges of the cap sheet patch material.
   2. All mineral granule cap sheet surfaces, to be repaired, shall be primed, or granules pressed in to expose underlying asphalt prior to installing cap sheet patches.

S. Construction/installation of on-roof mock-up roofing system in presence of the Engineer and manufacturer's technical representative.

T. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed (other than interply) are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
   1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or using torch grade material, with joints and edges sealed.
   2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.
   4. Contractor to coordinate roof system installation to allow for the free flowing drainage of water to the roof drains. Progress of roof system installation shall not allow for ponding of water at nighttime tie-offs.

3.14 BASE-PLY SHEET INSTALLATION

A. General:
   1. Thoroughly Cleaned Substrate Surface: Thoroughly sweep or air blow (e.g. leaf blower) surface of installed gypsum cover boards to remove shavings, dust, all particulate and any other contaminants that may prohibit smooth and fully adhered application of the base sheet.
   2. Carefully install base sheet according to roofing system Manufacturer's published instructions starting at low point of roofing system. Pre-relax sheets, and align base-ply sheets without stretching. Extend sheets over and terminate beyond cants.

   3. Shingle side laps of base sheet uniformly and ensure that base-ply sheet covers substrate at any point. Install in direction to shed water across side seams not parallel to side seams.

4. At all Roof Plumbing and Electrical Penetrations: Prior to installation of base sheet, install target plies of Project specified base sheet in asphalt roof cement over the previously installed polyisocyanurate roof insulation and coverboard, tightly fitted around all mechanical, plumbing and electrical conduit openings. Seal target ply-to-protrusion intersection with an underlying small fillet bead of asphalt roof cement, and as illustrated in applicable Project Drawings. Prevent molten asphalt and torching-flame and vapors from entering the interior spaces of the building.
5. Fully-Adhered Installation and Implement Progressive Repairs: All base sheets shall be installed free of voids/air pockets, wrinkles, buckles, fishmouths, tears and/or other defects. Repair all fishmouths, blisters, wrinkles, buckles, voids, blisters, and areas of defect and/or membrane damage such as tears, prior to application of the next sequential roof membrane system component.

B. Installation of Base Sheet:
1. Rolls of base sheet shall be unrolled and allowed to “relax” prior to installing for the minimum length of time as recommended by the manufacturer. Starting at the low point in the roof, base sheet shall be installed perpendicular to the slope over the underlying gypsum coverboard and previously installed target plies at penetrations, fully heat fused using propane-fueled roofing torches. All base sheets shall extend a minimum of 2-inches above the top edge of cant strip at roof-to-vertical surfaces, or as illustrated in Project Drawings.
2. Applicator shall work from the side or in front of the roll being applied to avoid displacement of molten modified asphalt. All plies shall be carefully and thoroughly broomed and seams rolled to achieve full adhesion of ply layers.
3. Install base sheet in full (i.e., 39 5/8-inch) widths. Lap each succeeding sheet not less than 3-inches at side seams, and not less than 6-inches at end laps. Offset end laps at least 36-inches apart.
    a. Note: At intersection with wood curbs, blocking, nailers, etc., base sheet shall be laid loose from the toe of the cant and extend beyond the head of the cant, as required by the selected manufacturer.
4. Wood Surfaces: As an alternate to asphalt roof cement/adhesive applied base ply, apply Project Approved, compatible primer over wood surface and allow to dry as required by the Manufacturer. Install self-adhering SBS base flashing, in order to provide protection from contact of open flame from hand-held propane-fueled roofing torches or hot air welder. Prior to installing the surfacing ply of the membrane base and wall flashing system, all seams shall be checked in order to assure that they are fully-adhered and bonded with no gaps that would allow flame from heat-welders to make contact with underlying wood. Unbonded seams shall be repaired as necessary.

3.15 INSTALLATION OF SPECIFIED SBS INTERPLY MEMBRANE

A. General:
1. Compliance: Comply with the membrane Manufacturer’s instructions and as outlined in this specification section for installation of interply membrane.
2. Thoroughly Cleaned Substrate Surface: Thoroughly sweep and blow with power blower, surface of installed base sheet to remove shavings, dust, accumulated excess sand and other particulates that may prohibit smooth and fully adhered application of the Interply membrane.

3. Fully-Adhered Installation with Progressive Repairs: All interply membrane shall be installed free of voids/air pockets, blisters, wrinkles, buckles, fishmouths, tears and/or other defects. Repair all fishmouths, wrinkles, buckles, voids, blisters, and areas of defect and/or membrane damage such as tears, prior to application of the next sequential roof membrane system component.

B. Installation of Interply Membrane Ply over Base Sheet:
   1. Install starter course of interply, approximately 13⅛-inch wide, followed with full (i.e., 39 5/8-inch) width sheets. Lap each succeeding sheet not less than 3-inches at side seams, and not less than 6-inches at end laps. Offset end laps at least 36-inches apart and staggered from end laps of underlying sheets/plies.
   2. Rolls of interply sheet shall be unrolled and allowed to “relax” for the minimum length of time as recommended by the Manufacturer. Starting at the low point in the roof, interply membrane shall be installed perpendicular to the slope, over previously installed base sheet surface with propane-fueled roofing torches or hot-air welding equipment as approved by Manufacturer. Interply sheets shall extend to the top edge of the cant strip as illustrated in Project Drawings.
   3. Applicator shall work from the side or in front of the roll being applied to avoid displacement of molten modified asphalt. All plies shall be carefully and thoroughly broomed and seams rolled to achieve full and complete adhesion of ply layers.
   4. Offset each successive sheet of interply a minimum of 1/3-sheet width from the underlying membrane seam. Stacked laps/seams are not acceptable. End laps on overlapping selvage edges shall be cut at a “dog ear” angle and fully-adhere.
   5. All side seams and end laps shall be fully-bonded and pressed in with hand-held round-nosed trowel. Asphalt exude (e.g., flow or bleed-out) seams are to be left untooled, not buttered. Special attention shall be given at “T” lap seams to also achieve full and complete adhesion. All side seams, end laps, and T-lap seams shall be properly and fully-adhered with a visible asphalt bleed out.

C. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.

D. Repair tears and voids in laps and lapped seams not completely sealed.

E. Install roofing sheets so side and end laps shed water.

3.16 INSTALLATION OF SPECIFIED SBS CAP SHEET

A. General:
   1. Compliance: Comply with the membrane Manufacturer’s instructions and outlined in this specification section for installation of cap sheet membrane.
   2. Thoroughly Cleaned Substrate Surface: Thoroughly blow with power blower surface of installed interply sheet to remove shavings, dust, excess sand and other particulates that may prohibit smooth and fully adhered application of the granulated cap sheet membrane.
   3. Fully-Adhered Installation with Progressive Repairs: All granulated cap sheet membrane shall be installed free of voids/air pockets, wrinkles, buckles, fishmouths, tears and/or other defects. Repair all fishmouths, blisters, wrinkles, buckles, voids, blisters, and areas

of defect and/or membrane damage such as tears, abrasions, surface damage prior to application of the next sequential granulated cap sheet course.

4. Note: Prior to installing specified SBS cap sheet, all roof areas determined by the Engineer and/or Manufacturer's Representative, which potentially need to receive a ply or multiple plies of specified interply membrane as a sacrificial ply, in efforts to minimized accumulation of standing water (e.g., "bird baths), shall be executed, fully-adhered and watertight.

B. Installation of Cap Sheet:
   1. Install starter course of cap sheet, approximately 26¼-inch wide, followed with full (i.e., 39 5/8-inch) width sheets. Lap each succeeding sheet not less than 3-inches at side seams, and not less than 6 inches at end laps. Offset end laps at least 36-inches apart maintaining a neat and logical pattern, and stagger from end laps of underlying interply sheet.
   2. Rolls of cap sheet shall be unrolled and allowed to "relax". Starting at the low point in the roof, fully adhere cap membrane to the underlying interply membrane surface with propane-fueled roofing torches or hot-air welding equipment approved by Manufacturer. Cap sheet shall extend to the top edge of the cant strip, as illustrated in Project Drawings.
   3. Applicator shall work from the side or in front of the roll being applied to avoid displacement of molten modified asphalt. All plies shall be carefully and thoroughly broomed and seams rolled to achieve full and complete adhesion of ply layers.
   4. Offset each successive course of cap sheet a minimum of 1/3 sheet width from the underlying membrane seam. Stacked laps/seams are not acceptable. End laps on overlapping selvage edges shall be cut at a dog ear angle and fully-adhere.
   5. All portions of granulated membrane cap sheet end laps to be overlapped by adjacent membrane sheets shall have granules pressed in (embedded) to expose underlying asphalt, or primed, if approved by manufacturer, with Project Approved asphalt primer prior to heat-welding the overlying membrane.
   6. All side seams and end laps of the cap sheet shall be fully- adhered/bonded.
   7. A clean 20 lb. seam roller shall be properly used on granule-surface cap sheet side seams and end laps to assure proper contact of interfacing materials, full and complete adhesion as required by Specifications, and Manufacturer. Asphalt exude (e.g., flow or "bleed-out") at seams are to be left untooled, not buttered. Special attention shall be given at "T" lap seams to achieve full and complete adhesion. All side seams, end, and T-lap seams shall be properly and fully-adhered with a visible asphalt bleed out.
   8. Embed roofing granules, of matching color to that of the cap sheet surfacing, in the asphalt bleed-out that extends beyond the laps and seams, while asphalt is still molten and tacky so granules adhere and cover bleed-out.
   9. Install roofing sheets so side seams and end laps shed water.
   10. Repair tears and voids in laps and lapped seams not completely sealed.

3.17 MEMBRANE BASE AND WALL FLASHING

A. General:
   1. Membrane base and wall flashing shall be installed in compliance with these specifications and Manufacturer's requirements, and as illustrated in applicable Project Drawings.

2. Prior to installing the surfacing ply of the membrane base and wall flashing system, all seams shall be checked in order to assure that they are fully-adhered and bonded with no gaps that would allow hot-air or flame from heat-welders to make contact with underlying wood or flammable material. Unbonded seams shall be repaired as required.
3. Exposed finished membrane flashings shall be composed of one sheet of Project Specified smooth-surface SBS modified asphalt base flashing installed prior to granulated field sheets. Type dependent on substrate to be covered, followed by one appropriate roll width sheet of Project Specified white granule-surfaced SBS modified membrane flashing. Membrane base and wall flashings shall be fully-adhered to the inside face and tops of the perimeter curbs, parapet walls, equipment curbs and other vertical surfaces.
4. Membrane base and wall flashing sheets shall be cut from end of roll, allowed to relax for the minimum length of time as recommended by the Manufacturer, and installed in strapped orientation to help ensure neat, fully-adhered seams and complete adhesion over underlying angle changes such as at cant strips and vertical surfaces without voids. All plies shall be thoroughly laminated and 100% adhered.

B. Installation of Two (2)-ply Membrane Base and Wall Flashings:
   1. Installation of Base ply of Smooth-Surfaced Ply of Membrane Base/Wall Flashing over thermal barrier board at parapets and mechanical curbs:
      a. Install one ply Project Approved base-ply in asphalt flashing cement or as an alternate application, apply Project Approved primer to all surfaces to receive self-adhering membrane flashing base ply per Manufacturer's recommendations. Allow primer to dry prior to application of flashing sheet.
      b. Fully-adhere membrane flashing base ply in full-width sheets installed in strapped configuration to prepared and primed surfaces in strict compliance to manufacturer's published recommendations.
      c. Starting at the uppermost terminating edge, neatly adhere membrane flashing free of voids and wrinkles. Carefully move cut membrane base flashing sheets downward, adhering the flashing into place (do not drop the material into place), by applying uniform pressure with gloved hands and a rubber-faced hand roller moving in a, back-and-forth cross direction over the entire surface of the flashing; at the same time, slowly pull the release film off the back of the flashing where self-adhering product is used. Keep gloved hands and the edge of the roller near the contact point of the membrane flashing-to-substrate material to avoid air entrapment, wrinkles, or misalignment.
      d. At factory produced 3-inch side lap or selvage edge, remove the protective seam tape (where exists) and apply even pressure to fully adhere seam area with a rubber-faced hand roller.
      e. After placing flashing, apply uniform pressure to the entire seam area with a clean hand roller to ensure full adhesion.
      f. Install base ply of membrane flashing free of voids, wrinkles, buckles, blisters, fishmouths, etc., fully adhered and watertight.
   2. Installation of Granule-Surfaced Membrane Flashing Cap Sheet:

      a. Install granulated membrane flashing over the base/wall flashing ply sheet with hand-held propane-fueled roofing torches. Granulated cap sheet shall be cut from end of roll and installed in strapped fashion. Side seams shall be 3-inches, and offset

from underlying laps a minimum of 12-inches. Membrane flashings shall be rubbed in thoroughly by well-protected gloved hands or silicone roller while the heated modified bitumen is still hot and fluid/molten to obtain complete bonding and full adhesion of the sheets, as well as neat and uniform bleed-out of asphalt at the perimeter edges.

b. Roofing granules, of matching color to that of the surfacing cap sheet, shall be neatly broadcast into asphalt bleed-out at seams, while asphalt is still fluid and tacky so granules adhere.
c. Extend flashing sheets up and over the top of curbs and up walls and as indicated on Drawings. Extend membrane flashing upward on wall surfaces beyond edge of underlying ply, and downward beyond the toe of the cant strip onto the field of the roof 8-inches as indicated in Drawings. Feather all membrane terminations in proper sequence.
d. Mechanically fasten 2-ply membrane flashing to underlying substrates along the upper edge of the 2-ply membrane flashings. Space fasteners a minimum of 6-inches on center, and as illustrated in Project Drawings. All vertical terminations of the 2-ply membrane flashings shall be fastened with termination bar fastened at 4-inches on-center and sealed with three coursing of specified vertical-grade asphalt roofing cement and reinforcing fabric.

3.18 MEMBRANE BASE AND WALL FLASHING

A. General:
1. Prior to installing the surfacing ply of the membrane base and wall flashing system, all seams shall be checked in order to assure that they are fully-adhered and bonded with no gaps that would allow hot-air or flame from heat-welders to make contact with underlying wood or flammable material. Unbonded seams shall be repaired as required.
2. Exposed finished membrane flashings shall be composed of one sheet of Project. Specified smooth-surface SBS modified asphalt base flashing installed prior to granulated field sheets. Type dependent on substrate to be covered, followed by one appropriate roll width sheet of Project Specified white granule-surfaced SBS modified membrane flashing.
3. Membrane base and wall flashings shall be fully adhered to the inside face and tops of the perimeter curbs, parapet walls, equipment curbs and other vertical surfaces. Membrane base and wall flashing sheets shall be cut from end of roll, allowed to relax for the minimum length of time as recommended by the Manufacturer, and installed in strapped orientation to help ensure neat, fully-adhered seams and complete adhesion over underlying angle changes such as at cant strips and vertical surfaces without voids. All plies shall be thoroughly laminated and 100% adhered.

B. Installation of Two (2)-ply Membrane Base and Wall Flashings:
1. Installation of Base ply of Smooth-Surfaced Ply of Membrane Base/Wall Flashing:
a. Over thermal barrier board at parapets and mechanical curbs:
(1) Install one ply Project Approved base-ply in asphalt flashing cement or as an alternate application, apply Project Approved primer to all surfaces to receive self-adhering membrane flashing base ply per Manufacturer’s recommendations. Allow primer to dry prior to application of flashing sheet.

(2) Fully-adhere membrane flashing base ply in full-width sheets installed in strapped configuration to prepared and primed surfaces in strict compliance to manufacturer's published recommendations.
(3) Starting at the uppermost terminating edge, neatly adhere membrane flashing free of voids and wrinkles. Carefully move cut membrane base flashing sheets downward, adhering the flashing into place (do not drop the material into place), by applying uniform pressure with gloved hands and a rubber-faced hand roller moving in a, back-and forth cross direction over the entire surface of the flashing; at the same time, slowly pull the release film off the back of the flashing where self-adhering product is used. Keep gloved hands and the edge of the roller near the contact point of the membrane flashing-to substrate material to avoid air entrapment, wrinkles, or misalignment.
(4) At factory produced 3-inch side lap or selvage edge, remove the protective seam tape (where exists) and apply even pressure to fully adhere seam area with a rubber-faced hand roller.
(5) After placing flashing, apply uniform pressure to the entire seam area with a clean hand roller to ensure full adhesion.
(6) Install base ply of membrane flashing free of voids, wrinkles, buckles, blisters, fishmouths, etc., fully adhered and watertight.

2. Installation of Granule-Surfaced Membrane Flashing Cap Sheet:
   a. Install granulated membrane flashing over the base/wall flashing ply sheet with hand-held propane-fueled roofing torches. Granulated cap sheet shall be cut from end of roll and installed in strapped fashion. Side seams shall be 3-inches, and offset from underlying laps a minimum of 12-inches. Membrane flashings shall be rubbed in thoroughly by well-protected gloved hands or silicone roller while the heated modified bitumen is still hot and fluid/molten to obtain complete bonding and full adhesion of the sheets, as well as neat and uniform bleed-out of asphalt at the perimeter edges.
   b. Roofing granules, of matching color to that of the surfacing cap sheet, shall be neatly broadcast into asphalt bleed-out at seams, while asphalt is still fluid and tacky so granules adhere.
   c. Extend flashing sheets up and over the top of curbs and up walls and as indicated on Drawings. Extend membrane flashing upward on wall surfaces beyond edge of underlying ply, and downward beyond the toe of the cant strip onto the field of the roof 8-inches as indicated in Drawings. Feather all membrane terminations in proper sequence.
   d. Mechanically fasten 2-ply membrane flashing to underlying substrates along the upper edge of the 2-ply membrane flashings. Space fasteners a minimum of 6-inches on center, and as illustrated in Project Drawings. All vertical terminations of the 2-ply membrane flashings shall be fastened with termination bar fastened at 4-inches on-center and sealed with three coursing of specified vertical-grade asphalt roofing cement and reinforcing fabric.

C. Roof Drains Lead Flashings:

1. New sheet lead drain flashing shall be completely primed with specified asphalt primer on both sides and allowed to completely dry prior to installation.

2. Extend the specified base sheet over the properly prepared drain bowl flange and into the drain bowl. Fully-adhere the base sheet to the drain bowl flange with specified asphalt roof cement or Manufacturers recommended adhesive.
3. Extend the specified interply over previously installed base sheet on drain bowl flange and into the drain bowl. Fully-adhere the interply by heat-welding.
4. Embed the primed, 30-inch square lead flashing sheet in specified asphalt roof cement. Apply asphalt roof cement in uniform thickness, smooth and free of voids. Carefully peen and form lead to extend neatly onto the drain sump, and conform to the profile of drain bowl. Peen carefully to wrap onto and extend over the bowl flange to fit watertight against the inner portion of the drain bowl and as illustrated in Drawings.
5. Install 2-ply membrane target flashing consisting of specified interply membrane, as illustrated in Drawings. Fully-adhere the membrane target flashing ply with specified asphalt roofing cement. Fully-adhere the granulated target ply by heat welding. Extend the specified membrane target flashing plies over the drain bowl flange. Feather target flashing plies consecutively, a minimum of 4-inches beyond the lead flashing and each successive ply's leading edge(s), so that a separate seal or tie-off is achieved with each and every ply.
6. Immediately (while membrane is still warm) following installation of cap sheet at drain, install new, or rehabilitated existing, clamping rings with new stainless steel bolts, and torque bolts evenly, in alternating patterns and tighten carefully but snugly to provide a 100% watertight seal. Do not over-tighten bolts, which may cause deformation or cut through the plies.
7. All drain rings shall be installed at the end of each day, to provide a 100% watertight seal at drain locations.

3.19 EXISTING ROOF DRAIN ASSEMBLY RETROFIT AND REFINISHING

A. Existing Roof Drain at Entry Roof:
   1. Existing roof drain clamp ring bolt holes shall be cleaned and threads reworked and lightly oiled to render holes usable, or drilled out, properly sized and rethreaded (i.e., tapped) to receive new stainless steel clamping ring hold-down bolts. The clamping rings shall be installed to provide a snug, even mechanical compression of the integrated sheet lead and membrane flashings onto the drain bowl flange to make watertight detail. Do not over-tighten clamping ring bolts.
   2. Painting Existing Primary Roof Drain Bowl, and Clamp Ring: Prepare, prime, and paint existing exposed, properly prepared surfaces of all existing internal overflow primary roof drain bowls including, flanges, clamp rings, as well as accessible internal surfaces of the drain nipples with specified corroded metal surface paint system, as outlined within Specification Section 09 96 00 – High Performance Coatings at location indicated on Project Roof Plan Drawings.

3.20 THROUGHWALL SCUPPER DRAINS AND CONDUCTOR HEADS

A. Install New stainless steel through-wall scupper drains and conductor heads connected to existing downspouts.
   1. Locate and core opening through exiting EIFS clad concrete masonry unit parapet walls as required by the Project Engineer.
   2. Remove existing through-wall scuppers at openings located on the Drawings.

3. Install new stainless steel through-wall scuppers in strict compliance with Manufacturer's recommendations, and as illustrated on applicable Project Drawings.
4. Install new stainless steel conductor head properly secured to the exterior face of the building and existing downspouts.
5. Contractor to repair and fill-in existing overflow through-wall scupper rough opening with Project Approved cementitious repair material specified in Specification Section 04 20 00 – Unit Masonry.

3.21 SHEET METAL FLASHINGS

A. Counterflashings, cap flashings, and similar flashing work shall be coordinated and sequenced with installation of membrane roofing system as illustrated on Project Drawings and specified in herein, and indicated in as Section 07 62 00 - Sheet Metal Flashing and Trim.

3.22 WALKPAD INSTALLATION

A. General:
   1. Walk pads shall be installed over finished membrane surface in strict compliance with Manufacturer's recommendations, as illustrated on the applicable Project drawings.
   2. Walk pads shall only be installed to dry membrane surfaces that are free of debris

B. Installation:
   1. Install walk pads securely using manufacturer's approved adhesive or method for heat fusing to fully adhere each pad.
   2. Install walk pads with minimum 2-inch minimum to 6-inch maximum gaps to allow for free drainage of water.

3.23 PROTECTION OF COMPLETED WORK AND CORRECTIONS

A. Protect new SBS modified asphalt membrane roofing from damage and wear during construction period and until Physical Completion of the entire project.

B. Correct deficiencies and/or damage in, or remove, SBS modified asphalt membrane roofing that does not comply with requirements, repair substrates, install new roofing, and repair base flashings to a condition free of damage and deterioration, and according to warranty requirements.

3.24 FIELD QUALITY CONTROL

A. At end of construction period, or at a time when remaining construction will in no way affect or endanger roofing, meet with Project Building Envelope Monitor and Project Engineer to survey roof installation as part of the Pre-Completion Survey. Engineer or Monitor may prepare a written report with a Punch List, describing nature and extent of items needing attention, completion, and any defects or damage found that needs correction.
B. Completion Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Project Building Envelope Consultant, Project Engineer and Owner's Project Manager 48 hours in advance of date and time of inspection.

C. Roofing system will be considered defective if it does not pass tests and inspections.
   1. Walk and survey roof to see that all work is complete and Punch List items have been attended to, prior to deeming roof as finished.

3.25 ROOFING INSTALLER'S GUARANTEE FORM

(See following page)

ROOFING CONTRACTOR'S SBS MODIFIED BITUMEN ROOF SYSTEM ROOFING WARRANTY AGREEMENT

WHEREAS (Contractor) _____
of (Address) _____
herein called the "Roofing Contractor", has performed roofing and associated
("work") on following project: _____
Owner: _____
Address: _____
Name and Type of Building: _____
Address: _____
Area of Work: _____ Date of Acceptance: _____
Warranty Period: _____ Date of Expiration: _____

AND WHERE Roofing Contractor 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.

NOW THEREFORE Roofing Contractor 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 replacement of said work as are necessary to correct faulty and defective work, and as are necessary to maintain said work in watertight condition.

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, windstorm; b) fire; c) failure of roofing system substrate including cracking, settlement, excessive deflection, deterioration, and decomposition; d) faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work, e) vapor condensation on bottom of roofing; and f) activity on roofing by others including construction contractors, other persons and animals whether authorized or unauthorized by Owner with the exception of normal light foot traffic by the Owner's authorized maintenance personnel. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Contractor, and until cost and expense thereof has been paid by owner or by another responsible party so designated.
2. The Roofing Contractor is responsible for damage to work covered by this Warranty, including consequential damages to building or building contents, resulting from leaks or faults or defects of work.
3. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Contractor or Owner's qualified maintenance staff, 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 upon date of said alterations, but only to extent said alterations affect work covered by this Warranty. If Owner engages Roofing Contractor to perform said alterations, Warranty shall not become null and void, unless Roofing Contractor, prior to proceeding with said work, shall have notified Owner in writing, showing reasonable cause for claim that said alterations would like damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

4. 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 upon date of said change, but only to extent said change affects work covered by this Warranty.

5. The Owner shall promptly notify Roofing Contractor of observed, known or suspected leaks, defect or deterioration, and shall afford reasonable opportunity for Roofing Contractor to inspect work, and to examine evidence of such leaks, defects or deterioration.
6. This Warranty is recognized to be the only warranty of Roofing Contractor on said work, and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to him in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Contractor of responsibility for performance of original work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

IN WITNESS THEREOF, this instrument has been duly executed this __ day of _____, 20__.

Signature of Roofing Contractor_____

END OF SPECIAL ROOFING GUARANTEE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. General provisions of the Construction Contract, including Drawings and Specifications and all bidding requirements, Bid Form and all reference documents, apply to the work of this Section.

B. Technical publications, standards, and reference documents as outlined in individual Technical Specification Sections and as indicated on Drawings.

1.02 RELATED WORK:

A. Division 1 - All Related Sections

B. Section 02 41 19 - Selective Demolition

C. Section 06 10 00 – Rough Carpentry

D. Section 07 52 16 – SBS Modified Bitumen Roof System

E. Section 07 92 00 - Joint Sealants

F. Section 09 90 00 – Painting and Coating

1.03 SUMMARY:

A. General:
   1. This section shall be read in conjunction with other Project Specification Sections, Drawings and related photographs indicating the nature of and general extent of sheet metal work necessary for this Project.
   2. The Contractor shall furnish all materials, labor, equipment, services, and accessories to provide and install all sheet metal flashing work including all related accessories required for a complete 100% weatherproof and watertight installation as described in this Specification Section, and illustrated in Project Drawings.
      a. Provide and install new 24-gauge Polyvinylidene Fluoride (PVF2) coated sheet metal standing seam parapet wall coping with integrated 20-gauge galvanized hold-down cleat meeting standards of both ANSI/SPRI ES-1 and FM 4435.
      b. Provide and install new 24-gauge Polyvinylidene Fluoride (PVF2) coated sheet metal Through-wall flashing with S-lock receiver and counterflashings meeting standards of both ANSI/SPRI ES-1 and FM 4435.
      c. Provide and install new 24-gauge Polyvinylidene Fluoride (PVF2) coated sheet metal standing seam roofing, drip edge flashing, and skirt flashings meeting standards of both ANSI/SPRI ES-1 and FM 4435.
      d. Provide and install new 24-gauge stainless steel saddle flashings at coping-towall locations.
      e. Provide and install new 24-gauge stainless steel skirt flashing to extend existing counterflashings.

f. Provide and install new 24-gauge colored stainless steel curb cap flashings and mechanical units, exhaust curbs, and skylights.
g. Provide and install new 24-gauge colored stainless steel through-wall scuppers and conductor heads.
h. Provide and install new 40lb sheet lead flashings at soil pipe vent stacks and conduit pipe penetrations.
i. Provide and install all associated new accessories for sheet metal flashing work including, but not limited to, fasteners, trim, termination bars, continuous batten strips, high heat self-adhering membranes, water-resistive barrier, painting, etc. as specified and illustrated in Project Drawings.

1.04 BENCHMARK REFERENCES AND STANDARDS

A. 2015 International Building Code as adopted and amended by the City of Seattle, Washington.

B. National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual, 5th Edition, Published 2006, as applicable to architectural sheet metal work.

C. National Roofing Contractors Association (NRCA) Architectural Metal Flashing, Condensation and Air Leakage Control and Reroofing, published in 2014, as applicable to architectural sheet metal work.

D. SMACNA “Architectural Sheet Metal Manual” (current addition), as applicable to architectural sheet metal work.

E. ANSI/SPRI ES-1, 2003 Edition, 2009 edition and most current Edition, where coping and/or other cap flashing is being replaced with new sheet metal coping/cap flashing.

F. ASTM A 240/A 240 M Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

G. ASTM A 653/A 653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

H. ASTM B 749 Standard Specification for Lead and Lead Alloy Strip, Sheet, and plate Products.

I. ASTM D 1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

J. ASTM A 153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

K. ASTM B 32 Standard Specification for Solder Metal.

1.05 REGULATORY AGENCY REQUIREMENTS

A. Contractor shall comply with the 2015 Seattle Building Code (SBC) including any requirements by state or city jurisdictions. Conform to all applicable codes for cladding and roofing system requirements, including fire resistance, etc. Report any conflicts of material manufacturers' installation instructions, with these Project Specifications and/or manufacturer's installation instructions and/or Detail Drawings and/or Code to the Consultant prior to proceeding with work.

B. Conform to applicable mechanical, plumbing, energy, and electrical codes, as well as ADA regulations.

C. Comply with the requirements of Occupational Safety and Health Administration (OSHA), National Industry Occupational and Health (NIOSH), and all local governing authorities for work place safety.

D. Compliance: The Contractor shall comply with all applicable requirements to ensure the Owners, Owners' Staff, and Tenants' safety and security as specified herein, and with all applicable Federal, State, and Local regulations, laws, and ordinances.

1.06 SUBMITTALS

A. Submittal Requirements: Submit the following, according to Conditions of the Construction Contract, Division 1 Specification Sections, and as required herein, to the Project Architect for review and potential approval prior to the Pre-Construction Conference.

B. Project Drawings: A copy of the Project's sheet metal related drawings shall be re-reviewed and signed by the General Contractor and Sheet Metal Sub-contractor, and their designated Superintendent(s) and Project Foreman and included in the submittal package to be reviewed by the Project Architect. Signatures shall indicate said Parties' acknowledgement of review and full understanding of Project Drawings and requirements.

C. Shop Drawings: Submit shop drawings of sheet metal work where work differs or elaborates upon contract drawings showing layout, joining, profiles, and anchorages of fabricated work, including major counterflashings and trim fascia units, layouts at 1/4" scale, details at 3" scale.

D. Product Data: For each type of sheet metal related product specified. Provide Manufacturer's printed product information indicating material characteristics, ASTM material standard compliance, performance criteria, and product limitations.
   1. Technical product data from manufacturers for each product required, including technical information for galvanizing, type of stainless steel alloy, types of factory finishes, paint, fasteners, etc.
   2. MSDS sheets for all products.

E. Samples for Selection: For each type of Colored Stainless Steel, and coated metal indicated.

F. Physical Samples for Verification: Submit one (1) fully-fabricated and soldered physical samples of each stainless steel saddle for review and incorporation into the completed work.

1.07 QUALITY CONTROL

A. Contractor's Responsibilities:
   1. Contractor shall provide experienced supervisors (i.e., Superintendent and Foreman) and personnel (i.e., crew) to perform the work, who are trained in the application of the materials and procedures specified in this Specification. Contractor shall provide documentation from the Manufacturer that the Contractor meets experience and training requirement for the specified system. Contractor shall maintain on-site supervision continuously to assure on-going quality control for superior quality application.
   2. Contractor shall have a minimum of five (5) years' experience with similar type installations. Provide a list of completed projects similar in scope of work located in the State of Washington
   3. The Contractor shall be responsible for the quality control of all of their own work, as well as the work performed by employed crewpersons working under this Specification, and/or related specification, which is considered part of the Project Contract.
   4. Contractor shall notify the Consultant of any conflicts that may result in a deviation from the Manufacturer's Specifications, Industry Standards, Code compliance, job safety, or function as a result of the Project's Scope of Work, Specifications, and/or Project Drawings.
   5. If the Project Architect, Envelope Consultant, and/or Specified Manufacturer determine that the quality of work does not conform to the Specifications, and Project Drawings, and/or Manufacturer's requirements, as well as Industry Standards, the Contractor must correct all deficiencies and advise the Architect, Consultant, and Manufacturer of the corrective actions taken.
   6. Contractor must demonstrate the ability to perform the work in a quality, timely manner with minimal noise and disruption to or impact on Owner, Tenants, Patrons, Employees, and the Public.
   7. No modification to the Specifications, Project Drawings or substitutions of specified products shall be made without direct approval by Project Architect and Envelope Consultant. Contractor shall provide Project Architect and Envelope Consultant with a written request for review and potential approval.

B. Manufacturer's Responsibilities:
   1. Manufacturer's Technical Services Representative shall be available for technical information and project-site meetings, and be thoroughly experienced with the products to be installed, installation requirements and practices, quality control of the installation, and with any published considerations in the geographical area and climate where construction will take place.

1.08 QUALITY ASSURANCE

A. The General Contractor and Sub-contractors shall be responsible for complete, watertight, and weatherproof building envelope systems and assemblies. The Contractor shall establish and follow best practices for the trade and of quality-control and quality assurance to assure each and every building envelope systems successful completion.

B. On-Site Observation: The Owner reserves the right to have the Envelope Consultant perform observation or monitoring of the sheet metal flashing and trim installation. Such observation shall not relieve the Contractor of responsibility for proper execution and thorough completion of the Work.

C. Outstanding items and efforts to resolve them may be reviewed during Construction Progress Meetings. Action Items identified in Field Reports shall be attended to by the Contractor. The Contactor and their Sub-contractors shall cooperate fully with the Project Architect, Envelope Consultant, the Consultant's Monitors, and all mock-ups and testing. Any testing that may be deemed necessary will be performed to determine compliance with these Contract Documents.

1.09 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in original unopened containers with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.

B. Store and handle sheet metal products, and all related materials to prevent degradation, damage and discoloration.

C. Remove strippable protective film immediately prior to or after installation and do not allow the strippable film to remain on materials in extreme cold, heat, or direct sunlight.

1.10 STANDARD SPECIFICATIONS

A. Conform to recommendations of "Architectural Sheet Metal Manual", latest edition issued by Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) insofar as applicable for all metals.

1.11 PROTECTION FROM ELECTROLYTIC AND CORROSIVE ACTION

A. Protect adjacent dissimilar metals from electrolytic action by adequate coating or separation tape.
   1. Coat exterior plates and concrete surfaces against which sheet metal work is to be applied with suitable divorcing coating, paints and/or membrane separator ply or sheet.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Provide roofing and cladding related material types of each sheet metal components. AEP Span Dura Tech MX.

B. Benchmark Standards for Types of Project Related Metals:
   1. Sheet Metal Finish: Provide at designated locations new factory finished 24-gauge steel (or as indicated) sheet metal flashings factory coated with Gavalum™ or Zincalum™ corrosion protected coating, and finished with minimum Polyvinylidene Fluoride (PVF 2)

Kynar®500 or Hylar®5000, 70% resin finish coat applied over a 2 mil-thick minimum baked-on epoxy base primer to a total minimum film thickness of 2 mils total dry film thickness and backside primed with baked-on epoxy primer with dry film thickness of 2 mil minimum by the following Manufacturers: Firestone UNA-Clad, AEP-Span, Color-clad, Peterson, Metal-Era, Nu-Ray Metal Products, Fabral or Project Approved.

a. Color: ZACtique ll
b. Sheet Metal Perimeter Coping Flashings shall comply with Building Code and ES-1 testing criteria. Where new sheet metal perimeter coping flashing is specified for installation use Project Approved, 24-gauge, Kynar®500 or Hylar®5000 finished metal edge systems tested per standards of both ANSI/SPRI ES-1 and FM 4435.

2. Galvanized Finish: Provide new galvanized sheet metal, commercial quality with 0.20 percent copper, ASTM A 526 except ASTM A 527 for lock-forming, G-120 hot-dip galvanized; 24-gauge min., except as indicated otherwise.
3. Stainless Steel: Provide new AISI Type 304 stainless steel sheet metal, 24-gauge (or as indicated), with all joints soldered, complying with ASTM A 167. Stainless steel shall be mill finish, soft, except where harder temper required for forming and performance.

2.02 FASTENERS

A. General: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers, and anchoring devices. Provide metal hangers and framing anchors of size and type recommended by manufacturer for each use, including recommended nails. Provide fasteners and anchorages with a minimum hot-dip zinc coating (ASTM A 153) or as specified.

B. Nails, screws, and other fasteners for fastening all preservative-treated (PT) wood components shall be minimum 304 stainless steel. Nails shall be sized appropriately (e.g., 8d, 10d, 16d, etc.) as required to securely anchor that component.

C. Concealed fastening of sheet metal to metal shall be self-taping, flat or pan head screws to be Project Approved.
   1. Length shall be sufficient to penetrate a minimum of ¾-in. through the flange of metal framing.

D. Concealed fastening of sheet metal to concrete shall be ¼-in. stainless steel Tapcon® by Textron, Rawl Zamac Lead “Nailin”, or Project Approved.
   1. Length shall be sufficient to penetrate a minimum of 1 3/8-in. into substrates.

E. Exposed fastening of sheet metal shall be self-tapping, high-dome capped screws with punched bonded EPDM washers. Finish to match exposed metal or permit painting at primed steel locations.

F. Pop Rivets: Rivets, as necessary shall be stainless steel, closed-end watertight pop-rivets, with stainless steel mandrels, length as required for securing jointing (minimum.125-inch dia. With a grip range of.188-inch to.250-inches) as manufactured by POP, Emhart Fastening Technologies, Shelton, CT, (203) 924-9341, or approved equal.

2.03 MISCELLANEOUS MATERIALS

A. Self-Adhering Membranes:
   1. Sealant Tape:
      a. Acceptable Manufacture and Product: EternaBond DoubleStick and manufacturer recommended primer, by EternaBond, or Project Approved equal.
   2. UV-Resistant Self-Adhering Membrane: Provide self-adhering membrane with an aluminum surfacing.
      a. Acceptable Manufacture and Product: EternaBond AlumiBond and manufacturer recommended primer, by EternaBond or Project Approved equal.
   3. High Heat Resistance Self Adhering Membrane: Provide self-adhering, high heat resistant membrane, 30-mils thick, Class "A" fire rated.
      a. Acceptable Manufacture and Product: Grace Vycor Butyl and manufacturer recommended primer, by Grace Construction Products, or Project Approved equal.

B. Joint Sealants: Joint sealant as specified in Section 07 92 00.

C. Solder: For use with steel or copper, provide 60-40 tin/lead solder (ASTM B 32), with rosin flux over tinned surfaces.

D. Flux: Flux shall be muriatic acid killed with zinc (zinc-chloride), rosin flux, or approved brand of soldering flux.
   1. Note: Immediately upon completion of soldering, residual flux shall be thoroughly washed off with clean water.

E. Sealant Tape: Tremco MBT-35 Metal Building Tape or butyl tape to meet TT-C-1796-A OR approved equivalent, for concealed metal-to-metal joints.

F. Separation Tape: 1/16" x ½" neoprene tape for concealed locations.

G. Bituminous Coating: FS TT-C-494 or SSPPC - Paint 12, solvent-type bituminous paint, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

H. Miscellaneous: Provide stainless steel draw bands, .045 EPDM storm collars sheet metal anchoring devices and similar accessory units indicated in drawings and as required for long-term, weathertight, successful performance.

PART 3 – EXECUTION

3.01 PROTECTION

A. Installer shall advise Contractor of required procedures for protection of flashings and sheet metal work during construction, to ensure that work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

B. Electrolytic and Corrosive Action:
   1. Protect adjacent dissimilar metals from electrolytic action by adequate coating. Coat plates and concrete surfaces against which galvanized and/or stainless steel work is intended to be applied with suitable paint or membrane separation.

3.02 EXAMINATION

A. Examine surfaces to receive sheet metal and verify that substrate and adjacent materials are dry, clean, cured, sound and securely attached. Verify substrate surface is flat, smooth, free of fins, projections, voids, or planar irregularities.

B. Ensure that installation of sheet metal is properly sequenced with the work of other Sections.

C. Unsatisfactory conditions shall be reported to the General Contractor and corrected before application of sheet metal. Begin installation only after unsatisfactory conditions have been corrected and surfaces are dry. Initiation of installation constitutes Contractor's acceptance of substrates and conditions.

3.03 INSTALLATION / APPLICATION

A. Workmanship:
   1. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, the 5th Edition of the NRCA Roofing and Waterproofing manual, and with SMACNA "Architectural Sheet Metal Manual", 6th Edition.
   2. Execute work by skilled craftsmen according to best methods of the trade. Lines, moldings, and edges shall be sharp and true. Reinforce as required for stiffness. Allow for thermal expansion and contraction, and for shrinkage of any new wood nailers, and/or blocking that may be part of construction. Set units true to line and level as indicated. Joints and seams shall be neatly formed and finished with surfaces free of oil canning, waves and buckles. Exterior work shall be permanently watertight and weathertight.
   3. Install work in a permanently watertight and weatherproof manner, with laps, joints, and seams in shingle fashion to drain runoff over joint and/or laid away from prevailing weather.
   4. Anchor units of work securely in place by methods indicated. Spacing of fasteners shall be adequate to assure strong, wind uplift resistant, watertight joints. Use concealed fastenings wherever possible. Where necessary to expose fasteners, use high dome hex-head EPDM gasketed screw fasteners with finish color to match sheet metal. All materials exposed to view shall receive matching exterior finish.
   5. Provide for thermal and mechanical expansion of exposed sheet metal work. Space movement joints at maximum 10 feet intervals with no joint allowed within 24-inches of corner or intersection.
   6. Provide for separation of metal from non-compatible metal or corrosive substrates by covering surfaces at locations of contact, with separation tape or other permanent separation as recommended by manufacturer/fabricator.
   7. Tinning and Soldering:
      a. Prior to soldering, sheet metal shall be mechanically cleaned of all oxides and oils on both sides for a width of not less than 1½-inch. Tinning is not required with lead coated or tin zinc alloy coated copper but is suggested to promote better soldering.

b. All joints and connections shall be soldered where indicated to produce strong and watertight joints. Soldering shall be done slowly with well-heated coppers to heat the seam thoroughly and to sweat solder completely through the full width of the seam. Seams shall show at least one full inch of evenly flowed solder. Whenever possible, all soldering shall be done in the flat position. Seams on slopes steeper than 45 degrees shall be soldered a second time.

B. Fabricated Units:
1. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with Detail Drawings, and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized, Consultant-approved industry practices.
   a. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal work in 10' lengths without oil-canning, buckling and tool marks, true to line and level, or sloped as indicated, with exposed edges folded back to form hems.
2. Shop fabricate to shapes and profiles indicated. Where indicated, joints and connections to be soldered for strong and 100% watertight joints.
3. Take necessary steps to remove coating in area of solder joints prior to fabricating flashings out of colored stainless steel. Grind and clean immediate area around solder joints. Coating shall not be removed from any portion of the flashing that is visible when surrounding components have been installed, unless it is necessary in order to achieve watertight solder joint.
4. Lap all flashings 6-inches minimum away from prevailing weather utilizing bayonet joints shown in the Drawings as detailed. Prior to installing joint, apply double rows of continuous sealant as specified in section 07 92 00 - Joint Sealants along entire lap joint including both horizontal and vertical surfaces. All laps, joints, etc. shall be fully sealed, watertight.
5. Provide for thermal expansion of exposed sheet metal work. Space movement joints at maximum 10 feet intervals with no joints allowed within 24- inches of corner or intersection.
6. Provide where flashings are indicated on drawings or are required for a weathertight job. Exposed corners shall be shop formed and soldered where stainless steel or galvanized steel. Use concealed fastenings wherever possible. Where necessary to expose fasteners, use high dome hex-head EPDM gasketed screw fasteners with finish color to match sheet metal.
7. Counterflashings: Form to detail in standard sheet lengths of specified sheet metal, width to overlap base flashings at least 4 inches. Lap with bayonet joints and provide continuous hemmed drip edge at bottom. Provide watertight end closures at ends of reglets and counterflashings.
8. Provide end dams or other watertight closure at end termination of all flashing to ensure water is directed to exterior of building.

3.04 CLEANING

A. Comply with Manufacturer's recommendation for cleaning fingerprints and other contaminants from colored stainless steel. Fully clean all exposed stainless steel prior to completion of project.

B. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes, and promptly apply matching touch-up paint to surface scratches and cut "raw" edges prior to exposure to weather.

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes:
1. Pre-finished galvanized steel gutters.
2. Steel downspouts.

B. Related Sections:
1. Section 05 50 00 – Metal Fabrications
2. Section 07 52 16 – SBS Modified Bitumen Roof System
3. Section 07 62 00 – Sheet Metal Flashing and Trim.

1.02 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM D17855 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Conform to SMACNA (ASMM) for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.

B. Conform to applicable code for size and method of rain water discharge.

1.04 SUBMITTALS

A. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

B. Samples: Submit two samples, 12 inch long illustrating component design, finish, color, and configuration.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Gutters and Downspouts:
   1. Basis of Design for Gutters: Subject to compliance with requirements, provide products manufactured by: NorthClad Rainscreen Solutions, 11831 Beverly Park Road, Everett, WA 98024, Phone: (425) 487-1111, E-mail: dkillian@northclad.com, Website: www.northclad.com.
      a. Series 600 gutters, 4” x 4” size, with 22 gauge galvanized, pre-finished steel and the 20 gauge stainless steel screens. 3” *NorthClad® Gs 44 Square Down Spout.*
   2. Or approved equal.

2.02 MATERIALS

A. Polyvinyl Chloride (PVC): ASTM D2665, virgin vinyl, SDR 35 pipe and fittings, high impact type, colorfast; grey color.

B. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 22 gauge base metal.
   1. Exterior Finish: Polyvinlidene Flouride (PVF2) minimum 70% Kynar resin (K-600) dry film thickness 0.8 mils minimum.
   2. Exterior Primer: Baked on epoxy primer coat dry film thickness 0.2 mils minimum.
   3. Total exterior dry film thickness: 1.0 mils minimum.
   4. Interior finish: Factory standard prime-coat, dry film thickness 0.5 mils minimum
   5. Color: As selected by architect from manufacturer’s standard colors.

2.03 COMPONENTS

A. Gutters: Shall be of free floating design supported without penetration by suspension from a gutter cleat, gutters shall be formed in continuous sections of profile and size indicated.

B. Downspouts: NorthClad Gs 44 Square DS
   1. Manufacturer shall be in compliance with required references and standards.
   2. Size: 3” x 3”. in 20-foot lengths or longest practical length appropriate to the installation conditions.

C. Connectors: Furnish required connector pieces for galvanized steel components.

D. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: Type recommended by fabricator.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Brackets.

E. Fasteners: Stainless steel, with soft neoprene washers.

2.04 ACCESSORIES

A. Anchorage Devices: Type as recommended by fabricator.

B. Gutter Straps: Minimum 20 gauge perforated stainless steel cleat system as manufactured by NorthClad Rainscreen Solutions. Holes to be 3/8" minimum on a ½" stagger. Provide 8" wide cleanouts @ 10'-0" o.c. where continuous stainless clip is used; 2" wide 16 gauge minimum straps spaced at no more than 18" o.c. if continuous system is not used.

C. Expansion joints: Provide manufacturer's standard expansion joint assemblies allowing for minimum 3/4" thermal movement; spacing per manufacturer.

D. Downspouts: Manufacturer's standard of type and gauge.

E. Downspout Brackets: Fabricate brackets to match color, finish, and thickness of downspouts unless otherwise indicated.

2.05 FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

F. Field measure conditions prior to fabricating work.

G. Roll form gutters in longest practical lengths.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.02 PREPARATION

A. Apply bituminous protective backing on surfaces in contact with dissimilar metals.

B. Downspouts: remove manufacturer's markings and nomenclature on exterior of downspout pipe prior to installation. Do not damage or mar the downspouts.

3.03 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

C. Provide manufacturer’s standard expansion joints at 50’-0” o.c. maximum. Sections of less than 50’-0” shall be roll formed continuous without joints of any kind.

D. Gutter drops to slope to downspout connections.

END OF SECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Project Manual apply to the work of this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Storm Collars
   2. Rubber rooftop supports

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other Work.

C. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:
   1. Size and location of roof accessories specified in this Section.
   2. Method of attaching roof accessories to roof or building structure.
   3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for roof accessories with factory-applied color finishes.

1.04 QUALITY ASSURANCE

A. Standards: Comply with the following:
   1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
   2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Storm Collars
   1. Stainless steel 316L

B. Rubber rooftop supports
   1. Dura-Block rooftop support

2.02 MATERIALS, GENERAL

A. Aluminum Sheet: ASTM B 209 for alclad alloy 3005H25 or alloy and temper required to suit forming operations, with mill finish, unless otherwise indicated.

B. Extruded Aluminum: ASTM B 221 alloy 6063-T52 or allow and temper required to suit structural and finish requirements, with mill finish, unless otherwise indicated. Galvanized Steel Sheet: ASTM A 653/A 653M with G90 coating designation; commercial quality, unless otherwise indicated.

C. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M with Class AZ-50 coating, structural quality, Grade 40, or as required for strength.

D. Insulation: Manufacturer's standard rigid or semirigid glass-fiber board of thickness indicated.

E. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

G. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coating.

H. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

I. Elastomeric Sealant: Generic type recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25, and Uses NT, G, A, and, as applicable to joint substrates indicated, O.

J. Roofing Cement: Adhesive compatible with roofing system.

2.03 FINISHES, GENERAL

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: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's specifications for cleaning, conversion coating, and painting.
   1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils, medium gloss.
   2. Color: As selected by Owner from manufacturer's full range.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: Comply with manufacturer's written instructions. Coordinate instillation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor roof accessories securely to supporting structural substra5tes so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual," unless otherwise indicated.

C. Separation: Separate metal from incompatible metal or corrosive substrate, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

D. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form a seal.

E. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counterflashing). Seal overlap with thick bead of mastic sealant.

F. Operation Units: Test-operate unit with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.02 CLEANING AND PROTECTION

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

END OF SECTION

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. Firestopping of all penetrations through fire barriers, including:
   1. Voids around:
      a. Pipes.
      b. Ducts.
      c. Conduit.
   2. Other openings, as required by authorities having jurisdiction.
   3. Other openings indicated.

B. Smokestopping of all penetrations through smoke barriers, including:
   1. Voids around:
      a. Pipes.
      b. Ducts.
      c. Conduit.
      2. Joints between smoke barriers and other construction.
      3. Other joints and openings, as required by authorities having jurisdiction.

C. Work Not Included: Repairing penetrations made in error and repairing penetrations which are too large to be sealed by the methods indicated; these are to be repaired using the original material of the construction.

D. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not and other openings indicated.

1.02 GENERAL REQUIREMENTS

A. Drawings and Division 00 and Division 01 apply to this section

B. Section 09 21 16 - Gypsum Board Systems

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

C. ITS (DIR) - Directory of Listed Products current edition.

D. FM 4991 - Approval Standard for Firestop Contractors 2013.

E. SCAQMD 1168 - Adhesive and Sealant Applications 1989 (Amended 2017).

F. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. See Division 00 and Division 01 for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors, or meeting any two of the following requirements:.
   2. With minimum 3 years documented experience installing work of this type.
   3. Able to show at least 5 satisfactorily completed projects of comparable size and type.
   4. Licensed by authority having jurisdiction.

1.06 PROJECT CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 – PRODUCTS

2.01 GENERAL – (Not Used)

2.02 MATERIALS

A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by National Volatile Organic Compound Emission Standards for Consumer and Commercial Products.

B. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
   1. Elongation: 500 percent.
   2. Density: 4 lb/cu ft.
   3. Durability and Longevity: Permanent.
   4. Color: Black, dark gray, or red.

2.03 PRODUCTS - FIRESTOPPING SYSTEMS

A. Elastomeric Silicone Firestopping Manufacturers
   1. 3M Fire Protection Products: www.3m.com/firestop.
   2. Specified Technologies, Inc: www.stifirestop.com.

B. Firestop Sealants and Caulks
   1. Specified Technologies, Inc; STI SpecSeal Sealant: www.stifirestop.com.
   2. 3M Fire Protection Products; 3M Firestop Sealant No. 200: www.3m.com.
   3. 3M Fire Protection Products; 3M CP25WB-Caulk: www.3m.com.

C. Firestop Collars
   1. Specified Technologies, Inc; STI SpecSeal Firestop Collars: www.stifirestop.com
   2. 3M Fire Protection Products; 3M PPD Collars: www.3m.com.

2.04 AREAS OF INSTALLATION

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use any system listed by UL or tested in accordance with ASTM E 814 that has F Rating equal to fire rating of penetrated assembly and minimum appropriate T Rating and that meets all other specified requirements.

B. Firestopping at Uninsulated Metallic Pipe and Conduit Penetrations, of diameter 4 inches or less: Caulk or putty.
   1. Roof Slabs: F Rating 2 hour.
   2. Area Separation Walls: F Rating 3 hour.
   3. Stairway Walls: F Rating 2 hour.
   4. Other Interior Partitions: F Rating 3/4 hour.

C. Firestopping at Combustible Pipe and Conduit Penetrations, of diameter 4 inches or less: Any material meeting requirements.
   1. Floors: F Rating 2 hour.
   2. Roof Slabs: F Rating 2 hour.
   3. Area Separation Walls: F Rating 3 hour.
   4. Corridor Walls: F Rating 1 1/2 hour.
   5. Other Interior Partitions: F Rating 3/4 hour.

D. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
   1. Elongation: 500 percent.
   2. Density: 4 lb/cu ft.

3. Durability and Longevity: Permanent.
4. Color: Black, dark gray, or red.
5. Manufacturers:
   a. 3M Fire Protection Products: www.3m.com/firestop.
   b. Specified Technologies, Inc: www.stifirestop.com.

E. Firestop Sealants and Caulks
1. Specified Technologies, Inc; STI SpecSeal Sealant: www.stifirestop.com.
2. 3M Fire Protection Products; 3M Firestop Sealant No. 200: www.3m.com.
3. 3M Fire Protection Products; 3M CP25WB-Caulk: www.3m.com.

F. Firestop Collars
1. Specified Technologies, Inc; STI SpecSeal Firestop Collars: www.stifirestop.com
2. 3M Fire Protection Products; 3M PPD Collars: www.3m.com.

G. Wrap Strips
1. 3M Fire Protection Products; 3M FS-195 Wrap Strip: www.3m.com.
2. Durability and Longevity: Permanent.
3. Color: Dark grey.
4. Firestop Putty: Compound that expands on exposure to surface heat gain; conforming to the following:
   a. Durability and Longevity: Permanent.
   b. Color: Black, dark gray, or red.
   c. Manufacturers:
      1) 3M Fire Protection Products; Product MPS-2 Moldable putty Stix & Putty Pads: www.3m.com/firestop.
      2) Specified Technologies, Inc; Product SpecSeal Firestop Putty Bars & Pads: www.stifirestop.com.
   d. Durability and Longevity: Permanent.

PART 3 – EXECUTION

3.01 GENERAL – (Not Used)

3.02 FIELD QUALITY CONTROL

A. Obtain the services of firestopping material manufacturer's representative to instruct installers and to inspect the completed installations for correctness.

B. Inspect completed installations for completeness and correct installation.
1. If installed work is to be covered in completed work, inspect and obtain approval prior to covering.
2. Obtain the approval of the authority having jurisdiction.
3. Submit report of inspection to the Owner.

C. Preinstallation Inspection: Inspect all fire and smoke barriers for penetrations of any type; mark or otherwise identify all penetrations indicating action required:
1. Repair

2. Firestopping
3. Smokestopping.

D. Conduct inspection prior to covering up or enclosing walls or ceilings
   1. Conduct inspection jointly with authorized representative of authority having jurisdiction.
   2. Submit a report detailing findings of inspection to the Owner.

E. If the configuration of a particular penetration does not conform to the configuration necessary for the required firestopping assembly:
   1. Notify the installer of the penetration for modification of the configuration to suit the assembly
   2. Do not use the firestopping assembly in other configurations except as specifically stated in the test report or as approved by the authority having jurisdiction.

F. Verify openings are ready to receive the work of this section.

3.03 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

3.04 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

3.05 CLEANING AND PROTECTION

A. Clean up excess material adjacent to penetrations promptly; use methods and materials approved by the manufacturers of the penetration seals and of surfaces to be cleaned.

B. Protect adjacent surfaces from damage by material installation.

C. Protect installed work from damage from construction operations using substantial barriers if necessary.

D. Repair damaged materials in accordance with manufacturer's instructions.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Drawings and general provisions of the Project Manual apply to the work of thissection.

1.02 RELATED SECTIONS

A. Section 03 01 30.71 – Concrete Rehabilitation

B. Section 03 30 00 – Cast In-Place

C. Section 08 11 13 Hollow Metal Door and Frames

D. Section 08 41 13 Aluminum Storefront

E. Section 08 45 23 Insulated Translucent Wall Panel

1.03 REFERENCED STANDARDS

A. Work shall conform, at a minimum, to the requirements of the 2018 International Building Code (IBC).

B. ASTM C 1193-16 (Most Current Edition), Standard Guide for Use of Joints Sealants.

C. ASTM C920-16 (Most Current Edition), Standard Specification for Elastomeric Joint Sealants.

D. ASTM C 1248 “Standard Test Method for Staining of Porous Substrate by Joint Sealants”

E. ASTM C 1311 “Standard Specification for Solvent Release Sealants”

F. ASTM C 1330 “Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants”

G. Sealants: The Professionals’ Guide, published by the Waterproofing & Restoration Institute (SWR), 1995 or most current edition.

1.04 SUMMARY

A. Extent of each type of sealant work is indicated on drawings and by provisions of this section.

B. This section includes sealants for the following applications
   1. Exterior joints: in the following vertical surfaces and non-traffic horizontal surfaces:
      a. Joints between different materials.
   2. Sealant Work: At all locations where sealant performs as the primary or secondary weather barrier for the various Project related sheet metal and trim, roofing and related accessories, rough carpentry, wall cladding, locations, such as in joints and overlaps of

the sheet metal-to-saddle junctions, sheet metal coping joints, counterflashing, at metal joinery equipment, the tops of lead plumbing flashings, storm collars, where flashing materials are sequenced into the new specified roof membrane system, new roof system, and/or wall cladding, architectural features, door frames at building transitions, and all other junctures where materials intersect, remove old sealants (if and where present), clean and, as required, prime substrates, and apply new specified sealant, watertight and airtight in proper configuration that will allow long-term successful performance and dimensional movement of the sealant section.

1.05 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seal without causing staining or deterioration of joint substrates.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, project name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.

B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature change, contaminants, or other causes.

1.07 SUBMITTALS

A. General: Submit in accordance with Division 01 Submittals.

B. Product Safety Data Sheets from manufacturers for each joint sealant required.

C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

D. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed joint sealant application similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

B. Joint Sealant Materials: Install joint sealant materials from a single approved manufacturer for each different product required.

C. Install exterior sealant joint that are long term watertight, waterproof, and weatherproof.

1.09 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
   1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturers. Or below 40 deg. F (4.4 deg. C)
   2. When joint substrates are wet due to rain, frost, condensation, or other causes

B. Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.10 SEQUENCING AND SCHEDULING

A. Sequence installation of joint sealers work of other trades so that substrates to be sealed are ready for sealant, so that locations to receive sealant are not covered by other work before sealant is applied, and so that sealant joints are allowed to fully cure without damage from construction.

B. Sequence installation of joint sealers to occur not less than 21 nor more than 30 days after completion of waterproofing unless otherwise indicated.

1.11 WARRANTY

A. Installer’s warranty: Written warranty, signed by installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within the specified warranty period.
   1. Warranty period: 1 year from the date of Physical Completion

B. Manufacturer’s warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric 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: 10 years from the date of Physical Completion

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

B. Colors: Provide selection made by Engineer from manufacturer's standard colors for products of type indicated.

C. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168, VOC Limits, effective January 7, 2005.
   1. Sealants: 250 g/L (less water).
   2. Sealant Primers for Nonporous Substrates: 250 g/L (less water).
   3. Sealant Primers for Porous Substrates: 775 g/L (less water).

2.02 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant which complies with ASTM C 920 requirements, including those for Type, Grade, Class, and intended uses indicated in the 'Joint Sealant Schedule' located at end of this section.

B. Available Products: Subject to compliance with requirements, elastomeric sealants that may be incorporated in the Work include, but are not limited to, the products specified in the "Joint Sealant Schedule' located at the end of this section.

2.03 TAPE SEALANTS

A. Tape Sealant: Manufacturer's standard, solvent-free, butyl-based tape sealant with a solids content of 100 percent formulated to be non-staining, paintable, and non-migrating in contact with nonporous surfaces with or without reinforcement thread to prevent stretch and packaged on rolls with a release paper on one side.

B. Available Products: Subject to compliance with requirements, tape sealants that may be incorporated in the Work include, but are not limited to, the following:
   1. "Extr-Seal Tape," Pecora Corporation
   2. "Shim-Seal Tape," Pecora Corporation
   3. "PTI 606," Protective Treatments, Inc.
   4. "Tremco 440 Tape," Tremco, Inc.
   5. "MBT-35," Tremco, Inc.

2.04 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type that are non-staining; 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. Plastic Foam Backer Rod: Preformed, compressible, resilient, non-staining, non-waxing, non-extruding strips of flexible plastic foam of material indicated below and of size and shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, non-out-gassing in un-ruptured state and with diameter 40% greater than the joint width.

D. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint fillermaterials or joint surfaces at back or joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.05 SELF LEVELING POLYURETHANE SEALANT

A. Product Manufacturers
   1. Sonneborn, Product: Sonolastic SL2, Degussa
   2. Iso-Flex 880 GB, Lymtal
   3. Sika, Product: Sikaflex-2x SL and NS, Sika
   4. THC-900/THC-901 or Vulkem 245, Tremco
   5. Substitutions in accordance with Section 01 60 00 - Product Requirements.

B. Color to match existing concrete.

2.06 MISCELLANEOUS MATERIALS

A. Primer: Provide type recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from pre-construction joint sealant substrate and field tests.

B. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials.

C. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints as applicable, easily removable upon completion.

D. Accessory Materials for Fire-Stopping Sealants: Provide forming, joint fillers, packing and other accessory materials for installation of fire-stopping sealants as applicable to installation conditions indicated.

PART 3 – EXECUTION

3.01 INSPECTION

A. Require installer to inspect joints indicated to receive joint sealers for compliance with requirements for joint configurations, installation tolerances and other conditions affecting joint sealant performance.

B. Do not allow joint sealant work to proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Sawcut and grind cracks to be sealed to provide a crack opening profile as shown on the Drawings.

B. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealant manufacturers and the following requirements:

C. Remove all foreign material from joint substrates which could interfere with adhesion and cohesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil; grease; waterproofing; water repellents; water; surface dirt, fungus, efflorescence, laitance, release agents, and frost.

D. Clean porous joint substrate surfaces to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

E. Clean non- porous surfaces by chemical cleaners or other means, which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers as recommended by joint sealant manufacturer.

F. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on pre-construction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primer to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

G. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged bysuch contact of be cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing seal.

3.03 INSTALLATION OF JOINT SEALERS

A. General: Comply with joint sealant manufacturer’s printed installation instructions, including "tooling" and all techniques applicable to products and applications indicated, except where more stringent requirements apply

B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants

D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
   1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths, which allow optimum sealant movement capability.
      a. Do not leave gaps between ends of joint fillers.

b. Do not stretch, twist, puncture, or tear joint fillers
c. Remove absorbent fillers, which have become wet prior to
d. sealant application and replace with dry material.

2. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints could result in sealant failure.

E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

F. Tooling of non-sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.
   a. Use masking tape to protect adjacent surfaces of recessed tooled joints

3.04 PROTECTION AND CLEANING

A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of physical completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealant installations with repaired areas indistinguishable from original work and watertight.

B. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

3.05 ELASTOMERIC JOINT SEALANT SCHEDULE

A. Non-staining Silicone Joint Sealants:
1. No staining of substrates when tested according to ASTM C 1248.
2. Silicone, Non-staining, S, NS, 50, NT: Non-staining, single-component, non-sag, plus 50 percent and minus 50 percent movement capability, non-traffic-use,
3. neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Dow Corning 795;
   b. Pecora 895 NST;
   c. GE Momentive – SCS2000 Silpruf;
   d. or Project Approved Equal submitted through the Substitution Request and Potentially Approved by the Project Architect.

B. Polyurethane Joint Sealants
   1. Urethane, S, NS, 25, NT: One-part silyl-terminated, non-sag, non-traffic use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
   2. Use related to Joint Substrates: M, G, and as applicable, to joint substrates indicated, O.
   3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BASF – Master Seal 150
      b. or Project Approved Equal submitted through the Substitution Request

C. Self-leveling Polyurethane Sealant
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BASF, Product: Master Seal SL2
      b. Iso-Flex 880 GB, Lymtal
      c. Sika, Product: Sikaflex-2x SL, Sika
      d. THC-900/THC-901 or Vulkem 245, Tremco
      e. or Project Approved Equal submitted through the Substitution Request

D. Butyl Joint Sealants
   1. Non-Skinning Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Sika – Sikalastomer 511;
      b. Pecora BA-98;
      c. Tremco – JS-773 Synthetic Butyl Sealant;
      d. or Project Approved Equal submitted through the Substitution Request and Potentially Approved by the Project Architect.

END OF SECTION

DIVISION 08

Openings

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Standard and custom hollow metal doors and frames.
   2. Steel sidelight, borrowed lite and transom frames.
   3. Light frames and glazing installed in hollow metal doors.

B. Related Sections:
   1. Division 01 Section "General Conditions".
   2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
   3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
   4. Division 08 Section "Door Hardware".
   5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
   2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
   3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
   4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
   5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
   6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
   10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
   11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
   12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
   13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.

14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.03 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.
   1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
   2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
   3. Smoke Control Door Assemblies: Comply with NFPA 105.
      a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Storm Shelter Openings: Provide complete door systems for hurricane or tornado storm shelters, and other areas of refuge, complying and tested according to ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.
   1. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

F. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
   1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.05 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.06 COORDINATION

A. Coordinate installation of anchorages 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.

B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
   1. CECO Door Products (C).
   2. Curries Company (CU).

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 38 percent.

D. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.03 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Design: Flush panel.
   2. Core Construction: Manufacturer's standard polystyrene. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 2.8 or better.
   3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
   4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
   5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
   6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Design: Flush panel.
   2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
      a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
   3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.

4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Manufacturers Basis of Design:
   1. Curries Company (CU) - Polystyrene Core - 707 Series.

2.04 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
   1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
   2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
   3. Manufacturers Basis of Design:
      a. Curries Company (CU) – M CM Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
   1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
   2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
   3. Manufacturers Basis of Design:
      a. Curries Company (CU) - M Series.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
   2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.06 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.07 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.08 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 thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:
   1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
   2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
   3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" 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.

4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:
   1. Shipping Limitations: 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.
   2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
      a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
   3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
   4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
   5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
   6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
   7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
   8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   9. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry 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) Two anchors per jamb up to 60 inches high.
         2) Three anchors per jamb from 60 to 90 inches high.
         3) Four anchors per jamb from 90 to 120 inches high.
         4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
      b. 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) Three anchors per jamb up to 60 inches high.
         2) Four anchors per jamb from 60 to 90 inches high.
         3) Five anchors per jamb from 90 to 96 inches high.
         4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
         5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
   10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
   11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or

asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
   1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
   2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
   3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
   4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.09 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.01 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. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.03 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 ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
   1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
   3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
   4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Standard Steel Doors:
      a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
      b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
      c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
      d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.04 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 and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.05 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
   1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Access door and frame units in wall and ceiling locations as required.

B. Access doors as indicated in the contract documents, or as otherwise required to access concealed construction of any type that requires regular maintenance or repair.

1.03 RELATED REQUIREMENTS

A. Section 05 40 00 – Cold formed Metal Framing: Blocking and framing for access openings.

B. Section 09 21 16- Gypsum Board systems

C. Section 09 90 00 – Painting and Coating

D. Division 23: Mechanical section for mechanical requirements through finished walls and ceilings

1.04 REFERENCE STANDARDS

A. ASTM A666 Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM A879/A879M Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface.

C. ASTM 1008/A1008M Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardened

D. ASTM B209 Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate

E. ASTM B221 Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.05 SUBMITTALS

A. See Section 01 33 00 – Submittals, for submittal procedures.

B. Product Data: Submit manufacturer’s product data

C. Shop drawings:
   1. Door and panel units: show types, thickness of metals, full size profiles of door members.
   2. Hardware: Show materials, finishes, locations of fasteners, types of fasteners, locations and types of operating hardware, and details of installation.
   3. General: Show connections of units and hardware to other Work

D. Warranty: Submit executed copy of manufacturer's standard warranty.

E. Closeout: Submit door and access panel keys to the Owner

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain Access Panel and frame through one source from a single manufacturer wherever possible.

B. Manufacturer Qualifications: A minimum of 5 years of experience manufacturing similar products.

C. Installer Qualifications: A minimum of 2 years' experience installing similar products.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original unopened packaging.

B. Store materials in a dry, protected, well vented area.

C. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.09 WARRANTY

A. Manufacturer Warranty: manufacturer agrees to replace doors that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.01 ACCESS DOOR AND PANEL APPLICATIONS

A. Wall and Ceilings:
   1. Location: As indicated on the construction drawings.
   2. Size: 12"x 12" min, unless otherwise indicated.

B. Fire Rated Walls and Ceiling
   1. Location: As indicated on the construction drawings.
   2. Wall Fire Rating: As indicated on the construction drawings.
   3. Size: 12” x 12” min, unless otherwise indicated.

2.02 WALL AND CEILING UNITS

A. Manufacturers:
   1. Milcor ™ Company: https://www.milcorinc.com/products/m/architectural-grade-flush-door
      a. M-ARCHITECTURAL GRADE FLUSH DOOR
      b. UNIVERSAL FIRE RATED ACCESS DOOR
   2. Acudodor Products Inc: https://www.acudor.com/
      a. Flush Access Door
      b. Fire Rated Access Door
   3. Karp: http://karpinc.com/product/flush-access-door-surfaces/
      a. Flush Access door for all surfaces
      b. Fire Rated Access Door for Walls and Ceilings

B. Access Doors: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.
   1. Material: Steel
   2. Door Style: Single Thickness with rolled or turned in edges
   3. Finish: Factory Finished; powder coat, manufacturer’s standard color, white.
   4. Hardware:
      a. Latch: Cylinder lock furnished with two keys.

C. Fire Rated Access Door: Factory fabricated door and frame units, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.
   1. Material: Steel
   2. Door Style: Singe Thickness with rolled or turned in edges
   3. Units in Fire Rated Assemblies: Fire rating as required by applicable code for the fire rated assembly in which they are to be installed. See drawings for wall and ceiling fire ratings.
   4. Finish: Factory Finished; powder coat, manufacturer’s standard color, white.
   5. Hardware:
      a. Latch: Cylinder lock furnished with two keys.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify rough opening are correctly sized and located.

B. Verify that existing rough opening framing is complete, secured, and suitable for attachment of new access door.
   1. Verify that wrapping of metal studs as required at fire rated assemblies is complete before installation of fire rated access door.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work

B. Prepare surfaces using method recommended by manufacturer for applicable substrates in accordance with project conditions Surfaces should be structurally sound, free of voids, spalls, loose aggregate and sharp ridges.

3.03 INSTALLATION

A. Install units in strict accordance with manufacturer's instructions and approved submittals.
   1. Test units for proper function and adjust until proper operation is achieved.
   2. Repair finishes damaged during installation.
   3. Restore finishes so no evidence remains of corrective work.

B. Install Frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

3.04 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. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

C. Protect completed work from subsequent construction activities as recommended by manufacturer

END OF SECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Project Drawings and general provisions of the Construction Contract, including General and Supplementary Conditions, Division 01 Specification Sections and bidding requirements, apply to the work of this Section.

B. Technical publications, standards, and reference documents as outlined in individual Technical Specification Sections and as indicated on the Project Drawings.

1.02 SUMMARY

A. General: Furnish all labor, materials, equipment, and services necessary and incidental to execution and completion of removal of existing fenestration system and installation of new, exterior Aluminum Framed fenestration systems according to the Contract Documents, this Section, and the Project Drawings where indicated. Installation shall coordinate with fenestration rough opening flashings, sealants, and shall be long-term weather proof, with all associated accessories as necessary for thorough water-tight and weather-proof installation of new extruded aluminum fenestration.

B. Section Includes, aluminum framed glass storefront fenestration, swing doors, and entrance door systems at Ray Williamson Pool Office and Natatorium area scheduled for removal and replacement.

C. Aluminum-Framed Storefront
1. Arcadia, Inc., AG451T Series, 2” x 4-1/2” Thermally broken; center glazed system, screw spline, shear block, compensating stick or punched opening fabrication for 1” glass.
2. Ensure that proper, complete and watertight installation.

D. Related Sections:
1. Divisions 0 and 1 – All related Sections
2. Section 02 41 19 - Selective Demolition
3. Section 06 10 00 – Rough Carpentry
4. Section 07 92 00 – Joint Sealants
5. Section 08 71 10 – Door Hardware
6. Section 08 80 00 – Glazing

1.03 BENCHMARK REFERENCES AND STANDARDS

A. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. 2018 International Building code (IBC), as amended by the State of Washington
2. 2018 Washington State Energy code.
3. ANSI A117.1 Accessible and Useable Buildings and Facilities
4. NFPA 80-Fire Doors and Windows

B. General: The following documents, industry standards, publications, and the information contain therein, shall guide the work, as applicable. The work shall be evaluated in compliance with the benchmark references and the Contract Documents, notify the Consultant promptly. The more conservative published requirement shall guide the work.
   1. Architectural Sheet Metal Manual, published by Sheet Metal and Air Conditioning Contractors National Association (SMACNA), (1979[3rd Ed.] and 2003 [6th Ed], and most current edition).
   2. Sealants: The Professionals' Guide, published by the Waterproofing & Restoration Institute (SWR), 1995.
   3. Manufacturers' technical data sheets, MSDS sheets, and installation instructions for each product specified and/ or used.

C. ASTM-American Society for Testing and Materials:
   1. ASTM E 283-04 "Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors."
   2. ASTM E330-02 "Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference."
   3. ASTM E331-00 "Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference."
   4. ASTM E 547 "Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential."
   5. ASTM G85 Modified Salt Spray (Fog) Testing.
   6. ASTM E774-00 "Specification for Sealant Insulating Glass Units."
   7. ASTM E1105, Standard test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.
   8. ASTM E-1886-02 "Standard for Testing Windows and Doors for Cyclic Wind {ressires."
   9. ASTM E 1996-02 "Standards for Testing Windows and Doors for Windborne Debris (large Missile and small Missile)."
   10. ASTM C1193, Standard Guide for Use of Joint Sealants.
   11. ASTM E241, Standard Guide for Limiting Water Induced Damage of Buildings.
   12. ASTM E2112-07 "Standard Proactive for Installation of Exterior Windows, Doors and Skylights."

D. AAMA- America Architectural Manufacturers Association:
   1. AAMA /NWWDA 101/ I.S.2-97 "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors."
   2. AAMA 503-03 "Voluntary Specification for Field Testing of Windows and Sliding Glass Doors. "No reduction allowed.
   3. AAMA 611-98 "Voluntary Specification for Anodized Architectural Aluminum."
   4. AAMA 701-00 "Voluntary Specification for Pile Weather Stripping."
   5. AAMA 800-92 "Voluntary Specification for Test Methods for Sealants,"
   6. AAMA 906-96 "Voluntary Specification for Sliding Glass Door Roller Assemblies."
   7. AAMA 1503-98 "Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, and Doors, and Glazed Wall Sections."
   8. AAMA 2605-05 "Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels."

9. AAMA CW-10-97 “Care and Handling of Architectural Aluminum from Shop to Site.”

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Convene before starting work of this section. Conduct conference at Project site with location as mutually agreed by owner’s Project manager, General Contractor, Project Architect.

B. Purpose and Agenda
   1. Before the scheduled commencement of the Aluminum Framed storefront/ Entrance fenestration installation and associated flashing work, the Fenestration Installation Subcontractor, and related subcontractors (e.g., sheet metal subcontractors, etc.), and lead installers (foreperson) of each component of associated work, and other work in and around fenestration installation which must precede or follow fenestration installation shall attend a pre-Installation conference.
   2. The meeting shall be conducted by the General Contractor and shall be attended by the Project Architect, Aluminum Fenestration Installation Subcontractor, and other directly concerned with the installation of the materials and performance of the Work including Aluminum Fenestration Manufacturer(s), other subcontractors, insurers, test agencies, and governing authorities. After the meeting, the Architect will furnish Pre-Installation Meeting Minutes to the parties in attendance. At the meeting, the group shall review the materials specified and procedures related to the Fenestration Installation Work, including but not necessarily limited to the following:
      a. Distribution of any additional sets of Project Manuals, as may be needed.
      b. Review requirements of Project Documents (Including Specifications and Drawings) as part of the Contract and submittals (both completed and yet to be submitted)
      c. Review governing regulations and requirements for insurance, bonding, and certification. General safety and fall protection plans shall be described by the General Contractor. The consultants will explain project monitoring and testing as may be applicable.
      d. Review Project Abatement Consultant’s abatement requirements to ensure all abatement, containment, cleanup, and safety precautions are followed at all areas where asbestos containing, lead paint, or other hazardous materials are known, discovered, or suspected.
      e. Review and finalize the General Contractor’s Preliminary construction schedule related to fenestration Installation work, including the General Contractor’s plan for coordination or the work of the various trades involved, and other items/ events impacting the Work. The contractor shall furnish a quality control plan for the Aluminum fenestration installation, including protection measures for the stored materials, installed components, property, building, and grounds, etc.
      f. Review material(s) availability and the procurement of materials(s) and equipment yet to be delivered, material and equipment storage locations, and facilities needed to make continuous progress and avoid delays.
      g. Review the Aluminum Fenestration installation subcontractor’s supervisory and lead personnel, including cell phone numbers and emergency contact information. Equipment, power needs, any temporary facilities required for continuous Work progress and avoidance of delays will also be reviewed.

h. Review, discuss, and coordinate the interrelationship of Aluminum fenestration with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
i. Review and discuss the sequence of work required to construct a watertight and weather-tight exterior building envelope.
j. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.
k. Review Aluminum fenestration system and building protection requirements for construction period extending beyond fenestration installation, through final clean-up and removal of all construction materials, demolished materials, and surplus materials, and review requirements for leak free terminations and tie-offs.
l. Tour representative areas of the building, review and discuss scope of work for Aluminum fenestration installation, and related work. Review Alternated accepted by Owner related to the Project. As well as other preparatory work that may be performed by other trades.
m. Review weather and forecast weather conditions, and discuss protection and procedures for coping with unfavorable conditions, emergencies, and other potential circumstances including possibility of temporary protection of buildings.

1.05 SUBMITTALS

A. See Section 01 33 10 Submittals, for submittal procedures.

B. Installation of fenestration shall not commence until complete submittal package for storefronts are reviewed and approved by the Project Architect.

C. Product Data: Submit Manufacturer's descriptive technical literature, data sheets, and installation instructions, including but not limited to:
1. Provide clear technical information regarding model numbers, series numbers, types, sizes, all accessories, and all other pertinent information
2. Construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, and operating instructions for each type of storefront indicated.
3. Submit color of Aluminum frame for review and approval by Owner, and Architect.
4. Licensed Structural Engineer stamped wind design pressure calculations indicating fenestration units and their attachment to building meet International Building Code Requirements.

D. Shop Drawings: Include plans, elevations, sections, details, hardware, accessories, attachment to other Work, and operational clearances. Include dimensions, relations to construction of adjacent work, air seal and weather seal to adjacent construction, component anchorage/ fastenings and locations, anchor/ fastening intervals, flashing details, methods and materials, and hardware details. Specifically include the following:
1. Fastening requirements, anchorage requirements, and rough opening requirement. Attachment details.
2. Mullion details, including integral reinforcement and stiffeners.
3. Fenestration schedule
4. Joinery Details

5. Expansion provisions
6. Weather stripping and gasketing details.
7. Fenestration rough opening flashing, sheet metal sill and head flashing, and associated flexible flashings.
8. Written certificate verifying specified flashing and sill pan is acceptable to Fenestration Manufacturer and will not negatively impact the Manufacturer's warranty.
9. Thermal break details
10. Glazing details.
11. Stops, fasteners, and all other accessories

E. Samples for Verification:
1. Fenestration corner sample
2. Consultant reserves the right to require additional samples that show fabrication techniques, workmanship, and design or hardware and accessories
3. Exposed finishes: 2" by 4"in color and finish selected by Owner/ Architect.
4. Exposed Hardware: Full Size units.

1.06 QUALITY CONTROL

A. Contractor Requirements:
1. Contractor shall provide experienced supervisors(i.e., Superintendent and Foreperson) and personnel (i.e., crew) to perform the work, who are trained in the application of the materials and procedures specified in this Specification. Contractor shall provide documentation from the Manufacturer that the contractor meets experience and training requirement for the specified system. Contractor shall maintain on-site supervision continuously to assure on going quality control for superior quality application.
2. Contractor must have minimum five (5) years experience and specialize in installing Aluminum framed fenestration.
3. The contractor shall be responsible for the quality control of all of their own work, as well as the work performed by the subcontractors working under this Specification, and/ or related specification which is considered part of the Project Contract.
4. Contractor shall notify the Architect/ Consultant of any conflicts that may result in a deviation from the Manufacturer's Specifications, Industry standards, code compliance, job safety, or function as a result of the Project scope of Work, Specifications, and/ or Project Drawings.
5. If the Architect, Consultant and/ or Specified Manufacturer determine that the quality of work does not conform to the Specifications, and Project drawings, and /or Manufacturer's requirements, as well as Industry Standards, the Contractor must correct all deficiencies and advise the Architect Consultant and Manufacturer of the corrective actions taken.
6. Contractor must demonstrate the ability to perform the work in a quality, timely manner with minimum noise and disruption to or impact on Owners, Guests, Employees, Patrons, and the Public.
7. No modification to the Specifications, Project Drawings or substitutions of specified products shall be made without direct approval by the Project Architect. Contractor shall provide consultant with a written request for review and potential approval.

B. Manufacturer's Responsibilities:
   1. Manufacturer capable of fabricating extruded Aluminum framed fenestration that meets or exceeds performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations
   2. Demonstrate a minimum of ten (10) years of successful performance on similar projects:
   3. Manufacturer's Technical services representatives shall be available for technical information and project-site meetings, and be thoroughly experienced with the products to be installed, installation requirements and practices, quality control of the installation.
   4. Prior installation, Manufacturer shall provide any and all published special considerations for the suitability, installation, use, and maintenance of their Product(s) in the geographical area and climate where construction will take place.

C. Source Limitations: Single source responsibility
   1. Obtain extruded aluminum-framed fenestration system from single source from single manufacturer.

1.07 SYSTEM DESCRIPTION

A. General: In addition to requirements shown or specified, comply with:
   1. Applicable provisions of AAMA Aluminum Storefront and Entrance Manual for design, materials, fabrication and installation of component parts.

B. Design Requirements: Arcadia AG451T Series is a framing system that provides for flush glazing on all sides without projected stops, with glass in the center of the frame. Framing system suitable for outside or inside glazing.

C. Performance Requirements:
   1. Limit air leakage through assembly to 0.06 CFM/min/sq. ft. (.00003 m^3/sm^2) of wall area at 6.24 PSF (300 Pa) as measured in accordance with ASTM E283.
   2. Water Resistance: No water leakage when measured in accordance with ASTM E331 with a static test pressure of 8 PSF(383 Pa).
   3. Limit mullion windload deflection of L/175 with full recovery of glazing materials, when measured in accordance with ASTM E 330.
   4. System shall not deflect more than 1/8" at the center point, or 1/16" at the center point of a horizontal member, once deadload points have been established.
   5. System shall accommodate expansion and contraction movement due to surface temperature differential of 180 degrees F.
   6. Seismic testing shall conform to AAMA recommended static test method for evaluating performance of curtain walls and storefront wall systems due to horizontal displacements associated with seismic movements and building sway.
   7. Thermal Performance – When tested in accordance with AAMA 1503.1 the following results should be attained: U-Maximum .63/CRF – minimum of 59.
   8. National Fenestration Rating Council (NFRC) specific application evaluation.

1.08 QUALITY ASSURANCE

A. The General Contractor and Subcontractor shall be responsible for complete, watertight, and weatherproof building envelope systems and assemblies. The contractor shall establish and follow best practices for the trade and of quality-control and quality assurance to assure each and every building envelope systems successful completion.

B. On-Site Observation: The Owner reserves the right to have the Consultant perform observation or monitoring of the flashings and fenestration installation. Such observation shall not relieve the Contractor of responsibility for proper execution and thorough completion of the work.

C. Single Source Responsibility:
   1. Obtain entrances, storefronts, ribbon walls, window walls, curtain walls, window systems, and finish through one source from a single manufacturer.
   2. Provide test reports from AAMA accredited laboratories certifying the performances as specified in 1.07.

D. Performance Testing: Select installed fenestration shall be tested per ASTM E1105 to ensure fully weathertight, leak-free performance. No reduction in test pressure shall be allowed.
   1. On-Site Testing: As deemed necessary by the Consultant, the Contractor shall assist in testing the installed fenestration system. The Contractor shall restore testing locations to reference standards. Costs for such testing will be the Owner's responsibility unless testing indicates materials or portions of the installed materials and/ or systems are non-compliant with Project requirements. Costs for testing that indicate non-compliance shall be the Contractor's responsibility. Non-complying work shall be corrected, and testing repeated until the entire assembly complies with Project's Contract Documents, Industry standards, and the Manufacturer(s) Installation Specifications.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site undamaged in Manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.

B. Handle fenestration to prevent damage to components and to finishes.

C. Protect fenestration from moisture, construction traffic, full sun, and damage. Store fenestration out of contract with ground, fully upright, and protected from wracking, bending, or other distortion and/ or breakage. Protect fenestration in well-ventilated and covered, dry area. Extruded aluminum framed fenestration systems shall be kept dry until installed and flashed.

D. Protect window sashes, glazing, frames, and extrusions. Replace units delivered with damaged frames or components. Units with damage to frames are not to be repaired and must be removed from the site and replaced with new.

E. Protect fenestration from condensation; do not use non-vented plastic or other covering that causes condensation. Provide ¼". Space between units to promote air circulation.

1.10 PROJECT AND ENVIRONMENTAL CONDITIONS

A. Hazardous Materials: Prior to removal of existing fenestration or commencement of fenestration related work, ensure that all abatement procedures are executed in strict coordination with all activities.

B. Field Measurements: The Contractor shall verify fenestration rough openings by field measurements before fabrication and indicate measurements on Shop Drawings. The Contractor shall provide the Project Team with a fenestration rough opening schedule that can be used for fenestration manufacture. Verify the size of each individual fenestration system rough opening to ensure the opening is adequate in size to accommodate the manufactured fenestration unit and all flashings and related components.

C. Do not install flashings and sealant to damp no wet substrates.

D. Ensure substrates are clean, dry, fully prepared, and uncontaminated to allow full and successful bonding of flashing membrane and sealant.

E. Protect installed fenestration from construction, work of other trades, and weather and moisture, until fenestration are incorporated into complete weather resistive barrier and cladding and the Project is complete.

1.11 MOCK-UPS

A. Conduct in-site mock-ups for flashing and installation of fenestration. The mock-ups may be scheduled and conducted to coincide with the Pre-Installation Meeting.
   1. Fenestration units shall be installed per Technical Specifications and Contract Drawings, including all rough opening flashing, sheet metal flashing, and sealant. Provide and install all necessary fenestration units, associated materials and components, labor, and services for the successful completion of the mock-ups.
   2. Plan, schedule, and execute the mock-ups such that the Owner's Representative, Architect and Consultant are present to observe construction and successful completion of the mock-ups.
   3. Construct full scale, in-situ mock-ups, which if accepted, may remain in place.
   4. Verify that fenestration utilized in mock-ups conform to the performance requirements specified by this Section.
   5. Confirm installation means and methods that will be repeated throughout work of this Section, including sealing of perimeter joint systems, installation of flashings, and primary watertight and secondary water shedding interface with adjacent construction.
   6. Conform to Architectural intent and allow for minor adjustments.
   7. Location: As directed by Architect and Envelope consultant, mock-ups shall be field tested, at discretion of Architect/Consultant, and Owner's Representative.
   8. Installation of fenestration flashing shall not commence until the mock-ups of each fenestration types are reviewed and approved by the Owner's Representative and Architect.
   9. Approved mock-ups shall represent minimum quality required for the Work.

10. The fenestration mock-ups shall be coordinated with required Sealant Pull Testing (See Section 07 92 00 – Sealant) and water spray testing as applicable.

1.12 REGULATORY AGENCY REQUIREMENTS

A. General: Contractor shall comply with all applicable requirements to ensure the Owners' safety and security as specified herein, and with all applicable Federal, Washington State, and Local City of Bainbridge Island regulations, laws, and ordinances

B. The Contractor shall comply with current Washington State and City of Bainbridge Island Building Codes. Report and conflicts with Material Manufacturer's installation instructions, Project Specifications, Detail Drawings, and/ or Applicable Codes to the Project Architect prior to proceeding with the Work.

C. The Contractor shall comply with the requirements of State of Washington Department of Industrial Relations, Washington Division of Occupational Safety and Health, Occupational Safety and Heal Administration (OSHA), National Industry Occupational and Health (NIOSH), and all local governing authorities (e.g.,) for work place safety.

1.13 SEQUENCING AND SCHEDULING

A. Deliver to job in time for proper and timely installation.

B. Coordinate with flashing of fenestration rough openings.

C. Coordinate with all adjacent trades and systems to allow proper flashing of fenestration rough openings, and proper integration of fenestration rough opening flashing.

1.14 CERTIFICATIONS

A. Manufacture's Certification that products:
1. Furnished for the Project meet or exceed specified requirements.
2. Are suitable for the indicated use.

1.15 MANUFACTURER'S WARRANTY

B. System shall be warranted against failure and/or deterioration of metals due to manufacturing process for a period Warranty Period of:

1. Fenestration Unit: 2 years from date of Substantial Completion.
2. Glazing Units: 10 years from date of Substantial Completion.
3. Aluminum Finish: 10 years from date of Substantial Completion.

1.16 GUARANTIES

A. Contractor's Guarantee:
1. Contractor shall guarantee that all fenestration are installed in accordance with the Project Documents, and will be free from defective workmanship and that the work will

remain weatherproof with no premature defects for a period five (5) years from the date of substantial completion in addition to Project Warranty.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Basis of Design: Arcadia, Inc., 2301 E Vernon, Vernon, CA. Telephone:(323)269-7300, Fax :(323)269-7390

B. Acceptable Products:
   1. Arcadia, Inc., AG451T Series.

C. Or approved equal.

2.02 ALUMINUM FRAMED STOREFRONT SYSTEMS

A. Storefront Fenestration:
   1. For use at Ray Williamson Pool, Office 101 and Natatorium area as depicted in the Project Drawings.
   2. Approved Basis of Design Products:
      a. Arcadia AG451T Series; 2” x 4 ½”
      b. Or Approved equal.
   3. Operating Types: Provide the following operating types in locations indicated on Drawings:
      a. Thermally broken operable glazed Accessible entrance storefront system.
      b. Thermally broken operable glazed Accessible door
      c. Fixed storefront window ribbon
      d. Fixed storefront window

2.03 GLAZING

A. Glass and Glazing: Manufacturer’s standard glazing system that produces weathertight seal.
   1. Glass: ASTM C1036, Type I, q3, Category II Safety glass complying with testing requirements in 16 CFR 1201.
   2. Safety Glazing Labeling: Permanently mark safety glazing with certification label of the SHGC or the manufacturer. Label shall indicate manufacturer’s name, type of glass, thickness, and safety glazing standard with which glass complies.
   3. Insulating-Glass Units: ASTM E 2190
      a. Maximum U-value as required to meet the overall window U-value including glazing and frame listed in the current version of the Washington State Energy Code.
      b. Filling: Fill space between glass lites with argon as required to meet overall window U-value.
      c. Spacer: Extruded thermoplastic butyl with integrated desiccant.
      d. ‘Low-E Coating: Sputtered on second surface and fourth surface.

e. Glazing Gaskets: Gaskets shall be of material and design compatible with adjacent materials and coatings and to neither degrade nor promote corrosion of adjacent Aluminum or other components.
   (1) Compression type design, replaceable, molded or extruded, or ethylene propylene diene monomer (EPDM).
   (2) Shall be or type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging.

2.04 FRAMING MATERIALS AND ACCESSORIES

A. Framing members, transition members, mullions, adaptors, and mounting: Extruded 6063-T6 aluminum alloy (ASTM B221 – Alloy G.S. 10a T6).

B. Screws, fastening devices, and internal components: Aluminum, stainless steel, or zinc-plated steel in accordance with ASTM.A-164. Perimeter anchors shall be aluminum or steel, providing the steel is properly isolated from aluminum.

C. Glazing Gasket
   1. Compression-type design, replaceable, molded or extruded, or ethylene propylene diene monomer (EPDM).
   2. Shall be of type that locks securely into the glazing reglet to prevent glazing gaskets from disengaging.

D. Sealant and Backer Rod:
   1. Provide and install sealant and backer rod at interior air and water seal and exterior perimeter joints as show in Project Drawings, and as specified in Section 079200-Sealants.
   2. Sealant Faces: Where extrusion frame shapes do not provide a continuous, watertight flat surface for bonding of sealant joints for exterior or interior air and water seals at jambs and head, provide and install inserts also called caulk stops, manufactured and provided by fenestration system manufacturer for that purpose and for use with the fenestration system.

2.05 FINISHES

A. Finish all exposed areas of aluminum and components as indicated.
   1. Fluorocarbon Coating: AAMA 2605.
      a. Resin: 70% PVDF Kynar 500/Hylar 5000.
      b. Substrate: cleaned and pretreated with chromium phosphate.
      c. Primer: Manufacturer’s standard resin base compatible coating. Dry film thickness.
         1) Extrusion: Minimum 0.20 mil.
      d. Color Coat: 70% PVDF, dry film thickness.
         1) Extrusion: 1.0 mil.
      e. Color: Silver Grey
      f. Acceptable Coatings Manufacturers:
         1) PPG Industries, Inc.
         2) Valspar Corporation

2.06 SYSTEM FABRICATION

A. Continuous sub-sill shall be provided under sill members to collect water infiltration and divert from the interior of the system.

B. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance requirements, for hardware attachment, and as indicated.

C. Fasteners shall be so located as to ensure concealment from view in the final assembly.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Inspect fenestration rough openings, substrates, framing members, anchorage, and related conditions, with the Installer and the Installer's foreperson present, for compliance with requirements for installation tolerances before beginning installation. Verify that rough opening size is correct and will accommodate fenestration unit and all associated flashing and components, and adhere to manufacturer's recommendations. Examine rough opening for: level, plumb, and square rough opening, and without twist.

B. Verify rough opening dimensions, levelness of sill substrate, and operational clearances.

C. Examine wall flashings, water and weather barriers, and other built-in components to ensure a coordinated, watertight aluminum framed storefront installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Start of installation of fenestration system shall indicate that the Installer finds conditions of the rough opening, rough opening flashing, substrates, and framing members to be suitable for successful fenestration installation per Project Documents and Manufacturer's requirements.

3.02 PREPARATION

A. Prior to installation of fenestration system, protect fenestration, wood, concrete, plaster, and gypsum substrates from weather, moisture, and damage. Install water-resistive barrier system and membrane and sheet metal flashing to clean, dry substrates.

B. Fully protect installed fenestration from damage during construction and prior to building completion and turn-over.

C. Prior to installation, remove all adhesive labels and contaminants from frames to ensure full-adhesion of flashing and sealant.

3.03 INSTALATION

A. General: Comply with Manufacturer's recommendations, Drawings, and Approved Shop Drawings for installation of fenestration, hardware, rough openings flashing, and other components.

B. Install fenestration plumb, level, and true to line, without twist, warp or rack of frames or sash. Anchor securely in place. Maintain alignment with adjacent work. Secure assembly to frame opening without distortion or stress.

C. Install fenestration for proper, easy operation, and leak-free fully weather-tight and secure performance.

D. Coordinate installation with rough opening and exterior wall flashing and other components of the work. See Drawings for fenestration installation and flashing details prior to fenestration installation.

E. Do not install fenestration units in rough opening if flashing is damaged. Correct fenestration rough opening flashing prior to unit installation

F. Install fenestration, and components to drain condensation, water penetrating joints, and moisture migrating within fenestration to exterior.

G. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight installation.

H. Separate Aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E 2112 Section 5.12 "Dissimilar Materials."

I. Rough Opening Flashing: Prior to installation of fenestration, flash fenestration rough opening per Project Drawings for fully leak-free and watertight performance of the installed fenestration assembly.

J. Attach new fenestration per Manufacturer's written recommendations and Structural Engineer Approved Shop Drawings. Do not place fasteners through rough opening flashing at horizontal surface of sill.

K. Exterior Sealant Joints: Install properly backed sealant joints at exterior fenestration as shown in Project Drawings.
   1. Install backer rod between fenestration frame and membrane flashed rough opening framing. Where sufficient clearance does not exist to install back rod, install bond breaker tape as specified in Section 07 92 00 – Joint Sealants.
   2. Install sealant joint at fenestration perimeter per Section 07 92 00 – Joint Sealants. Ensure joint is continuous and watertight. Allow no air leakage around the fenestration.

L. Interior Perimeter Air Seal: Install continuous sealant joint at interior perimeter of fenestration.
   1. Install backer rod between fenestration frame and rough opening flashing.

2. Install continuous sealant joint at fenestration perimeter. Ensure that joint is continuous, watertight, and does not allow air leakage around the fenestration.

3.04 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft (1.5 mm/m) non-cumulative or 1/8 inches per 8 ft (3 mm/3 m), whichever is less.

3.05 FIELD QUALITY CONTROL

A. Test the Aluminum storefront for water leaks in accordance with AAMA 501.2. Conduct test in the presence of the Architect.

B. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.06 CLEANING

A. Refer to Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Lubricate hardware and moving parts.

C. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weather tight closure.

D. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.

E. Clean exposed surfaces immediately after installing fenestration. Prevent damage to protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
   1. Keep protective films and covering in place until final cleaning.

F. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

G. Protect fenestration surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact fenestration surfaces, remove contaminants immediately according to manufacturer’s written instructions.

H. Replace units when repair is unsatisfactory to the Consultant or Owner, or is impractical.

3.07 SCHEDULE

AA: (1) 5’8” x 8’9” (verify in field); Factory Glazed, Accessibility compliant Entrance Storefront system

BB: (2) 9’0” x 7’11” (verify in field); Factory Glazed, Fixed storefront ribbon

CC: (2) 4’2” x 7’11” ” (verify in field); Factory Glazed, Fixed storefront

Door 1 and 3: 3’0”x7’0” (verify in field); Factory Glazed, Accessible Thermally broken operable glazed door

END OF SECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions, and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes the insulated translucent sandwich panel system and accessories, factory unitized, as shown and specified. Work includes providing and installing:
   1. Translucent wall assembly at clerestories above low-slope roof, including:
      a. Flat factory prefabricated structural insulated translucent sandwich panels.
      b. Aluminum installation system.

B. Related Sections:
   1. Section 07 20 00 – Building Insulation
   2. Section 07 62 00 - Flashing and Sheet Metal
   3. Section 07 92 00 - Joint Sealants

1.03 REFERENCES

A. American National Standards Institute (ANSI)
   1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

B. ASTM International (ASTM):
   1. ANSI Z97.1 - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
   2. ASTM D635 - Burn extent, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
   3. ASTM D1929 - Self-ignition, Standard Test Method for Determining Ignition Temperature of Plastics
   4. ASTM D2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics
   5. ASTM E84 - Flame spread and smoke development, Standard Test Method for Surface Burning Characteristics of Building Materials
   6. TAS 201/202/203 - High Velocity Hurricane Zone (HVHZ)
   7. ASTM E330 - Uniform load deflection, Standard Test Method For Structural Performance Of Exterior Windows, Doors, Skylights And Curtain Walls By Uniform Static Air Pressure Difference
   8. ASTM E331- Water penetration
   9. ASTM E283 - Air infiltration, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
   10. NFRC 100 – U-Factor
   11. NFRC 201 - Solar Heat Gain Coefficient
   12. NFRC 202 - Visible Transmittance

13. ASTM E108 - Class A burning brand
14. ASTM E90 - Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
15. ASTM E1332 - Rating Outdoor-Indoor Sound Attenuation

C. Fenestration and Glazing Industry Alliance (FGIA):
1. FGIA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
2. FGIA 605.2 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
3. 6. FGIA 606.1 - Voluntary Guide Specification and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
4. FGIA 607.1 - Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
1. TAS 201 - Criteria for conducting the hurricane impact test of materials and determining whether a particular product provides sufficient resistance to windborne debris.
2. TAS 202 - Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure Loading.
3. TAS 203 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

D. High Velocity Hurricane Zone (HVHZ)
1. TAS 202 - Criteria for Testing Impact and Non-Impact Resistant Building Envelope Components Using Uniform Static Air Pressure Loading.
TAS 203 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading

1.04 SUBMITTALS

A. Submit manufacturer’s product data. Include construction details, material descriptions, profiles and finishes of translucent wall panel system components.

B. Submit shop drawings. Include plans, elevations and details.

C. Structural calculations prepared by a structural engineer qualified in the design of Translucent Wall and Roof Assemblies licensed in the state where the project is located.

D. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements, including air, water, and structural performance data.
2. Manufacturer’s color chart listing the full range of colors available for aluminum finishing.
3. Preparation instructions and recommendations.
4. Storage and handling requirements and recommendations.
5. Installation methods and requirements.

E. Verification Samples: 12 x 12-inch (305 x 305 mm) inch glazing samples.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of ten years documented experience.
   1. Satisfactory completion of projects of similar scope and complexity.
   2. Include design, engineering, and fabrication, under single manufacturer.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

D. Verify dimensions of curb construction and material by field measurements before fabrication and document measurements on design drawings.

1.06 PRE- INSTALLATION CONFERENCE

A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.07 DELIVERY STORAGE AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
   1. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

C. Protect from damage due to weather, excessive temperature, and construction operations.

1.08 WARRANTY

A. Provide a single source curtain wall system manufacturer warranty against defective materials and fabrication. Submit manufacturer’s written warranty agreeing to repair failures in materials within one (1) year from date of delivery.

B. Provide the following single source curtain wall manufacturer glazing warranties. Third party warranties shall not be acceptable.
   1. All warranties shall be maintained without the requirement for periodic re-application of a UV-stabilizing exterior coat. Neither the expected humidity of the enclosed space nor the roof construction classification per ASTM E-108 shall affect warranty length or limitations.

C. Provide a ten (10) warranty on the interior glazing covering:
   1. Change in light transmission of no more than 6% per ASTM D-1003.

2. Color stability: interior glazing shall not change color more than 6 CIE Units DELTA E by ASTM D-2244.

D. Provide a ten (10) year warranty on the exterior glazing covering:
   1. Change in light transmission of no more than 6% per ASTM D-1003.
   2. Color stability: exterior glazing shall not change color more than 6 CIE Units DELTA E by ASTM D-2244.

E. In addition, submit the installer's written warranty agreeing to repair installation workmanship, defects and leaks within one year from date of delivery.

F. Manufacturer Finish Warranty:
   1. Anodized Color and Film Integrity: 10 years from date of substantial completion.
   2. Paint Cracking, Chalking and Color: 10 years after date of substantial completion.

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturer: Kingspan Light + Air, LLC, which is located at: 28662 Ballard Dr, Lake Forest, IL 60045, phone 714.540.8950, fax 714.540.5415, www.kingspanlightandair.us.

B. Other acceptable manufacturer: Requests for substitutions will be considered in accordance with the provisions of Section 01 25 00.

2.02 SYSTEM DESCRIPTION

A. UniQuad Translucent Wall assembled from extruded aluminum members capable of withstanding loads as defined by local jurisdiction building code.

B. Performance Requirements:
   1. Structural Members: Sized to support design loads in accordance with Building Code requirements.
      a. The glazing joint shall comply with the deflection limitation of IBC Table 1604.3 for exterior walls with flexible finishes
         1) L/120 per ASTM E-330 – roof assemblies
         2) L/60 per ASTM E-330 – skylight assemblies
   2. Hurricane and Impact Resistant Skylight Systems: Project requires impact resistance on coastal areas and compliance with IBC,
      a. Acceptance Numbers: HVHZ - Large Missile Impact - Level D, up to 95psf
   3. Water penetration: Meets requirements of ASTM E331 that allows for no water infiltration at a test pressure of 15 psf
   4. Air Infiltration: Less than 0.3 cu ft per minute per sq ft (0.09 cu m per minute per sq m) of fixed area when tested to 6.24 psf (299 Pa) in accordance with ASTM E283.
   5. Thermal movement: Design, fabricate, and install t assembly to be free from objectionable distortion and stresses in fastening and joinery due to expansion and contraction when subjected to temperature variance.

6. Assembly framing is designed to be self-supporting. The system will impose reactions to the support structure, which include horizontal and vertical loads, due to dead load, live load, and wind load.
7. Thermal and Solar Performance
    a. To ensure Energy Code compliance, product U-Values must be listed in the NFRC Product Directory and have a NFRC Certified Product Directory (CPD) number.
    b. Basis of Design CPD Number: KLA-M-2, KLA-M-5, KLA-M-6 & KLA-M-7 NFRC CPD#
8. Flammability
    a. Interior and Exterior Glazing: Class CC1 fire rating classification per ASTM D-635.
9. Sound Transmission Class (STC) Rating, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 / E1332
    a. UniQuad; (4-inch panel)
        1) no infill - STC: 27 - OITC: 19
        2) 6mm – 4mm PC infill - STC: 28 - OITC: 21
        3) 9mm PC infill - STC: 29 - OITC: 22
        4) 12mm 4 5mm infill - STC: 35 – OITC: 27

2.03 TRANSLUCENT WALL AND ROOF ASSEMBLIES

A. Basis of Design: Kingspan Translucent Wall and Roof Assemblies Solution as manufactured by Kingspan Light + Air, LLC.
    1. An Integrated wall and roof daylighting system consisting of factory-produced, mechanically optimized, thermally enhanced, structurally engineered framing assembly and glazing systems designed for transferring daylight and views to interior spaces, complying with ICC AC-17.

B. Translucent Wall and Roof Assemblies Framing System:
    1. Extruded aluminum shall be ANSI/ASTM B-221; 6063-T6 or 6005-T5.
    2. All fasteners for aluminum framing to be stainless steel or cadmium plated steel, excluding the final fasteners to the building.
    3. All exposed Aluminum shall be finished:
    4. The translucent wall light framing is designed to be self-supporting between the support constructions. The deflection of the glazing panel joint and system framing members in a direction normal to the plane of the glazing, when subjected to a uniform load deflection, shall not exceed L/60 for the unsupported span per IBC Table 1604.3. All adjacent and support construction must support the transfer of all loads included horizontal and vertical, exerted by the system. Design or structural engineering services for the supporting structure or building components in not included in the curtain wall scope of this section
    5. All system aluminum framing exposed to the exterior shall be thermally broken.

C. Translucent Glazing Systems
    1. Design, engineer, manufacture, and installation of unitized double-glazed translucent wall system. An assembly of two independent insulated glazing panes in one integrated assembly, incorporated into a complete aluminum frame system that has been tested and warranted by the manufacturer as a single source system. Design shall provide for the replacement of the exterior glazing, independently of the interior glazing without

exposing the building's interior or compromising the weather tightness or interfering with the normal working functions of the building. Single pane glazing systems are not acceptable.

2. Overall glazing assembly thickness shall be a minimum 4", with two glazing panes and concealed interlocking connector (Double tooth connection. Thickness of the exterior and interior glazing shall be minimum 8mm thick
3. Translucent glazing must be constructed of polycarbonate with tight cell sizes not exceeding 0.18". Wide cells of size greater than 0.18" shall not be acceptable
4. Panel shall be extruded in one single formable length. Maximum panel width shall not exceed 2'. Transverse connections are not acceptable.
5. The panels should be manufactured with up stands that are integral to the unit.
6. Translucent panel shall incorporate Removable skin technology (RST) allows interior or exterior glazing to be replaced independently.
7. Glazing shall be factory sealed to restrict dirt ingress.
8. Glazing must be manufactured with a permanent, co-extruded ultra-violet protective layer. Post-applied coatings or films of dissimilar materials that need to be maintained are unacceptable.
9. The up stands shall be 90 degrees to the panel face (standing seam dry glazed concept). Welding or gluing of upstands or standing seams is not acceptable.
10. Free movement of the panels shall be allowed to occur without damage to the weather tightness of the completed system.
11. Glazing shall not become readily detached when exposed to temperatures of 300°F and 0°F for 25 minutes.
12. Thermal aging – the interior and exterior glazing shall not change color in excess of 0.75 Delta E per ASTM D-2244 and shall not darken more than 0.3 units Delta L per ASTM D-2244 and shall allow no cracking or crazing when exposed to 300°F for 25 minutes.
13. System shall incorporate air and water management and water channeling to allow thermal cycling to occur in order to remove moisture.

2.04 FINISHES

A. Material: Aluminum Frame
   1. Finish: Premium Plus (Kynar)
      a. Color: Night Hawk Gray
      b. Quality Standard: AAMA 2605.

B. Material: polycarbonate glazing
   1. Color: Frosted Grey

PART 3 – EXECUTION

3.01 EXAMINATION

A. Do not begin installation until the substrates have been properly constructed and prepared.

B. General Contractor to verify when structural support is ready to receive all work in this section and to convene a Pre-Installation Conference at least one week prior to commencing work of this Section.

C. Attendance required of General Contractor, canopy installer and all parties directly affecting and effected by the work of this section

D. All submitted opening sizes, dimensions and tolerances are to be field verified by general contractor unless otherwise stipulated.

E. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

F. Installer to examine area of installation to verify readiness of site conditions. Notify general contractor about any defects requiring correction. Do not work until conditions are satisfactory.

3.02 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.

C. If not originally coated, coat aluminum surfaces in contact with masonry, concrete, or dissimilar materials with heavy coat of zinc chromate or bituminous paint.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals, shop drawings, and in proper relationship with adjacent construction.

B. Install skylights plumb and true without warping or racking of panels.

C. Anchor system in accordance with approved Shop Drawings.

D. Apply manufacturer-approved sealant where indicated on Shop Drawings. Before application, clean surfaces as recommended by sealant manufacturer.

E. Remove all protective coverings on panels immediately after installation.

3.04 QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

3.05 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturer's recommendations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. Follow manufacturer's instructions when washing down exposed panel surfaces using a solution of mild detergent in warm water that is applied with soft, clean wiping cloths. Always test a small area before applying to the entire area.

D. Follow strict panel manufacturer guidelines when removing foreign substances from panel surfaces requiring mineral spirits or any solvents that are acceptable for use.

E. Installers shall leave panel system clean at completion of installation. Final cleaning is by others upon completion of project, following manufacturer's cleaning instructions.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section covers all work necessary for the execution and completion of skylight(s) as shown on drawings and specified herein.

B. Work includes but is not limited to the following: design, fabrication, glazing, and erection of skylight(s) as required for a complete and watertight installation.

1.02 REFERENCE

A. American Architectural and Manufacturers Association
   1. AAMA/WDMA/CSA/101/I.S. 2/A440-05 North American Fenestration Standard/Specification for windows, doors, and skylights. (includes standard test methods for air infiltration, water penetration, structural loading)
   2. AAMA 603.8-92 Pigmented Organic Coating on Extruded Aluminum
   3. AAMA 611 - Voluntary Standards for Anodized Architectural Aluminum
   4. ASTM A 193 / A 193M - 08b Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications

B. American Standards and Test Methods
   1. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
   2. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Profiles
   3. ASTM D 1667 - 05 Standard Specification for Flexible Cellular Materials - (Closed-Cell Foam)

C. Unified Facilities Criteria (UFC)
   1. DoD Minimum Antiterrorism Standards for Buildings

1.03 DESIGN REQUIREMENTS

A. Unit skylights are certified by National Accreditation & Management Institute and rated by the National Fenestration Rating Council (NFRC) for thermal performance. VT tested values for domes are not certified due to NFRC limitations.
   1. White Impact Modified Acrylic Dome over Clear Polycarbonate Multiwall Sheet:
      a) U-Factor: 0.44
      b) SHGC: 0.31
      c) VT: 0.29

1.04 SUBMITTALS

A. Submit full scale shop drawings indicating methods of construction, location and spacing of anchorage, joinery, finishes, size, shape, thickness of framing members, relationship to adjoining work and glazing materials used.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original and unopened packaging with parts manifest.

B. Store on site in a location and manner to avoid damage. Stacking should be done in a manner that will prevent damage. Store material in a clean, dry location away from high traffic areas. Any protection on the skylights during transportation should remain until installed.

C. Keep handling on site to a minimum. Exercise caution to avoid damage to finishes of material.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. CrystaLite, Inc., 3307 Cedar Street, Everett, WA 98201, 1-800-666-6065 www.crystaliteinc.com

B. Or approved equal.

2.02 MATERIALS

A. Aluminum frame 5000.
   1. Aluminum extruded components shall be alloy 6063-T5 or 6063-T6, of sufficient thickness for this application, and as required per structural calculations; ASTM B 221.
   2. Aluminum sheet and plate shall be alloy 5052-H32 per ASTM B 209.

B. Glazing Materials
   1. Polycarbonate multi-wall sheet.
      a. Fire rating: Class A per ASTM E-84. Class CCI per ASTM D-635.
      b. Maximum Flame Spread/Smoke Development: 5/35
      c. Sound Transmission: STC 21
      d. Impact resistance, when tested in accordance with ASTM D 5420 (Drop Dart): >72 foot-pounds (271.16 N m) for 1/4-inch (6 mm) thick material.
      e. Weather resistance, when tested for 1500 hours in accordance with ÅSTM G 53 and QUV 313B:
      f. Coating integrity: Intact after testing period.

2.03 FINISHES

A. Mill finish per AMS-OQ-A-200/9 and MIL-DTL-25995.

2.04 FASTENERS

A. Exterior fasteners and fasteners exposed to wet areas in frame shall be 300 series stainless steel per ASTM 193/A 193M, except pop rivets used on glazing cap are aluminum or stainless steel per manufacturer.

B. Dry area fasteners shall be cadmium-plated steel per ASTM F 1135 or stainless steel.

C. All welding shall be by the TIG process. All exposed welds to be finished to match frame color where practical.

2.05 GLAZING ACCESSORIES

A. Glazing tapes per ASTM D 1667, 2240, 3575. All other gaskets, setting blocks, and other materials used in glazing shall be of a type, quality and compatibility to provide performance of the skylight(s) covered in this section.

B. Silicone sealant per CAN/CGSB 19.13-M87; TT-S-001543A/ASTM C 920, Type S, NS, Class 25 use NT, G, A&O test requirements.

2.06 FABRICATION

A. Skylight(s) shall be factory fabricated and preassembled in largest size assemblies possible with considerations for shipping and jobsite handling.

B. Skylight(s) shall have properly designed weep systems for drainage to exterior.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Framing shall be installed and glazed by experienced workmen in accordance with the approved shop drawings, manufacturer’s instructions and glazing standards.

3.02 CLEANING AND PROTECTION

A. Subsequent to installation of skylight(s) the General Contractor shall be responsible for the cleanup and protection of all materials provided per this section, including, but not limited to glazing materials and framing members. No abrasive materials of any kind shall be used in cleaning of skylight surfaces.

3.03 WARRANTY

A. Plastic Glazed Skylights
   1. CrystaLite thermoformed plastic skylights are warranted against manufacturer’s defects for a period of five (5) years from date of purchase.
   2. CrystaLite skylights glazed with Lexan polycarbonate multiwall sheet shall have a ten (10) year prorated warranty from date of purchase.

B. Stipulations

1. Warranty replacement units will be remanufactured in the same size and description as the original units only and does not include removal of defective unit or installation of replacement unit. Warranty period will remain in effect from the original date of delivery. Warranty orders will be chargeable items with proper credit given upon return and inspection of original item.

C. Operator Hardware
   1. Solar Smart products are warranted against defect in materials and workmanship for a period of two (2) years from date of purchase.
   2. All Truth Hardware products, with the exception of electrical products, are warranted against defect in materials and workmanship for a period of ten (10) years from date of purchase. All Truth Hardware electrical products are warranted for one (1) year against defects in materials and workmanship.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.
   2. Sliding doors.
   3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Cylinders specified for doors in other sections.

C. Related Sections:
   1. Division 08 Section Hollow Metal Doors and Frames
   2. Division 08 Section Aluminum Storefronts

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
   1. ANSI/BHMA Certified Product Standards - A156 Series.
   2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
   3. ANSI/UL 294 - Access Control System Units.
   4. UL 305 - Panic Hardware.
   5. ANSI/UL 437- Key Locks.

1.03 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
   3. Content: Include the following information:
      a. Type, style, function, size, label, hand, and finish of each door hardware item.
      b. Manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
      e. Explanation of abbreviations, symbols, and codes contained in schedule.
      f. Mounting locations for door hardware.
      g. Door and frame sizes and materials.
      h. Warranty information for each product.
   4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

D. Informational Submittals:
   1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.04 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware 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.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
   1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
   1. Function of building, purpose of each area and degree of security required.
   2. Plans for existing and future key system expansion.
   3. Requirements for key control storage and software.
   4. Installation of permanent keys, cylinder cores and software.
   5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
   1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment

of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.06 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.07 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. 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. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of the hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Please note that ASSA ABLOY is transitioning the Yale Commercial brand to ASSA ABLOY ACCENTRA. This affects only the brand name; the products and product numbers will remain unchanged. The brand transition is expected to be complete in or about May of 2024, and products shipping after that time will be branded ASSA ABLOY ACCENTRA.

D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.02 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
   1. Quantity: Provide the following hinge quantity:
      a. Two Hinges: For doors with heights up to 60 inches.
      b. Three Hinges: For doors with heights 61 to 90 inches.

c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
   a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.03 DOOR OPERATING TRIM

A. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
   1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
   2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
   3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
   4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
   5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
   6. Manufacturers:
      a. Rockwood (RO).

2.04 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
   1. Manufacturers:
      a. Match Existing, Field Verify.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
   1. Threaded mortise cylinders with rings and cams to suit hardware application.
   2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
   3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
   4. Tubular deadlocks and other auxiliary locks.
   5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
   6. Keyway: Manufacturer's Standard.

C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

D. Keying System: Each type of lock and cylinders to be factory keyed.
   1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
   2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
   3. New System: Key locks to a new key system as directed by the Owner.

E. Key Quantity: Provide the following minimum number of keys:
   1. Change Keys per Cylinder: Two (2)
   2. Master Keys (per Master Key Level/Group): Five (5).
   3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):
   1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
   2. Provide transcript list in writing or electronic file as directed by the Owner.

2.05 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.
   1. Manufacturers:
      a. Corbin Russwin Hardware (RU) – ML 2000 Series.
      b. No substitutions.

2.06 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
   4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:
   1. Strikes for Mortise Locks and Latches: BHMA A156.13.
   2. Strikes for Bored Locks and Latches: BHMA A156.2.
   3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
   4. Dustproof Strikes: BHMA A156.16.

2.07 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
   1. Exit devices shall have a five-year warranty.
   2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
   3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
   4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
   5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
   6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
      a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
      b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
   7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
   1. Manufacturers:
      a. Corbin Russwin Hardware (RU) – ED5000 Series.
      b. No substitutions.

2.08 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:
   1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
   2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
   3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
   4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
   5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
   6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard..
   1. Manufacturers:
      a. Corbin Russwin Hardware (RU) - DC8000 Series.
      b. Norton Rixson (NO) - 7500 Series.

2.09 ARCHITECTURAL TRIM

A. Door Protective Trim
   1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
   2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
   3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
   4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
      a. Stainless Steel: 300 grade, 050-inch thick.
   5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
   6. Manufacturers:
      a. Rockwood (RO).

2.10 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
   1. Manufacturers:
      a. Rockwood (RO).

2.11 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
   1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
   1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:
   1. Pemko (PE).

2.12 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.13 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.02 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.03 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
   4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.04 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.05 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.06 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.07 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.08 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
   1. Quantities listed are for each pair of doors, or for each single door.
   2. The supplier is responsible for handing and sizing all products.
   3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
   4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer’s Abbreviations:
   1. MK – McKinney
   2. RU - Corbin Russwin

3. AD - Adams Rite
4. RO – Rockwood
5. PE – Pemko
6. SU - Securitron

Hardware Sets

Set: 1.0

Doors: 1

3	Hinge (heavy weight)	T4A3386 x NRP	US32D	MK
1	Fire Rated Rim Exit, Classroom	ED5200A PR955ET C6	630	RU
1	Surface Closer	7500	689	NO
1	Kick Plate	K1050 __X1.5LDW CSK BEV	US32D	RO
1	Door Stop	463-RKW	US32D	RO
1	Rain Guard	346C		PE
1	Gasketing	S44GR		PE
1	Sweep	315CN		PE

Set: 2.0

Doors: 2, 3, 8

3	Hinge, Full Mortise	TA2314 x NRP	US32D	MK
1	Storeroom Lock	ML2057 PSA C6	630	RU
1	Wall Stop	409	US32D	RO
1	Gasketing	S44GR		PE

Set: 3.0

Doors: 5, 7, 9

3	Hinge, Full Mortise	TA2314 x NRP	US32D	MK
1	Entrance Lock	ML2054 PSA C6	630	RU
1	Wall Stop	409	US32D	RO
1	Gasketing	S44GR		PE

Set: 3.1

Doors: 4, 6

3	Hinge, Full Mortise	TA2314 x NRP	US32D	MK
1	Entrance Lock	ML2054 PSA C6	630	RU
1	Surface Closer	7500	689	NO
1	Kick Plate	K1050 __X1.5LDW CSK BEV	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S44GR		PE

Set: 4.0

Doors: 10

3	Hinge (heavy weight)	T4A3386 x NRP	US32D	MK
1	Pull Plate	126x70C	US32D	RO
1	Push Plate	70F	US32D	RO
1	Surface Closer	7500	689	NO
1	Kick Plate	K1050 __X1.5LDW CSK BEV	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S44GR		PE

Set: 5.0

Doors: 11

3	Hinge, Full Mortise	TA2314 x NRP	US32D	MK
1	Fire Rated Rim Exit, Classroom	ED5200A PR955ET C6	630	RU
1	Surface Closer	7500	689	NO
1	Kick Plate	K1050 __X1.5LDW CSK BEV	US32D	RO
1	Wall Stop	409	US32D	RO
1	Gasketing	S44GR		PE

Set: 6.0

Doors: 12, 20, 21

3	Hinge (heavy weight)	T4A3386 x NRP	US32D	MK
1	Storeroom Lock	ML2057 PSA C6	626	RU
1	Surface Closer	7500	689	NO
1	Kick Plate	K1050 __X1.5LDW CSK BEV	US32D	RO
1	Door Stop	463-RKW	US32D	RO
1	Rain Guard	346C		PE
1	Gasketing	S44GR		PE

1	Sweep	315CN	PE
1	Threshold	FHSL14SS as detailed	PE

END OF SECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Project Drawings and general provisions of the Construction Contract, including General and Supplementary Conditions, Division 01 Specification Sections and bidding requirements, apply to the work of this Section.

B. Technical publications, standards, and reference documents as outlined in individual Technical Specification Sections and as indicated on the Project Drawings

1.02 SUMMARY

A. Section includes:
   1. Glass.
   2. Glazing compounds and accessories.
   3. Window film.

1.03 RELATED REQUIREMENTS

A. Section 08 11 13 – Hollow Metal Doors and Frames

B. Section 08 41 13 – Aluminum Storefront

1.04 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

C. ASTM C1036 - Standard Specification for Flat Glass.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants.

F. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.

G. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

H. GANA (SM) - GANA Sealant Manual; Glass Association of North America.

1.05 SUBMITTALS

A. See Section 01 33 10 - Submittals.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements for each glass product and

glazing material indicated.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: For the following products, in the form of 12" square samples for each type of glass.

E. Glazing Schedule: Use same designation on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

F. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

G. 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.

H. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacture indicated glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

I. Product Test Reports: From a qualified testing agency indicated the following products comply with requirements, based on comprehensive testing of current products:

1. Glazing sealants.
2. Glazing gaskets.

J. Warranties: Special Warranties specified in this Section.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: an experienced installer who has competed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Clear Glass: Obtain clear float glass from one primary glass manufacturer.

C. Source Limitations for coated Glass: Obtain coated glass form one manufacturer for each type of coating and each type and class of float glass indicated.

D. Source Limitations for Laminated Glass: Obtain laminated-glass units from one manufacturer using the same type of glass lites and interlayers for each type of unit indicated.

E. Source Limitations for Glazing Accessories: Obtain glazing accessories form one source for each product and installation method indicated.

F. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and

ANSI Z97.1.

1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

G. 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 "Glazing Manual" and "Laminated Glass Design Guide."
   2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
   3. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."

1.07 ENVIRONMENTAL REQUIREMENTS

A. 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.

B. Maintain minimum ambient temperature before, during, and 24 hours after installation of glazing compounds.

1.08 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop Drawings.

1.09 WARRANTY

A. General Warranty: special warranties specified in this Section shall not deprive the Owner of other rights the 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. Manufacturer's Special Warranty on Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those coated-glass units that deteriorate as defined in Article 1.04 "Definitions" above, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: Ten (10) years from date of Substantial Completion.

C. Manufacture's Special Warranty on Laminated Glass: Written warranty, made out to Owner and signed by laminated-glass manufacturer agreeing to furnish replacements for laminated glass units that deteriorate as defined in Article 1.044 "Definitions" above, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
   1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. Vitro Architectural Glass, https://www.vitroglazings.com/
   2. AGC Glass North America, Inc; www.agcglass.com/#sle
   3. Cardinal Glass Industries; www.cardinalcorp.com/#sle
   4. Guardian Glass, LLC; www.guardianglass.com/#sle
   5. Pilkington North America Inc; www.pilkington.com/na/#sle
   6. Substitutions: Refer to Section 01 60 00 – Product Requirements

2.02 PERFORMANCE REQUIREMENTS – EXTERIOR GLAZING ASSEMBLIES:

A. Provide type and thickness of exterior glazing assemblies.

2.03 EXTERIOR GLAZING ASSEMBLIES

A. Performance Criteria: Select type and thickness of glass to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
   2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
   3. Glass thicknesses listed are minimum

2.04 GLASS MATERIALS

A. Float Glass Manufacturers:
   1. AGC Glass Company North America, Inc: www.us.agc.com.
   2. Guardian Industries Corp: www.sunguardglass.com.
   3. PPG Industries, Inc: www.ppgideascapes.com.

B. Float Glass: All glazing is to be float glass unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select), free of tong marks.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
   3. Tinted Types: Color and performance characteristics as indicated.
   4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

2.05 SEALED INSULATING GLASS UNITS

A. Sealed Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Edge Spacers: Aluminum, bent and soldered corners.
   3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
   4. Purge interpane space with dry hermetic air

2.06 GLAZING COMPOUNDS

A. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

B. Silicone Sealant, Type S: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 50, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; black color.

C. Elastomeric Glazing Sealant Standard: Comply with ASTM C920 and other requirements indicated for each liquid-applied, chemically curing sealant in Glazing Sealant Schedule at the end of Part 3, including those referencing ASTM C920 classifications for type, grade, class, and uses.

D. Glazing Sealant for Fire-Resistive Glazing Products: Identical to product used in test assembly to obtain fire-protection rating.

2.07 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; hardness range of 5 to 30 cured Shore A durometer; coiled on release paper; black color.

D. Expanded Cellular Glazing Tape: Closed-cell, PVC foam tape; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
   1. Type 1, for glazing applications in which tape acts as the primary sealant.
   2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

E. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; black color.

F. Glazing Clips: Manufacturer's standard type.

2.08 GLAZING GASKETS

A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames

with molded corner units and zipper lock strips, and complying with ASTM C-542, black.

B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards' referenced with mane of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1. Neoprene, ASTM C 864
   2. EPDM, ASTM C 864
   3. Silicone, ASTM C 115
   4. Thermoplastic polyolefin rubber, ASTM C 1115
   5. Any material noted above

C. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below, complying with ASTM C 509, Type II, black; and of profile and harness required to maintain watertight seal:
   1. Neoprene
   2. EPDM
   3. Silicone
   4. Thermoplastic polyolefin rubber
   5. Any material noted above.

2.09 WINDOW FILM

A. Window Film: Solar Art Ultra View 15 tinted film at storefront units. Installation to be completed by trained technicians per the manufacturer's install instructions.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine framing glazing, 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

B. Verify that openings for glazing are correctly sized and within tolerance.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.

E. Install sealants in accordance with manufacturer's instructions

3.03 INSTALLATION – EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 STANDARDS AND PERFORMANCE

A. Watertight and weathertight installation of each glass product is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors), without failure including loss or breakage of glass, failure of sealants or gaskets to remain water-tight and air-tight, deterioration of glazing materials and other defects in the work.

B. Protect glass from edge damage during handling and installation, and subsequent operation of glazed components of the work. During installation, discard units with significant edge damage or other imperfections.

C. Glazing channel dimensions as shown are intended provide for necessary bite on glass, minimum edge clearance, and adequate sealant thickness, with reasonable tolerances. Adjust as required by job conditions at time of installation.

D. Comply with combined recommendations and technical reports by manufacturers of glass and glazing products as used in each glazing channel, and with recommendations of Flat Glass Marketing Association "Glazing Manual," except where more stringent requirements are indicated.

E. Install insulating glass units to comply with recommendations by Sealed Insulating Glass Manufacturers Association, except as otherwise specifically indicated or recommended by glass and sealant manufacturers.

3.04 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. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

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 sealant-substrate 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 the length plus width is larger than 50 inches as follows:
   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. 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.

K. 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.

3.05 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first

and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape 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.

3.06 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. 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.

D. Install gaskets so they protrude past face of glazing stops.

3.07 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant form extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.08 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C716 and gasket manufacturer’s written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.09 CURE, PROTECTION AND CLEANING

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away form 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, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended 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 build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.

D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

E. Wash and polish glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Comply with glass product manufacturer's recommendations for final cleaning.

3.10 GLASS SCHEDULE

A. Type **S-1** - Sealed Insulating Glass Units: Safety glazing.
   1. Application: All exterior glazing unless otherwise indicated.
   2. Outboard Lite: Fully tempered float glass, 1/4 inch (6 mm) thick, minimum. Or as required to meet energy code and within the manufacturer’s window frame.
      a. Tint: Clear
      b. Surface 1: Self cleaning coating
      c. Surface 2: Low E coating; Solarban 70 Solar Control (Sputtered)
   3. Interspace Content: Argon w/ Warm Edge spacer
   4. Inboard Lite: Fully tempered float glass, 1/4 inch (6 mm) thick, minimum.
      a. Tint: Clear
      b. Surface 3: No Coating
      c. Surface 4: No Coating
   5. Total Thickness: 1 inch (25 mm).
   6. Visible light Transmittance: 64%
   7. Maximum U-value: As necessary to achieve a maximum overall U-Value of 0.34including the glazing and frame (fixed)
   8. Total Solar Heat Gain Coefficient: 0.38 max, nominal for South/East/West orientation and 0.51 max, nominal for North orientation

B. Type **S-2:** Uncoated Clear Fully Tempered Float Glass.
   1. Kind FT (fully tempered) – Glass where indicated on drawings.
      a. Overall Unit Thickness: ¼”
      b. Glass Edge Treatment: Flat polished.

3.11 SEALANT SCHEDULE

A. **GS-1:** Low-Modulus, Nonacid-Curing Silicone Glazing Sealant (GS-1)
   1. For use at all exterior glazing:
   2. Where glazing sealants of this designation are indicated, provide products complying with the following:
      a. Dow Corning: 790
      b. GE Silicones; Silpruf
      c. NUCO Industries, Inc: HiFlex 331
      d. Substitutions under provisions of 01630
   3. Type and Grade: S (single component
   4. Class: 25
   5. Use related to exposure: NT (non-traffic) and glazing substrates: M, G, A.

END OF SECTION

DIVISION 09

Finishes

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions, and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This section includes the following:
   1. Interior gypsum board at suspended gypsum board ceilings.
   2. Interior gypsum board for partition walls.
   3. High abuse gypsum wall board.
   4. Taping and sanding.
   5. Reveal Molding
   6. Interior Corner Guards
   7. Wall Guards

B. Related sections include the following:
   1. Section 07 92 00 – Joint Sealants
   2. Section 09 22 16 – Non-Structural Metal Framing
   3. Section 09 51 00 – Acoustical Ceilings
   4. Section 09 90 00 – Painting and Coating

1.03 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.04 REFERENCES

A. ASTM C36 - Gypsum Wallboard and ASTM C-588 – Gypsum Veneer Base (“Blue Board”)

B. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction

C. ASTM C630 - Water Resistant Gypsum Backing Board

D. ASTM C754 - Installation of Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board

E. ASTM E90 - Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions

F. ASTM C-840 Applications & Finishing of Gypsum Board

G. ASTM E119 - Fire Tests of Building Construction and Materials

H. GA-201 - Gypsum Board for Walls and Ceilings

I. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board

J. Gypsum Construction Handbook, third edition

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from GA-600, “Fire Resistance Design Manual.”

B. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by a qualified independent testing agency.
   1. STC-Rated Assemblies: Indicated by design designations from GA-600, “Fire Resistance Design Manual.”

C. Product Content: Provide paint, sealants, coatings and adhesives that comply with requirements for VOC levels per Division 01.

1.06 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division 01.
   1. Include manufacture’s published descriptive literature for gypsum board types, trims, accessories, and control joints.

B. Under provisions of Division 01, submit the following:
   1. Product information: Include manufacture’s published descriptive literature for gypsum board types, trims, accessories, and control joints.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Temperature and Ventilation: Provide adequate, properly regulated heating and ventilating in accordance with NWCB and manufacturer’s instructions

B. Lighting: Provide sufficient temporary lighting to properly perform the work and to achieve specified finishes.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - GYPSUM BOARD SYSTEMS

A. US Gypsum

B. National Gypsum Co

C. Georgia Pacific.

D. BPB Products

E. Substitutions: Under provisions of Division 01.

2.02 INTERIOR GYPSUM WALLBOARD

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

B. Fire-Rated Gypsum Board: ANSI/ASTM C36; fire-resistive; UL rated; 5/8-inch thick, maximum permissible length; ends square cut, tapered edges. Type X.

2.03 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.
   1. Material: Aluminum-coated steel sheet, rolled zinc, or aluminum-coated steel sheet or rolled sheet.
   2. Shapes:
      a. Corner bead: Use at outside corners.
      b. LC-Bead (J-Bead): Use at exposed panel edges.
      c. Expansion (Control) Joint: Use where indicated.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   2. Aluminum: Alloy and temper with not less than the strength; and durability properties of ASTM B 221 (ASTM B221M), alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.04 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C457.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Exterior Gypsum Soffit Board: Paper
   3. Glass-Mat Gypsum Sheathing Board: 10x10 glass mesh.
   4. Tile Backing Panels: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, beveled panel edges, 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 setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type sandable topping compound.
   5. Skim coat: For final coat of Level 5 finish, use setting-type sandable topping compound.

2.05 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Elastomeric Sealant: Medium-modulus, neutral-curing silicone sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturers for application indicated, and complying with requirements for elastomeric sealants specified in Division 7 Section "Joint Sealants."

C. Reveal Molding: Extruded aluminum molding 5/8"x5/8" reveal equal to Fry Reglet # DRM-625-625.

D. Reveal base: Extruded aluminum 5/8"x4" equal to Fry Reglet # DRMB-625-400.

E. Corner Guards: Stainless steel corner guards at outside corners to 4' A.F.F. Surface mounted guards to be 1 ½" x 1 ½", 16 ga. stainless steel, equal to Construction Specialties corner guard # SCO-8, mounted with construction adhesive standard. Field verify locations with Owner and Architect prior to installation.

F. Wall Guards: 4" x 1" vinyl cover, rubber cushion material, aluminum retainer material.

PART 3 – EXECUTION

3.01 INSPECTION

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. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Beginning of installation means acceptance of existing surfaces.

3.02 GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with GA 201 and GA 216 and NWCB specifications and recommendations, and manufacturer's instructions. Where in conflict follow more stringent requirements.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Do not install GWB directly to the slip track at the top of partition walls.

D. Corner Trim: Reinforce external corners with specified corner beads

E. Edge Trim: Install square edged metal trim bead at exposed edges and boundaries of areas and where abutting dissimilar materials.

F. Control Joints: Comply with NWCB GWB-5, except as otherwise indicated. Verify that required double framing is in place before installing control joints.
   1. Door and window openings: Minimum one control joint at each wall opening. Locate at strike side of door openings.
   2. Continuous Wall Planes: Not to exceed 30 linear feet.
   3. Ceilings: Not to exceed 50 linear feet. Area not to exceed 2,500 square feet.

G. Other trim: Install as indicated or required for complete and finished installation.

H. Panel Joints:
   1. Layout: Design to reduce joints to minimum.
   2. Install board in maximum lengths to minimize horizontal and vertical joints.
   3. Start installation of panels at exterior wall to position butt joints as far away from exterior wall as possible.
   4. Place edges in contact and fit neatly, without forcing into place.
   5. Stagger joints on opposite sides of partitions and on same side of wall surface at adjacent joints.

I. Single Layer Systems: Install in accordance with ASTM C840. Where modified, amended, or otherwise, or required by fire resistive or sound isolation system, conform to the requirements of the manufacturer's tests, as approved.
   1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing) and 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 board.
      b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

J. Multilayer Application 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 1 framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

K. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

L. Multilayer Application 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 offsets 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.
   1. Z-Furring Members: Apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) wither vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

M. Multilayer Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

N. Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at showers, tubs, and where indicated] [locations indicated to receive tile]. Install with ¼-inch (6.4 mm) gap where panels abut other construction or penetrations.

O. Mechanical and Electrical: Coordinate with Division 15 and 16. Provide for installations and penetrations of ductwork, equipment, receptacles, and other work.

P. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.

Q. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.

R. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.

S. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.

T. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

U. Horizontal Installation: Install 48-inch wide gypsum sheathing boards horizontally with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of stud flanges and stagger end joints of adjacent boards not less than one stud spacing. Screw-attach boards at perimeter and within field of board to each steel stud at approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

V. Vertical Installation: Install 48-inch wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud at approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

W. Air-Infiltration Barrier Application: Cover sheathing with air-infiltration barrier as follows:
1. Cut back air-infiltration barrier 1/2 inch on each side of break in supporting members at expansion- or control-joint locations.
2. Apply asphalt-saturated organic felt horizontally with 2-inch overlap and 6-inch end lap; fasten to sheathing with corrosion-resistant staples.
3. Apply proprietary building wrap to comply with manufacturer's written installation instructions.
4. Apply air-infiltration barrier to cover vertical flashing with 4-inch overlap.

3.03 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. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

3.04 JOINT TREATMENT

A. Joints and Interior Angles; Tape embedded in joint compound and three separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Tool joint compound smooth and free of tool marks and rides.
1. Center reinforcing tape over joint and coat into compound leaving approximately 164 inch to 1/32 inch under tape to provide proper bond.
2. Follow skin coat to embed tape, but not to function as second coat.
3. Allow embedding coat to thoroughly dry prior to application of second coat.
4. Allow embedding coat to thoroughly dry.
5. Apply third coat evenly over and extending beyond second coat on joints, feathering to smooth uniform finish.

B. Beads, Trim, Fastener and Joint Depressions:

1. Cover with three coats of taping and joint compound, each applied in different directions to make true and level with adjacent surfaces.
2. Allow sufficient drying time between coats.
3. Leave depressions flush with surface plane.

3.05 FINISHING GYPSUM BOARD ASSEMBLIES

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, beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
   1. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated within finish schedule.
   2. Level 4: At all locations not indicated for Level 2.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.06 LEVEL 4 FINISH

A. Apply Level 4 Finish in accordance with NWCB for all finish areas.

B. Where necessary sand between coats and after final coat, do not scuff paper, repair blemishes and joint ridges.

C. After final sanding wipe all drywall surfaces with a damp sponge to remove dust and particles.

D. Leave areas finished uniformly smooth for subsequent smooth finish (paint, wallcovering, or as indicated). No wall texturing is applied.

E. Apply a thin skim coat of joint compound, or material manufactured for this purpose, over entire surface. Finished surface to be free of tool marks and ridges.

F. Beads, Trim, Fastener and Joint Depressions:

1. Cover with three coats of taping and joint compound, each applied in different directions to make true and level with adjacent surfaces.
2. Allow sufficient drying time between coats
3. Leave depressions flush with surface plane.

3.07 ALLOWABLE TOLERANCES

A. Shim panels as necessary to comply with tolerances.

B. Between Board Faces: 1/16 inch offset.

C. Plane, Level, Warp, and Bow: 1/8 inch in 8 feet.

3.08 CLEANING

A. Clean beads, screeds, metal base, metal trim, mechanical and electrical items, and other work.

B. Wipe clean, leaving work ready for finish specified under other Sections.

C. As work is completed in each space, clean all rubbish, utensils, and surplus materials from the space. Leave floors broom-clean.

END OF SECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Supplemental, and Special Conditions and Division I Specification Sections, apply to this Section.

1.02 SUMMARY

A. Scope of work:
   1. Miscellaneous metal framing for ceiling and wall assemblies.
   2. Z-framing at ceiling
   3. Steel Suspended Ceilings and Soffit Framing
   4. Extruded aluminum reveal molding

B. This section includes the following:
   1. Framing accessories

C. Related Sections:
   1. Section 09 21 16 - Gypsum Board Systems

1.03 SUBMITTALS

A. Submit in accordance with Division 1- Submittals.

B. Shop drawings: Indicated details required for proper installation including gauges, typical cross sections, connection and fasteners to structure, fasteners, lateral bracing, and components not indicated by Product Data submittal.

C. Product Data: Manufacturer's published literature including each type of metal stud framing system and accessory. Show compliance with Specifications.

D. Evaluation Reports: Submit evaluation reports certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.

1.04 QUALIFICATIONS

A. Manufacturer: Company specializing in work of this section.

B. Installer: company specializing in work of this section.
   1. Recommended by the Northwest Wall and Ceiling Bureau.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

PART 2 – PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Listed manufactures are approved upon condition of satisfactory submittals referencing design requirements:
   1. CEMCO (818) 369-3564
   2. Steeler, Inc. (206) 725-2500
   3. Western Metal Lath and Framing systems 1-800-365-5284
   4. ClarkDietrich Building Systems (951) 360-3500
   5. Scafco Corporation
   6. Under provisions of Section 01 63 00

2.02 STEEL FRAMING

A. Comply with ASTM C754 for conditions indicated

B. Steel Sheet Components: Complying with ASTM C645 requirements for metal unless otherwise indicated.

C. Non-Load Bearing-Light Gauge Framing Members: Protective coating: Comply with ASTM C 645; roll-formed hot-dipped galvanized steel; complying with ASTM A 1003/A 1003M and ASTM A 653/A 653M G40 (Z120) or having a coating that provides equivalent corrosion resistance. A40 galvannealed products are not acceptable.

D. Steel Studs and Runners:
   1. Minimum Base Metal Thickness: 22 gauge, or as indicated
   2. Depth: As indicated

E. Equivalent Gauge Steel Studs and Runners:
   1. Minimum Base Metal Thickness: 0.015 inch 25 gauge eq., 0.019 inch 20 gauge eq.
   2. Depth: As indicated.

F. Deep-Leg Deflection Track: ASTM C645 top runner with 2-inch (50.8 mm) deep flanges.

G. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base Metal Thickness: 22 gauge

H. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.03 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

A. Components, General: Comply with ASTM c 754 for conditions indicated.

B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0624-inch (1.59 mm) diameter wire, or double strand of 0.0475-inch (1.21 mm) diameter wire.

C. Hanger Attachments to Concrete: As follows:
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure a load equal to 5 times that imposed by construction as determined by testing according to ASTM 488 by a qualified independent testing agency.
      a. Typed: Postinstalled, expansion anchor.

D. Hangers: As follows:
   1. Wire Hangers: ASTM A 641/A 641m, Class 1 zinc coating, soft temper, 0.162-inch (4.12 mm) diameter.

E. Carrying Channels: cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538-inch (1.37 mm), a minimum ½-inch (12.7 mm) wide flange, with ASTM A653/A653M, G40 (Z120) hot-dip galvanized zinc coating.
   1. Depth: 2-1/2 inches (63.5mm).

F. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 643/A653M, G40 (Z120) hot-dip galvanized zinc coating.
   1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8-inch (22.2 mm) deep.
      a. Minimum Base Metal Thickness: 0.0179-inch (0.45 mm).
   2. Steel Studs: ASTM C 645.
      a. Minimum Base Metal Thickness: 0.0179-inch (0.45 mm).
      b. Depth: 3-5/8 inches (92.1 mm).

2.04 EXTRUDED ALUMINUM REVEAL MOLDING

A. Basis of Design: “F” Reveal Molding by Fry Reglet Corporation. 12342 Hawkins Street. Santa Fe Springs, CA 91803. PH: 800-237-9773.
   1. “F” Reveal Molding
      a. Acceptable product: Number DRMF
      b. Description: trim reveal molding forming wall trim reveal where drywall terminates against sill, jamb, ceiling or other finish material in same plane.
      c. Material: extruded aluminum 6063 per ASTM B221.
      d. Dimensions: as indicated on drawings
   2. Finish: Architectural 200R1 medium etch (AA-M32c10A21), clear color.

B. Fasteners: exposed fasteners (provided by installer) shall be countersunk and shall match accessories in color.
   1. Aluminum to aluminum: aluminum or Type 302 or 304 stainless steel.

2. Aluminum to stainless steel or carbon steel: Type 302 or 304 stainless steel.

PART 3 – EXECUTION

3.01 INSPECTION

A. Beginning of installation means acceptance of existing surfaces.

3.02 PREPARATION

A. Protect installed finish work of other trades and surfaces to preclude damage from work of this Section.

3.03 INSTALLATION

A. Erect work in accordance with Contract Documents, References, Codes, and Manufacturer's instructions. Where in conflict, follow more stringent requirements.

B. Shimming and Bracing:
   1. Shim metal furring to provide true and level surface for application of wallboard.
   2. Cross brace chase partitions as recommended by manufacture or approved by Engineer.
   3. Laterally braced metal studs with finish system on side only or where finish system does not run full height of studs as, recommended by manufacturer, to meet lateral design loads.

C. Supplementary Framing and Backing: Install continuous steel channel backing notched between studs. Coordinate with requirements for support of wall mounted items including shelving, plumbing fixtures, mechanical equipment, and other construction as required. Include supplementary framing whir necessary to accommodate loading.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary acoustical insulation above ceiling.

1.02 RELATED REQUIREMENTS

A. Section 26 51 00 - Lighting.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

C. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 10 00 - Basic Requirements, for submittal procedures.

1.06 QUALITY ASSURANCE

A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL (FRD) for the fire resistance indicated.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Panels:
   1. Armstrong World Industries, Inc.
   2. USG Interiors

B. Suspension Systems:
   1. Armstrong World Industries, Inc.
   2. USG Interiors

C. Or approved equal.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.

B. Acoustical Tile Type IV: Painted mineral fiber, with the following characteristics:
   1. Size: 24 by 48 inches
   2. Edge: Beveled Tegular 15/16 in.
   3. Products: Ultima
   4. Color: White or Grey

2.03 SUSPENSION SYSTEM(S)

A. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Fire-Rated Exposed Steel Suspension System Type for use at rated ceiling assemblies: Formed steel, commercial quality cold rolled; light-duty.
   1. Profile: Tee; 9/16 inch (14 mm) wide face.
   2. Product: Suprafine XL Fireguard

C. Exposed Steel Suspension System Type for use at non-rated assemblies: Formed steel, commercial quality cold rolled; light-duty.
   1. Profile: Tee; 9/16 inch (14 mm) wide face.
   2. Product: Suprafine XL Peakform.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified such as stabilizer bars, hold-down clips, splices, and edge moldings required for suspended grid system.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide W-shaped molding for mounting at same elevation as face of grid.

PART 3 - EXECUTION

3.01 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

B. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

C. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

F. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.

G. Do not eccentrically load system or induce rotation of runners.

H. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.02 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

G. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Supplemental, and Special Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. 8mm Vulcanized Composition Rubber resilient roll flooring
   2. Adhesive and accessories required for installation and maintenance & repair.

1.03 REFERENCES

A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title, or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. American Society for Testing and Materials (ASTM):
   1. See – Part 2.0 PROPRIETARY PRODUCTS below.

1.04 SYSTEM DESCRIPTION

A. Performance Requirements: Provide Vulcanized Composition Rubber resilient flooring, which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage, or failure.

1.05 SUBMITTALS

A. Submit listed submittals in accordance with Section 01 33 00 Submittals.

B. Product Data: Submit product data, including manufacturer's guide specifications product roll or tile, for specified products.

C. Samples for Verification: 12 inches by 12 inches of each different color and pattern of resilient flooring specified, showing the full range of variations expected in these characteristics.

D. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns, and textures.

E. Quality Assurance Submittals: Submit the following:
   1. Certificates: Product Certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria, and physical requirements.

1. Manufacturer's Instructions: Manufacturer's installation instructions.

F. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals Section. Include methods for maintaining installed products, and precautions against cleaning materials and methods detrimental to finishes and performance.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

C. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

D. Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's instructions and manufacturer's warranty requirements. Comply with Division 1

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from exposure to harmful weather conditions, with ambient temperatures maintained between 65 and 85 deg F (18 and 30 deg C). Store on a clean, dry, flat surface protected from all possible damage. Materials should be stored in areas that are fully enclosed, weathertight with the permanent HVAC system set at a uniform temperature of at least 68 degrees F. The flooring material should be conditioned in the same manner.

C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturers.

D. Material should not suffer damage during handling (i.e. edge chipping, warping, etc.)

1.08 PROJECT CONDITIONS

A. Environmental Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during, and after installation as recommended by manufacturer.
   1. Temperature Conditions: 68 degree F for 72 hours prior to, during and after installation.

B. Install flooring and accessories after other finishing operations, including painting, have been completed.

C. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test.

D. Field Measurement: Verify the actual measurements / openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.09 WARRANTY

A. Provide manufacturer's standard warranty. Submit, for owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of, other rights owner may have under Contract Documents

B. The commercial rubber flooring is warranted to be free from manufacturing defects for a period of ten (10) years from the date of substantial completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Provide additional amount of approximately 5% of the total floor surface of each type and color.

PART 2 - PRODUCTS

2.01 PROPRIETARY PRODUCTS

A. ECOsurfaces ECOnights Vulcanized Composition Rubber Resilient Flooring and adhesives for commercial applications.
   1. 8mm ECOnights Vulcanized Composition Rubber resilient roll flooring

2.02 VULCANIZED COMPOSITION RUBBER RESILIENT FLOORING

A. Manufacturer: ECOsurfaces 715 Fountain Ave, Lancaster PA, 17601, inquire@spartansurfaces.com
   1. Construction: Vulcanized composition rubber resilient flooring.
   2. Size: 48 in. roll width, 25' length

3. Overall Thickness: 3/8" (8.0 mm)
4. Tensile Strength: ASTM D412 >200 PSI, min
5. Flexibility ¼" Mandrel: ASTM F137
6. Thermal Resistance "R": ASTM C518 0.10 F-ft^2-h/Btu
7. Static Load Limit: ASTM F970 <0.005in. @ 400 psi
8. Slip Resistance/ Coefficient of Friction: ASTM D2047 >0.9
9. VOC Content: Floor Score, ASTM D5116 Certified
10. Color Stability: ASTM F1515: Good
11. Chemical Resistance
    a. 5% Acetic Acid: No Change
    b. 70% Isopropyl Alcohol: No Change
    c. 5% Sodium Hydroxide: No Change
    d. 5% Hydrochloric Acid: No Change
    e. 5% Ammonia: No Change
    f. Bleach: No Change
    g. 5% Phenol: No Change
    h. Sulfuric Acid: No Change.
12. Abrasion Resistance: ASTM D3389/ EN 649: <1g. 100 cycles
13. Flammability-Pill Test: ASTM D2859: Pass
14. Ambient Noise Reduction: ASTM C423: 0.10
15. Impact Insulation Class: ASTM E492: 51
16. Delta IIC: ASTM E2179: 22
17. Sound Transmission Coefficient: ASTM E90: 50

2.03 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based formulation provided or approved by flooring manufacturer for applications indicated.

B. Adhesives: one-component moisture cured polyurethane adhesive recommended by manufacturer to suit resilient products and substrate conditions indicated.
   1. ES-90

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions, and product carton instructions for installation.

3.02 EXAMINATION

A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are acceptable for product installation in accordance with manufacturer's instructions.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are to be placed a minimum thirty (30) days prior to the installation of commercial rubber floor. Slabs are to be dry and free from 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 flooring manufacturer.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.03 PREPARATION

A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

B. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates
   1. Verify that substrate is flat to within 3/16" in 10'

D. Mechanically remove traces of old adhesives, paint, or other debris by scraping, sanding, or scarifying the substrate. Do not use solvents. All high spots shall be ground level and low spots filled with a Portland based patching compound.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.04 FLOOR COVERING INSTALLATION

A. Comply with manufacturers Technical Manual for installing procedures and techniques for ECOnights Vulcanized Composition Rubber resilient flooring installation.

B. Inspect all materials for visual defects before beginning the installation.

C. Unroll floor coverings and allow them to stabilize overnight or minimum two hours before cutting and fitting.

D. Allow rough cuts to relax for minimum of two hours but preferably overnight

E. Lay out floor coverings as follows:
   1. Install rolls in the same direction; note "This Side Down" stamp at the beginning of the roll.
   2. End Seams to be staggered and overlapped approximately 3-6"
   3. Position Second roll with no more than 1/8" overlap over the first roll at the seam.

F. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

G. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

H. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

I. Adhere floor coverings 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.
   1. Roll the floor with a 75-100lb roller to ensure proper adhesive transfer. Overlap each pass of the roller by 50% of the previous pass to ensure the floor is properly rolled. Roll the width first and then the length.

J. Keep all foot traffic off the floor for a minimum of 24 hours, heavy loads for 48 hours.

3.05 CLEANING AND PROTECTING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from Project site and legally dispose of debris.

B. Protect flooring against mars, marks, indentations, and other 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 flooring manufacturer.

C. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.

3.06 RESILIENT FLOORING SCHEDULE

A. Resilient Rubber Flooring – RF-1
   1. Product: ECOnights
      a. Manufacturer: ECOsurface
      b. Pattern and Color: Mr. Slate 10 – 652

END OF SECTION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Supplementary and Special Conditions, and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Resilient base.

B. Related Sections include the following:
   1. Section 03 35 00 Concrete Finishing
   2. Section 09 21 16 Gygsum board system
   3. Section 09 65 00 Resilient flooring

1.03 REFERENCE STANDARDS

A. ASTM F1861 – Standard Specification for Resilient Wall Base 2021.

1.04 SUBMITTALS

A. See Section 01 33 00 for submittal procedures.

B. Product Data: For each type of product indicated. Include manufacturer’s written data on physical characteristics, durability, and fade resistance. Include Installation methods.

C. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store 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 or more than 90 deg F.

1.07 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Install resilient products after other finishing operations, including painting, have been completed.

1.08 EXTRA MATERIAL STOCK

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 50 linear feet, of each type, color, pattern and size of resilient product installed.

PART 2 – PRODUCTS

2.01 RESILIENT BASE

A. Resilient Base:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong World Industries, Inc.
      b. Burke Flooring Products; Division of Burke Industries, Inc.
      c. Roppe Corporation, USA.
      d. Allstate Rubber Corp.; Stoler Industries.
      e. Endura Rubber Flooring; Division of Burke Industries, Inc.
      f. Flexco, Inc.
      g. Johnsonite.
      h. Mondo Rubber International, Inc.
      i. Musson, R. C. Rubber Co.
      j. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
      k. PRF USA, Inc.

B. Resilient Base Standard: ASTM F 1861.
   1. Material Requirement: Type TP (rubber, thermoplastic).
   2. Manufacturing Method: Group I (solid, homogeneous)
   3. Style: Cove (base with toe).

C. Locations: Where “RB” (Rubber Base) is scheduled on drawings.

D. Minimum Thickness: 0.125 inch

E. Height: 4 inches unless indicated otherwise on Drawings.

F. Lengths: Coils in manufacturer's standard length.

G. Outside Corners: Preformed.

H. Inside Corners: Preformed.

I. Surface: Smooth

J. Finish: As selected by Architect from manufacturer's full range.

K. Colors and Patterns:
1. RB-1: Armstrong 61 Graphite Grey
2 Or similar

2.02 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:
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. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
b. Roppe Corporation, USA.
c. Flexco, Inc.
d. Johnsonite.
e. R.C.A. Rubber Company (The).

B. Description: Provide reducer strip and other rubber accessory molding as required to complete resilient flooring installation.
1. Products: As follows:
a. Transition strip for rubber floor.

C. Material: Vinyl or Rubber:

D. Profile and Dimensions: As indicated.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.03 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: Not more than 50 g/L.
b. Rubber Floor Adhesives: Not more than 60 g/L.

C. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

PART 3 – EXECUTION

3.01 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: 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 manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.
1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.02 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

3.03 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 finished flooring that would otherwise be exposed.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Cover resilient products until Substantial Completion.

END OF SECTION

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section includes the following:
   1. Surface preparation.
   2. Field application of paints and other coatings.
   3. Interior exposed surfaces to be finished are indicated in this section and on the Drawings include but are not limited to:
      a. Existing interior walls
      b. Repaired interior GWB.
      c. New interior GWB
      d. Interior steel doors and frames
   4. Exterior exposed surfaces to be finished include but are not limited to:
      a. Sheet metal flashings
      b. Exterior steel doors and frames
      c. Miscellaneous black metal, galvanized metal

B. Surfaces to receive high performance coatings are indicated in Section 09 95 00.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels (unless specifically noted otherwise).
   1. Prefinished items include the following factory-finished components:
      a. Architectural woodwork and casework.
      b. Acoustical wall panels.
      c. Finished mechanical and electrical equipment.
      d. Light fixtures.
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Ceiling plenums
      b. Pipe spaces.
      c. Duct shafts.
   3. Finished metal surfaces include the following:
      a. Anodized aluminum.
      b. Stainless steel.
      c. Chromium plate.
      d. Bronze and brass.
   4. Operating parts include moving parts of operating equipment and the following:
      a. Valve and damper operators.
      b. Linkages.
      c. Sensing devices.
      d. Motor and fan shafts.
   5. Labels: Do not paint over Underwriters laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.02 RELATED WORK

A. Drawings and Division 00 and Division 01 apply to this section.

B. Section 08 10 00 Steel Doors and Frames

C. Section 09 21 16 Gypsum Board Systems

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Master Painters and Decorators Association; 2004.

D. Conform to requirements of the following Reference Standards or as modified and supplemented herein:
   1. International Building Code (IBC)
   2. ANSI/ASTM D16 - Definitions of Terms in Relation to Paint, Varnish, Lacquer, and Related Products.
   3. Master Painters Institute Architectural Painting Specification Manual (MPI)
   4. Structural Steel Painting Council, Surface Preparations Specifications (SSPC)

1.04 SUBMITTALS

A. See Division 00 and Division 01 for submittal procedures.

B. Product Data: Provide complete list of all products to be used, including block fillers and primers, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system (copy of relevant MPI Manual page is acceptable).

C. Certification by manufacturer that products comply with Contract Documents and are compatible with applicable substrates and with each other.

D. A minimum of two (2) 12” x12” draw downs illustrating each of the colors specified or selected for the work. Provide color charts or samples of available colors where no color is specified.

E. Qualification Data: For firms and persons specified in the “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.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years of documented experience.

B. Material Safety Data Sheets: At project site maintain file of MSDS sheets for each product used; become familiar with and follow manufacturer's stated application and safety requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 PROJECT CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer’s instructions.

C. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

E. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer’s instructions.

1.08 EXTRA MATERIALS

A. Provide the Engineer with a written list of paint manufacturer, product name, color, number, sheen, and the area in which the paint was used.

B. At the Close Out of the Project provide the following:
   1. Unopened one gallon can of every component (paints, urethanes, and catalyzed coatings), color (latex, alkyd enamel) and sheens. Only one gallon of each container is allowed, and must be delivered to the SPR Facilities Division at: 4209 W. marginal Way SW, Seattle, WA 98106. All other containers (opened and unopened) are the

responsibility of and must be properly disposed of by the Contractors. No containers shall be left on site.

2. Product information, including SDS per Operation and Maintenance Manual.

C. Label each container with color, texture, and project locations, and date, in addition to the manufacturer's label.

PART 2 – PRODUCTS

2.01 GENERAL

A. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.

B. Where a specified paint system does not have a Premium Grade, provide Custom Grade system.

2.02 MATERIALS

A. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

B. Paints and Coatings: Provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI Categories, except as otherwise indicated.
1. Provide ready mixed paints and coatings, except field-catalyzed coatings.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

2.03 PRODUCTS – MANUFACTURERS

A. Provide all paint and coating products from the same manufacturer to the greatest extent possible.

B. Acceptable manufacturers are limited to the following. Use only Professional quality paint systems:
1. Benjamin Moore
2. Sherwin Williams
3. Miller
4. Or approved equal.

C. All materials shall be LEAD FREE.

2.04 INTERIOR PAINT SYSTEMS

A. Materials:
1. Coatings: Ready mixed, except field-catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating.
2. Coatings: Good flow and brushing properties; capable of drying or curing free of streaks or sags.
3. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
4. Weight per Gallon: 10.72 pounds minimum; viscosity 80-90 KV; solids 58 to 70 percent by weight, dry film 1.6 mils, wet film 3.6 mils.

B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.
a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).
2. Semigloss, Acrylic-Enamel Finish (restroom and locker walls and ceiling): 2 finish coats over a primer.
a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066).

C. Ferrous Metal: Provide the following finish systems over ferrous metal:
1. Low luster (eggshell or satin) Finish: One finish coat over an enamel undercoat and a primer.
a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer as recommended by the manufacturer for this substrate, applied at spreading rate to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).
b. Undercoat: Alkyd, interior enamel undercoat or semigloss, acrylic-latex, interior enamel as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).
c. Finish Coat: Eggshell, acrylic-latex interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).

D. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:

1. Low luster (eggshell or satin), Acrylic-Enamel Finish: Two finish coats over a primer.
   a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
   b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066).

E. Concrete Substrates, Nontraffic Surfaces
   1. Low luster (eggshell or satin) Finish: 2 Coats over a prime coat.
      a. Prime Coat: Interior latex matching topcoat.
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: Interior latex, satin.

2.05 EXTERIOR PAINT SYSTEMS

A. Black Metal:
   1. One coat rust-inhibitive primer.
   2. Two coats alkyd enamel, finish to match existing.

B. Galvanized Metal:
   1. One coat rust inhibitive primer.
   2. Two coats alkyd enamel, finish to match existing.

C. Products:
   1. Primer: Tnemec Primer 10-99, or approved equal.
   2. Paint: Kelly Moore 6700-100 Plasti-Namel Alkyd Rust Inhibitive Enamel.
   3. Or approved equal.

PART 3 – EXECUTION

3.01 GENERAL - SURFACES TO BE FINISHED

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.

B. Paint the surfaces described in PART 2, indicated on the Drawings, and as follows:
   1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
   2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
   3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
   4. In areas accessible to the public paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, and mechanical equipment occurring in finished areas to match background surfaces, unless otherwise indicated.

C. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
   2. Items indicated to receive other finish.
   3. Items indicated to remain naturally finished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

3.02 FIELD QUALITY CONTROL – EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials; report incompatible primer conditions and submit recommended changes for Owner's approval.

D. Provide field sample of 3’ x 3’ mock ups of each color selected for each material. Notify the Owner/ Owner’s Representative for field verification and approval and mock up prior to start of overall painting work.

3.03 PREPARATION

A. Prepare surfaces as specified in MPI Architectural Painting Specification Manual and as follows for the applicable surface and coating; if multiple preparation treatments are specified, use as many as necessary for best results; where the Manual references external standards for preparation (e.g. SSPC standards), prepare as specified in those standards; comply with coating manufacturer's specific preparation methods or treatments, if any.

B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces.

C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar items already installed that are not to be painted.
   1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before preparation and finishing.
   2. After completing painting in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove or repair existing coatings that exhibit surface defects.

E. Concrete, Cement Plaster and Unit Masonry Surfaces to be painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by

weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

F. Gypsum Board Surfaces to be painted: Fill minor defects with filler compound. Spot prime defects after repair.

G. Plaster Surfaces to be painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

H. Concrete Floors to be painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

I. Aluminum Surfaces to be painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

J. Uncoated Steel and Iron Surfaces to be painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

L. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instructions and as specified or recommended by MPI Manual, using the preparation, products, sheens, textures, and colors as indicated.
   1. Remove, refinish, or repaint work not complying with requirements.

B. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of a durable coating film; do not apply finishes to surfaces that are not dry.

C. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.
   1. Brush Application: Use brushes best suited for the type of material applied; use brush of appropriate size for the surface or item being painted; produce results free of visible brush marks.
   2. Roller Application: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.

3. Spray Application: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
4. Where application method is listed in the MPI Manual for the paint system that application method is required; otherwise any application method recommended by manufacturer for material used and objects to be painted is acceptable.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
1. Number of coats and film thickness required are the same regardless of application method.
2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.

E. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
1. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
2. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.
3. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
4. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
5. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.
6. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

3.05 CLEANING AND PROTECTION

A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.

B. Provide "Wet Paint" signs to protect newly painted finishes in public areas. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

3.06 FINISH SCHEDULE

A. General
   1. Work specified herein is in addition to painting called for under other Divisions and Sections.

B. Finish Schedule by Pool
   1. P-1: 2111-60 “Barren Plain” Benjamin Moore, at interior walls and ceilings.
   2. P-2: 2055-20 “Pacific Ocean Blue” Benjamin Moore, at restroom accent walls.
   3. P-3: Match existing adjacent colors.

3.07 INSPECTIONS

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Beginning of application means approval of substrate.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Supplemental, and Special Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 DESCRIPTION

A. Provide labor and materials for surface cleaning, preparation, coating and finishing of the following:
   1. Exterior and interior brick surfaces.
   2. Metal bases/ plates at bottom of glu lam beams in natatorium.
   3. Existing interior sprinkler pipes
   4. Columns at corners of storefront.
   5. Interior columns.
   6. Other surfaces, and existing metal surfaces indicated to be coated or re-coated on the Drawings

B. Related Sections include the following:
   1. Section 08 41 13 Aluminum Storefront
   2. Section 09 90 00 Painting & Coating

1.03 REFERENCES

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. Applicable ASTM and SSPC standards.

C. Paint Application Specification No. 1 “Shop, Field, and Maintenance of Painting of Steel” published in 2004 by The Society for Protective Coatings (SSPC).

D. Paint Application Specification No. 2 “Procedure for Determining Conformance of Dry Coating Thickness Requirements” revised in 2015 by The Society for Protective Coatings (SSPC).

E. Surface Preparation Specification No. 1 “Solvent Cleaning” published in 2015 by The Society for Protective Coatings (SSPC).

F. Surface Preparation Specification No. 2 “Hand Tool Cleaning revised in 2004 by the Society for Protective Coatings (SSPC).

G. Surface Preparation Specification No. 3 “Power Tool Cleaning” revised in 2004 by The Society for Protective Coatings (SSPC).

H. Joint Surface Preparation Standard SSPC- SP10/NACE No. 2”Near White Metal Blast Cleaning” issued in 2007 by the Society for Protective Coatings (SSPC)

I. ASTM D7091-13 “Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.

J. ASTM D 523 “Standard Test Method for Specular Gloss”

1.04 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:
1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "acrylic enamel").
2. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
3. Submit current published product data, product specifications and “Material Safety Data Sheets” (MSDS) equivalent to OSHA Form 20 for each product.
4. Include data to indicate chemical characteristics, performance criteria, limitations, substrate preparation, installation requirements, and curing requirements.
5. Include information for accessories and other required components.
6. No substitutions are allowed.

B. Certification by manufacturer that products comply with Contract Documents and are compatible with applicable substrates and with each other.

C. Submit three paper drawdowns, 8-1/2 by 11 inches in size, illustrating requested colors for each finishing product specified.

D. VOC content of all interior opaque coatings actually used.

E. Maintenance Data: Submit data on cleaning, touch-up, and repair of coated and coated surfaces.

F. Submittals must identify specific project-relevant products. Indiscriminate submittals are not allowed.

G. Contractor shall submit a safety plan in accordance with regulatory requirements.

1.05 FIELD MOCKUP

A. Provide field mock-up of approximately 4 (four) square feet to illustrate the surface preparation, color, texture, and finish. Step down mock-up to expose each step.

B. Install field mockup of surface preparation and the stepped down coating system at location determined by owner.

C. Owner shall review field mockup installed for acceptability of quality of finish. Accepted area will serve as the standard for the work.

D. Accepted mockup may remain as part of the Work.

1.06 QUALITY ASSURANCE

A. The General Contractor and Subcontractors shall be responsible for complete, watertight, weatherproof, and fully adhered building envelope systems and assemblies. The Contractor shall establish and follow best practices for the trade and of quality-control and quality assurance to assure each and every building envelope systems' successful completion.

B. Single Source Responsibility: Provide primers and other under coatings produced by same manufacturer as finish coats. Use only thinners approved by manufacturer, and use only within recommended limits.

C. Applicator Qualifications: A single applicator ("Painting Contractor") shall perform the work of this section; and shall be a firm with successful experience in painting projects similar in scope to that required for this project and familiar with the painting systems specified herein.
   1. Contractor(s) must provide written documentation of having minimum five (5) years' experience and specialize in applying the coating.

D. Applicator shall provide all personnel trained in the application of the materials and systems and shall maintain supervision as specified elsewhere.

E. Coordination of Work: Review other sections of these specifications in which surface preparation and prime paints are to be provided to ensure compatibility of total coating system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

F. Conformance Standards: Work in this section shall conform to the minimum standards for material and work as set forth in the Steel Structures Painting Council, Vols. 1 and 2 for steel cleaning methods.

G. Material Safety Data Sheet (MSDS): Submit MSDS for all materials, equipment, chemicals, and chemical containing products for Engineer's review prior to its application and use.

H. Mandatory (1) yr Anniversary Review: At the end of (1) year Owner shall inspect completed work and Contractor shall be responsible to repair any examples of poor workmanship at no cost to the Owner.

1.07 QUALIFICATIONS

A. Manufacturer's Qualifications: Company with at least 20 years of experience in the manufacture of high performance architectural coatings equal to those specified in this section.

B. Contractor's Qualifications: Coating contractor with a record of successful in-service coating applications similar to the material, design, and extent of the work described in this section.

1. Coating Contractor must submit three successful projects of the same scale and nature, including the type of coating system specified herein, to be considered qualified for approval.

C. Technicians Qualifications: Workers thoroughly skilled and trained in the techniques for applying High Performance Architectural Coatings.

1.08 REGULATORY REQUIREMENTS

A. Conform to applicable federal, state, and local regulatory requirements.

B. Flammable Liquids: Observe regulations regarding flammable liquids such as posting "No Smoking" signs. Allow no open flames, welding, or other ignition sources in the work area.

C. Conform to applicable laws, codes, and regulations for disposal of materials, debris, and containers.

D. High Performance coatings materials shall be VOC compliant.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 50’ F.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

D. Submit invoices for verification of accurate material purchase.

E. Remove materials and empty containers from the area of work at the close of each day.

1.10 JOB CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the coating product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply paint in mist, rain, fog, or snow or when there is a probability of precipitation during application and dry time. Do not apply paint when relative humidity exceeds 85 percent or at temperatures less than 5’F (3’ C) above the dew point. DO not apply paint to damp or wet surfaces. Take adequate precautions to ensure that materials, substrates, and applied paint, are protected from possible moisture, damage, or contamination.

D. Minimum Application Temperatures for Acrylic Coatings: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

1.11 EXTRA MATERIALS

A. Provide the owner with a written list of paint manufacturer, product name, color, number, sheen, and the area in which the paint was used. Provide touch-up quart of each color and type to the owner.

C. Label each container with color, texture, and project locations, and date, in addition to the manufacturer's label.

1.12 WARRANTY

A. The contractor will issue a five-year warranty for the work covered under this Section. Warranty period will extend for five years from the date of physical completion of the work and shall cover any failure of paint adhesion during this period.

B. The Coating manufacturer will provide a five (5) year limited material warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Specific products indicated are from Tnemec Co., Inc**.**
1. Coating Basis of Design: Tnemec Company Inc. Local Source: TNW Inc. 206-762-5755, email: tnwoffice@tnemec.com

B. Or approved equal

2.02 MATERIALS

A. High Performance Coatings and Paint: Product designed for field application containing uniformly dispersed pigments in a homogeneous coating with good flow properties; capable of air-drying or curing free of discoloration

B. Materials shall not be altered except for reducing in accordance with the recommendations of the manufacturer

C. Colors: Colors shall be custom tinted by the manufacturer for each finish product specified as selected by the Owner. Owner will provide colors in advance of the coating operation. Owner' agent will select from Standard Colors to the greatest extent possible.

D. Coating Products Manufacterured by Tnemec Company are used as the standard of Quality. Other materials will not be considered.

2.03 COLOR SYSTEMS

A. Each coat, including primer, intermediate coat and finish coat are to be a discernibly different tone to allow for confirmation of specified coating application.

B. Submit samples for Consultant's approval. Provide separate color samples for primer and finish coats.

2.04 COATING FOR MASONRY SUBSTRATES

A. Includes existing brick walls as specified, indicated in contract documents and/or directed by Architect.

B. Water Repellent: Prime-a-pell H2O Series 633 Siloxane/Silane Blend

C. Surface Preparation: The surface to be treated must be sound, dry and free of cracks, dirt, oils, efflorescence, paint, curing compounds and all other contaminants, which may affect the penetration of Prime-A-Pell H2O. Fill all cracks, voids and repoint mortar joints if necessary. New concrete and mortar must be allowed to cure a minimum of twenty-eight (28) days before treatment. Protect plants, shrubs and glass from overspray. Should incidental contact occur with surfaces not intended for treatment, remove overspray immediately with mild soap and water. Do not allow soap solution to contact the surface being treated.

D. Application: Apply using a low-pressure rotary or gear pump sprayer with a fan tip (0.03-0.06 orifice) that allows for application of the product at 20-30 psi. A commercial grade pump-up spray tank equipped with a fan tip is also acceptable. Airless paint sprayers are not acceptable for the application of water repellents. Do not atomize the product. On vertical installations, apply with a wet-on-wet technique. Apply a saturating application of the product working from the bottom up. On porous substrates such as concrete masonry units, allow a slight rundown (less than three inches). On high density materials such as precast concrete panels or GFRC, do not allow any rundown. On all substrates allow the product to penetrate the substrate for approximately 5 to 7 minutes, then apply again in the same manner. This second pass will require less material. Follow coverage rate guidelines, however, a test application should always be performed.

2.05 COATING FOR CMU SUBSTRATES

A. Includes existing interior CMU walls as specified, indicated in contract documents and/or directed by Architect.

B. Primer:
   1. Tnemec Series 1256. At required thickness to fill CMU

C. Intermediate Coats:
   1. Hi-Build Epoxiline ll Tnemec Series N69 Polyamidoamine Epoxy. 6.0- to 8.0- mil Dry Film Thickness

D. Finish Coat:

1. CRU Tnemec Series 290 Aliphatic Polyester Polyurethane. 2.0- to 3.0- mil Dry Film Thickness

2.06 COATING FOR STEEL SUBSTRATES

A. Includes existing and non-galvanized & previously painted as schedule to remain; columns in storefront system, fire sprinkler pipes, and other steel materials as specified, indicated in contract documents and/or directed by Architect.

B. Primer:
1. PrimePrime Tnemec Series 394 Polyurethane, Mio-Zinc Filled Primer. 6.0- to 8.0- mil dry film thickness;

C. Intermediate Coat:
1. Hi-Build Epoxiline ll Tnemec Series N69 Polyamidoamine Epoxy. 4.0- to 6.0- mil dry film thickness per coat;

D. Finish Coat:
1. Endure-Shield Tnemec Series 1095 Aliphatic Acrylic Polyurethane. 3.0- to 5.0- mil Dry Film Thickness

2.07 COATING FOR GALVANIZED SUBSTRATES

A. Includes existing galvanized metal glu-lam bases and plates as specified, indicated in contract documents and/or directed by Architect.

B. Primer:
1. Hi-Build Epoxiline ll Tnemec Series N69 Polyamidoamine Epoxy. . 6.0- to 8.0- mil dry film thickness;

C. Finish Coat:
1. Endura-Shield Tnemec Series 1095 Aliphatic Acrylic Polyurethane. 3.0- to 5.0- mil dry film thickness per coat;

PART 3 - EXECUTION

3.01 EXAMINATION

A. Applicator must examine areas and conditions under which coating work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.

B. Begin coating application only after unsatisfactory conditions have been corrected and surfaces thoroughly prepared, wiped clean and dry, and well protected. Starting of coating work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

C. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

D. Do not coat over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of durable coat film.

3.02 PREPARATION - SURFACES TO RECEIVE COATING

A. General: Perform preparation and cleaning procedures in accordance with coating manufacturer's instructions and as herein specified, for each particular substrate condition.

B. Clean substrates of substances that could impair bonds of paints, including dirt, oil, grease, salt, rust, and incompatible paints and encapsulates.
   1. Remove incompatible primers and re-prime substrate with compatible primers as required to produce paint systems indicated.
   2. Grind, wire brush, and sand, as required removing corrosion, scale, existing paint build-up or any other residual contaminant that may inhibit proper paint adhesion.

C. Preparation of Painted Surfaces: Remove old paint not tightly and fully bonded to the surface. Prepare substrate using published methods and as recommended by paint manufacturer.

D. Preparation of steel surfaces: SSPC SP3 power tool, followed by SSPC-SP1 solvent wipe.
   1. All the scale needs to be removed before priming.

3.03 APPLICATION

A. General: Apply coating in accordance with manufacturer's directions. Use applications and techniques best suited for substrate and type of material being applied. Use identifiably different colors for all separate components of specified coating systems.
   1. Mixing: Precondition to temperature as required by the manufacturer. Mix using a mechanical mixer to achieve a uniform consistency immediately prior to use.

B. Do not apply coatings or paint to surfaces that are not dry. Allow applied coats to dry as required before next coat is applied. Do not exceed recoat window listed on product data sheet.

C. Batch-mix multiple containers of a single color to assure a continuous balance of colors and ingredients.

D. Clean surfaces free of loose particles just prior to coating and painting application.

3.04 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product and/or application requirements. Contractor shall remove non-complying paint materials from project site, pay for testings, and re-prepare, prime as may be required, 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.

B. Contractor's Responsibilities:
1. Contractor shall provide experienced supervisors and personnel to perform the work, who are trained in the application of the materials and procedures specified in this Specification. Contractor shall provide documentation from the Manufacturer that the Contractor meets the experience and training requirement for the specified system. Contractor shall maintain on-site supervision continuously to assure on-going quality control for superior quality application.
2. The Contractor shall be responsible for the quality control of all their own work, as well as the work performed by the subcontractors working under this Specification, and/or related specification which is considered part of the Project Contract.
3. Contractor shall notify the Project Architect of any conflicts that may result in a deviation from the Manufacturer's Specifications, industry standards, code compliance, job safety, or function as a result of the Project's Scope of Work, Specifications, and/or Project Drawings.
4. Any modifications to the Specifications, Detail Drawings, or Substitutions of specified products shall not be made without direct consultation, and written request for review and written approval from the Project Architect and Owner's Project Manager.
5. If the Project Architect, and/or Specified Manufacturer determine that the quality of work does not conform to the Specifications, and Project Drawings, and/or Manufacturer's requirements or Industry Standards, the Contractor must correct all deficiencies and advise the project team of the corrective actions taken.
6. Contractor must demonstrate the ability to perform the work in a quality, timely manner with minimal noise and disruption to/ or impact on building operations, and the Public.
7. Contractor shall notify the Project Architect and Building Envelope Consultant a minimum of fourteen (14) days prior to commencement of Work.

3.05 CLEAN-UP AND PROTECTION

A. Clean-Up: During progress of work, remove from site discarded coating materials, rubbish, cans and rags at end of each work day.

B. After completing paint application, clean overspray-spattered and otherwise effected surfaces. Remove overspray-spattered and otherwise effected paints, fallout dust(s), etc. by washing, careful scour padding, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protection: Protect work of other trades, existing surfaces, and surroundings against damage by coating and finishing work. Correct any damage by cleaning, repairing or replacing, and recoating, as required and acceptable to Consultant and Engineer.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 PAINT AND COATING COLOR SCHEDULE

A. Exterior concrete high performance coatings and painting, colors indicated below:

B. Finish Schedule:

1. Exterior/Interior brick walls (Refer to drawings for exact locations)
   a. Color CT-1: Clear
2. CMU walls (Refer to drawings for exact locations)
   a. Color CT-2: Barren Plain, 2110-60, Benjamin Moore
3. Galvanized metal bases and plates (Refer to drawings for exact locations)
   a. Color CT-3: Days End, 2133-30, Benjamin Moore
4. Steel columns and pipes (Refer to drawings for exact locations)
   a. Color CT-3: Days End, 2133-30, Benjamin Moore

END OF SECTION

DIVISION 10

Specialties

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Solid plastic toilet compartments, urinal screens, privacy screens.

B. Related Sections:
1. Division 1: Administrative, procedural, and temporary work requirements.

1.02 REFERENCES

A. ASTM International (ASTM):
1. A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
3. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. National Fire Protection Association (NFPA) 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.03 SYSTEM DESCRIPTION

A. Compartment Configurations:
1. Toilet partitions, privacy screens,: Floor mounted
2. Urinal screens: Wall mounted.

1.04 SUBMITTALS

A. Submittals for Review:
1. Shop Drawings: Include dimensioned layout, elevations, trim, closures, and accessories.
2. Product Data: Manufacturer's descriptive data for panels, hardware, and accessories.
3. Samples: 2 x 3 inch samples showing available colors

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 years experience in manufacture of solid plastic toilet compartments with products in satisfactory use under similar service conditions.

B. Installer Qualifications: Minimum 5 years experience in work of this Section.

1.06 WARRANTIES

A. Provide manufacturer’s 25-year warranty against breakage, corrosion, and delamination under normal conditions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Contract Documents Basis of Design: Hiny Hiders by Scranton Products. (www.scrantonproducts.com)

B. Substitutions: Under provisions of Division 01

2.02 MATERIALS

A. Doors, Panels and Pilasters:
1. High density polyethylene (HDPE), fabricated from polymer resins compounded under high pressure, forming single thickness panel.
2. Waterproof and nonabsorbent, with self-lubricating surface, resistant to marks by pens, pencils, markers, and other writing instruments.
3. 1 inch thick with edges rounded to 1/4 inch radius.
4. Fire hazard classification: Not required.
5. Color: Stainless
6. Texture: hammered
7. 8 inches long, fabricated from heavy-duty extruded aluminum with bright dip anodized finish, wrap-around flanges, adjustable on 30-degree increments, through bolted to doors and pilasters with stainless steel, Torx head sex bolts.
8. Hinges operate on field-adjustable nylon cams, field adjustable in 30 degree increments.
9. 6 inches long, fabricate from heavy-duty extruded aluminum with bright dip anodized finish, with wrap-around flanges secured to pilasters with stainless steel tamper resistant Torx head sex bolts.
10. Bumper: Extruded black vinyl.

B. Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.

C. Stainless Steel: ASTM A167, Type 304.

2.03 HARDWARE

A. Hinges

B. Door Strike and Keeper

C. Latch and Housing
1. Heavy-duty extruded aluminum.
2. Latch housing: Bright dip anodized finish.
3. Slide bolt and button: Black anodized finish.

D. Coat Hook/Bumper
1. Combination type, chrome plated Zamak.
2. Equip outswing handicapped doors with second door pull and door stop.

E. Door Pulls: Chrome plated Zamak.

2.04 COMPONENTS

A. Doors and Dividing Panels: 55 inches high, mounted 14 inches above finished floor.

B. Pilasters: 82 inches high, fastened to pilaster sleeves with stainless steel tamper resistant Torx head sex bolt.

C. Pilaster Sleeves: 3 inches high, 20 gage stainless steel, secured to pilaster with stainless steel tamper resistant Torx head sex bolt.

D. Wall Brackets: 54 inches long, heavy-duty aluminum, bright dip anodized finish, fastened to pilasters and panels with stainless steel tamper resistant Torx head sex bolts.

E. Headrail: Heavy-duty extruded aluminum, anti-grip design, clear anodized finish, fastened to headrail bracket with stainless steel tamper resistant Torx head sex bolt and at top of pilaster with stainless steel tamper resistant Torx head screws.

F. Headrail Brackets: 20 gage stainless steel, satin finish, secured to wall with stainless steel tamper resistant Torx head screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install compartments in accordance with manufacturer’s instructions and approved Shop Drawings.

B. Install rigid, straight, plumb, and level.

C. Locate bottom edge of doors and panels 14 inches above finished floor.

D. Provide uniform, maximum 3/8 inch vertical clearance at doors.

E. Not Acceptable: Evidence of cutting, drilling, or patching.

3.02 ADJUSTING

A. Adjust doors and latches to operate correctly.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Accessories for toilet rooms.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 – Rough Carpentry: Placement of reinforcement for backing plate reinforcement and blocking.

B. Section 10 21 16 – Solid Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004 (Reapproved 2010).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 01 33 10 - Basic Requirements, for submittal procedures.

1.06 WARRANTY

A. The Contractor shall guarantee all work installed under this specification. He shall make good, repair, or replace, at his own expense, any defective work materials, or parts which may show themselves within one year of final acceptance, to the satisfaction of the owner.

B. Equipment: All supplied materials and equipment shall carry their manufacturer's respective warranties; these warranties shall be commuted from the Contractor to the Owner prior to final acceptance.

1.07 MAINTENANCE

A. Furnish Owner with complete instructions, spare and replacement parts lists, recommended maintenance and cleaning materials, and other pertinent data required to maintain accessories.

1.08 KEYING

A. Where key-operated locks are required for accessories; key locks as directed; obtain keying instructions from owner prior to installation of locks.

B. Provide two (2) keys per unit minimum.

1.09 COORDINATION

A. This section is responsible for identifying where blocking installation is necessary and providing blocking to support products specified herein.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Bobrick.

B. Other Acceptable Manufacturers:
   1. A & J Washroom Accessories Inc: www.ajwashroom.com.
   2. American Specialties, Inc: www.americanspecialties.com.
   3. Substitutions: Section 01 10 00 – Basic Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

2.03 TOILET ROOM ACCESSORIES

A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, stainless steel, eccentric-shaped plastic spindle for 1/2 revolution delivery designed to prevent theft of tissue roll.
   1. Model: Bobrick B-2892.

B. Combination Towel Dispenser/Waste Receptacle: Recessed flush with wall, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.
   1. Mounting: Surface mounted.
   2. Model: Bobrick B-39619

C. Soap Dispenser: Liquid soap dispenser, deck-mounted on vanity, with polyethylene container concealed below deck; piston and 4 inch (100 mm) spout of stainless steel with bright polished finish; chrome-plated deck escutcheon.
   1. Soap Dispensers: Bobrick B-2111 or approved equal. Provide where indicated.

D. Grab Bars: Stainless steel, nonslip grasping surface finish.
   1. Heavy Duty Grab Bars: Floor supports are acceptable if necessary to achieve load rating.
      a. Push/Pull Point Load: Minimum 1000 pound-force (4448.2 N), minimum.
      b. Dimensions: 1-1/2 inch (38 mm) outside diameter, minimum 0.125 inch (3.17 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
      c. Length and Configuration: As indicated on drawings.

2. Bobrick B-5806 x 42, B-5806 x 48, B5806 x 18, or approved equal; configuration as indicated on drawings. Provide where indicated.

E. Mirror: Fixed Position Tilt Mirror: B-293 Series, size as indicated on drawings.
   1. Frame 18-8, type 304, heavy-gauge stainless steel with satin finish. Tapers from 4" depth at top to 1" depth at bottom.
   2. Mirror: No. 1 quality, ¼" select float glass, selected for silvering; electrolytically copper-plated by the galvanic process, guaranteed for 15 years against silver spoilage. All edges polished and protected by plastic filler strips; back is protected by full-size, shock absorbing, water-resistant, nonabrasive, 1/8" thick polystyrene padding.

F. Toilet Seat Cover Dispenser: Bobrick B-221 or approved equal. Provide where indicated.

G. Sanitary Napkin Waste Receptacle: Bobrick B-254 or approved equal, one per toilet stall in Women's restroom, or one per All-Gender restroom.

PART 3 EXECUTION

3.01 PREPARATION

A. Provide templates and rough-in measurements as required.

3.02 INSTALLATION

A. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on the drawings.
   2. Other Accessories: As indicated on the drawings.

3.03 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. BABY CHANGING STATIONS, PLASTIC WITH RECYCLED CONTENT.
   1. Surface-mounted horizontal design. (Koala Model KB200).

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry, blocking in walls.

B. Section 09 21 16 - Gypsum Board Systems, blocking in walls.

C. Section 10 28 00 – Toilet Room Accessories

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's data sheets for each product specified, including the following.
   1. Installation instructions and recommendations, including templates and rough-in measurements.
   2. Storage and handling requirements and recommendations.
   3. leaning and maintenance instructions.

1.04 QUALITY ASSURANCE

A. Manufacturer: Provide products manufactured by a company with a minimum of 5 years successful experience manufacturing similar products.

B. Single Source Requirements: To the greatest extent possible provide products from a single manufacturer.

C. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable
Koala Kare Products, a Division of Bobrick Guide Specifications in CSI Format
www.koalabear.com Toll Free: 888-733-3456
BABY CHANGING STATIONS

D. Baby Changing Stations: Provide products which comply with the following standards and requirements.
   1. Antimicrobial Treatment: Changing surfaces embedded with Microban®, with antibacterial claim substantiated by Kirby-Bauer test or other manufacturer approved equivalent standard industry test methodology.
   2. Americans with Disabilities Act (ADA).
   3. ANSI A117.1 - Accessible and Usable Building and Facilities.
   4. ANSI Z535.4 - Product Safety Signs and Labels.
   5. ASTM F 2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use.

6. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
7. European Standards: EN 12221 Changing units for domestic use.
8. CPSIA: Conformity with the U.S. Product Safety Commission product safety rules, bans, standards and regulations that include applicable chemical compliance requirements.

E. Manufacturing Location: United States.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Protect from damage.

1.06 WARRANTY

A. Manufacturer’s Warranties: Submit manufacturer’s standard 5 year warranty for materials and workmanship and include a provision for replacement caused by vandalism

PART 2 – PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturer: Koala Kare Products, a Division of Bobrick, www.koalabear.com.

B. Or approved equal

2.02 BABY CHANGING STATIONS, PLASTIC WITH RECYCLED CONTENT

A. Surface-Mounted Horizontal Design Baby Changing Stations:
1. Basis of Design: Model KB200-00, cream color, as manufactured by Koala Kare Products, a Division of Bobrick.
2. Materials. FDA approved injection-molded polypropylene.
3. Operation: Concealed pneumatic cylinder providing controlled, slow opening and closing of the changing station bed.
4. Hinge Mechanism: Reinforced full length steel-on-steel hinge.
5. Changing Surface: Contoured, concave and smooth, 450 sq. in.
6. Safety Straps: Replaceable, snap-lock, nylon protective holding straps.
7. Performance: When mounted to specification, unit has been tested to 300 lbs and will deflect less than 1 degree from 90 degrees with a 200 lb static load placed in the center of the changing surface.
8. Mounting: Concealed 11 gauge plated steel mounting chassis with 16 inch centers and 6 mounting points the top 2 mounting points feature keyholes for ease of installation units include mounting hardware.
9. Features: No hinge structure exposed on interior or exterior surfaces; two bag hooks; locking built-in dual cavity liner dispenser with 50 liner capacity supplied with 2 keys that are keyed alike to Bobrick Washroom Accessories.

10. Instruction Graphics: Universal instruction graphics and safety messages in Koala Kare Products, A Division of Bobrick Guide Specifications in CSI Format
    www.koalabear.com Toll Free: 888-733-3456
    BABY CHANGING STATIONS
11. Optional Braille Label: If required.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install products in strict compliance with manufacturer's written instructions and recommendations, including the following:
   1. Verify blocking has been installed properly.
   2. Verify location does not interfere with door swings or use of fixtures.
   3. Comply with manufacturer's recommendations for backing and proper support.
   4. Use fasteners and anchors suitable for substrate and project conditions
   5. Install units rigid, straight, plumb, and level, in accordance with manufacturer's installation instructions and approved shop drawings.
   6. Conceal evidence of drilling, cutting, and fitting to room finish.
   7. Test for proper operation.

3.02 CLEANING AND PROTECTION

A. Clean exposed surfaces of compartments, hardware, and fittings.

B. Touch-up, repair or replace damaged products until Substantial Completion.

END OF SECTION

DIVISION 21

Fire Suppression

PART 1 GENERAL

1.01 WORK INCLUDED

A. Work includes the following:
   1. Provide all design, materials, equipment, labor, supervision, tools and items necessary for the construction, installation, connection, start-up, testing and operation of all fire suppression work for this project as defined by Division 21 and the Contract Documents.
   2. Work shall conform to all relevant NFPA standards and local ordinances.

1.02 DEFINITIONS AND ABBREVIATIONS

A. The word "provide", as used in these specifications, means "furnish and install".

B. The word "accepted", as used in these specifications, means the acceptance of the Engineer and/or Architect.

C. Abbreviations:

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating & Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CISPI	Cast Iron Soil Pipe Institute
F	Fahrenheit
FM	Factory Mutual Engineering Corporation
HI	Hydraulic Institute
IBC	International Building Code
IMC	International Mechanical Code
MSS	Manufacturers' Standardization Society of the Valve and Fittings Industry, Inc.
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
psi	Pounds per square inch
psig	Pounds per square inch gauge pressure
SMACNA	Sheet Metal and Air-Conditioning Contractors' National Association
UL	Underwriters' Laboratories, Inc.
V	Volts
UPC	Uniform Plumbing Code
WAC	Washington Administrative Code
WSEC	Washington State Energy Code
WISHA	Washington Industrial Safety & Health Act

D. Refer also to Division 1 for additional acronyms and for additional definitions and explanations of terms.

E. Some of these abbreviations may not be used. All other abbreviations shall have the definition commonly associated with them by the trade or industry. Confirm the meaning of any unclear or unknown definitions with the Architect before proceeding with any work.

1.03 PLANS AND SPECIFICATIONS

A. The drawings and specifications are intended to describe all fire suppression work, unless otherwise shown. Provide all materials which are necessary for the proper completion of the installation and operation of the equipment.

B. The drawings are diagrammatic and do not show exact or complete piping configurations or the necessary number and types of fittings. Provide all labor and materials required to complete the work indicated and per code.
C. Any questions occurring during bidding or construction shall be resolved by direction in writing from the Architect. Any issues not so resolved or any conflicts shall result with the contractor bidding, furnishing and installing the most stringent condition. No exceptions.
D. During bidding, provide a line item breakout additive alternate cost for a fire protection booster pump. The need for a fire sprinkler pump will be determined during the fire suppression system design process by the fire sprinkler designer. If required the line item breakout will represent the additive costs to provide the pump, power for the pump, additional controls, coordination of the fire pump, and the design effort related to the pump.

1.04 LAW AND ORDINANCES

A. General:
1. All fire suppression work specified under this contract shall be in strict accordance with the latest rules and regulations of all applicable codes.
2. Contractor is not relieved from furnishing and installing work shown or specified which may be beyond requirements of ordinances, laws, regulations, and codes. This work shall be included within the construction contract.
3. Contractor is not relieved from furnishing and installing work required by the local Authority Having Jurisdiction (AHJ) which may be beyond requirements of ordinances, laws, regulations, and codes. Review by AHJ of systems should be sequenced to accommodate time in the construction schedule for revisions/correction and second review by AHJ.

B. Approval: File necessary plans, prepare documents and obtain necessary approval of governmental departments having jurisdiction and required certificates of inspection for work and deliver same to Architect before requesting acceptance and final payment for work.
C. Permits, Certificates and Taxes: Procure and pay for all the necessary permits, certificates, and taxes for all work as required in the General and Supplementary Conditions. In addition, perform all ordinance and performance tests in the presence of the Architect, and be responsible for advance notification. Submit copies of signed and accepted permits to the Architect.

1.05 SUBMITTALS

A. General:
1. Deliver material, submittal and shop drawing data to Architect in accordance with the requirements of the General Conditions, Supplemental Conditions, this section and Division 1.
2. Do not place orders for materials, fixtures, or equipment until approval is obtained from Architect in writing. Verbal approval shall not be contractually binding and will not be considered.
3. Make every attempt to respond to the reviewer's comments in a timely manner.
4. The project construction schedule, beginning with the acceptance of the bid and confirmation of the successful bidder, is not the responsibility of the Consultant Engineer. The Contractor's schedule shall recognize and accommodate the review intervals specified herein. The schedule shall identify and accommodate the specified submittal and re-submittal review and response period. The contractor shall not anticipate or base the construction schedule on expedited reviews or reviews of partial submittals. Submittals shall be organized and delivered as specified. No exceptions.

B. Submit
1. Provide submittals for all equipment and systems indicated and specified by the Contract Documents

2. Provide five copies of the submittals in 3-ring notebook(s), organized by specification section, large enough to accept total volume of material to the Architect. Reference project information shall include
   a. Project title,
   b. Project number and Location,
   c. Architect,
   d. Engineer,
   e. Contractor,
   f. Subcontractor(s),
   g. Submission date,
   h. Specification sections submitted.
3. Label cover and binder end. Clearly indicate any items not included with submitted assemblies. Consultant Engineer will not take responsibility for collating submitted information into notebooks.
4. Submit only the work of one section per submittal. Submittals within a section shall be organized by subsection so that they are in the order they appear in the specification. Items not in the specification but shown only on the plans shall be included as though they appear at the back of the specification section and be labeled with the appropriate sheet number or be submitted in a separate submittal.
5. Label every submitted product with the associated specification section reference (e.g. 210500-1.05.B.3-“Product A”) and indicate the specific product if multiple products, sizes, models, etc., are shown.
6. The Contractor shall make every attempt to respond to the Consultant Engineer's comments in a timely manner. Submittal material requiring more than three Consultant Engineer reviews will be considered non-responsive. The Consultant Engineer may elect to charge the contractor on an hourly basis for additional consultation as required to secure a responsive submittal.
7. Submittals not bound and organized as specified will be rejected.
8. Digital PDF submittals will be accepted in lieu of physical submittals at the discretion of the Architect and must meet the same organizational requirements.

C. Standards Compliance and Certification:
   1. Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI), American Society for Mechanical Engineers (ASME), Underwriters Laboratories Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and accepted.
   2. Submit certification for the product submitted and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply the product does not meet all requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; "equal or exceed the service and performance of the specified material." Simply state that the product conforms to the requirements specified.

D. Substitution of Materials: Substitutions of materials will only be considered where specified materials cannot be obtained or where prior approval has been provided. All work and equipment required incidental to the substitution is the responsibility of the Contractor. Refer to Division 1 for the requirements related to substitutions and prior approvals.

1.06 SHOP DRAWINGS

A. Shop drawings required shall include but are not limited to:
   1. Plan location of all Division 21 equipment.
   2. All fire protection pipe and sprinkler head layouts.

3. Access Doors for all Division 21 equipment.
4. Fire Sprinkler Room(s) layout.
5. Location and size of all access panels required.

B. All shop drawings shall bear the Contractor's stamp, certifying that the contractor has:
1. Verified all field dimensions and quantities as shown on the shop drawings.
2. Verified all field construction criteria, materials, catalog numbers and similar data.
3. Verify that system is designed to all appropriate NFPA codes.
4. Reviewed and coordinated submittal data with requirements of the work and the Contract Documents with the field conditions.
5. Coordinated all equipment clearances and manufacturers' written installation requirements.
6. Coordinated with all other trades' routing, access, space and clearance requirements.

C. Shop drawings shall be drawn on the Architect's final backgrounds; at a minimum, all walls, room numbers, and plan name indicating floor are to be included on the shop drawings. Drawings should be performed by Computer Aided Drafting software (preferred) or drawn neatly by hand in permanent ink. Any field verified dimensions should be shown, as well as each piece of equipment related to the shop drawing. Do not resubmit the fire suppression or architectural sheets marked-up with notes.

D. Submit in mailing tube if drawing cannot be shipped flat. Do not fold.

E. Submit drawings the same size as the bid set, 8-1/2" x 11", 11" x 17" or 24" x 36" unless size of the items depicted makes such sizes impractical. Shop drawings may be submitted as PDFs but must be full size or half-size documents.

F. Acceptance does not extend to products not represented by or included on the shop drawings, nor does it extend to verification of quantity or dimension surveys. Review is limited to checking for conformance with the design concept and to verify that the contractor has taken care in coordination between trades. No changes from the provisions of the Contract Documents are intended and the Contractor remains responsible for compliance with the provisions therein.

G. Shop drawings that do not meet the above requirements will be returned without review.

1.07 CONSULTANT REVIEW

A. Review is general and does not:
1. Permit departure from Contract Documents.
2. Relieve Contractor from responsibility for error in detail, quantities, dimensions or related items.
3. Relieve the contractor from providing a full code compliant system or installation, as determined by the governing code or reviewing official.
4. Accepted departure from previous instructions or detail.
5. Relieve Contractor of responsibility to provide all components, wiring, etc., required to make item operational or usable.
6. Relieve Contractor of the responsibility to coordinate all power and clearance requirements with other trades.
7. Imply acceptance of items for which no data is submitted.

B. Work which requires submittals shall not be started without Consultant Engineer's review.

C. Allow fifteen (15) working days for Consultant Engineer review.

D. Acceptance will be indicated by a signed stamp affixed to the submittal, or a letter over the Consultant Engineer's signature. No exceptions.

E. Re-submittals
1. Items of materials, fixtures and equipment not accepted by Consultant Engineer shall be resubmitted within 15 working days after Consultant Engineer review. If Contractor fails to submit items listed below for approval or resubmit in the event of disapproval within specified time, Contractor shall provide materials, fixtures and equipment as scheduled on

drawings. Where equipment is not scheduled the Contractor shall provide materials, fixtures and equipment as identified in the specifications.
2. Decision of Consultant Engineer shall be final and binding and items shall be provided without change in contract price or time of completion.
3. Where clarification is requested a response in writing may be accepted in lieu of a full re-submittal. Final documentation of the accepted, ordered, installed, item should still be provided.

1.08 PUNCH LIST & WARRANTEE

A. Refer to the requirements of Division 1.
B. Inform project design team of construction progress and schedule a site visit by the Engineer prior to covering pipe, duct, equipment that will, once construction is completed, be otherwise hidden from view. A substantial completion site visit will be completed at a later date.
C. Punch list items shall be provided to the contractor in writing. A written response indicating the corrective action taken or explanation of the situation must be returned to the Engineer.

PART 2 PRODUCTS

2.01 MOTORS

A. Provide motors conforming to the following unless noted otherwise:
1. Design and Construction: Unless otherwise indicated, provide electric motors and enclosures described by this specification conforming to the applicable definitions and requirements of NEMA MG-1.
2. Standard Commercial Product: Provide motors of manufacturers' standard commercial product. A standard commercial product is a product which has been or will be sold on the commercial market through advertisements or manufacturers' catalogs or brochures, and represents the latest production model(s).
3. Nameplates: Provide all motors with readily visible nameplates containing the information required in NEMA MG-1.
4. Drive guards: Provide drive guards and shaft guards for all exposed, rotating, shafts and drive connections.

B. Motor Requirements:
1. Manufacturer: General Electric, Lincoln, Allis-Chalmers, Goulds or U.S. Motors or accepted equal.
2. Type: Furnish High Efficiency motors. Motor efficiencies shall meet or exceed the efficiency values required by the Washington State Energy Code.

2.02 MOTOR CONTROL EQUIPMENT

A. General: The fire sprinkler contractor is responsible for providing and installing motor control equipment as required for fire protection equipment and systems. Refer also to the requirements of Division 26 and coordinate power requirements. Motor control equipment shall be comprised of the following:
1. Magnetic motor starters
2. Overload devices
3. Combination motor starter and disconnects
4. Manual starters
5. Simple disconnects
6. Control relays
7. Control interface equipment
8. Wire for control and power of the above.

B. Magnetic motor starters: Where equipment is under automatic control and is furnished with a disconnecting means, provide magnetic motor starters. Starters shall conform to or contain items called for below and unless noted otherwise, shall be full voltage non-reversing for NEMA size 3 and under. No starters smaller than NEMA size 0 and no half size starters are permitted.

Provide starters with protection for phase loss, phase imbalance, overload, and ground fault. Wye-delta type must have motor designed for this use. Coordinate work as required.

1. Overload devices: Melting alloy or bimetallic type. One overload shall be provided for each phase. Provide ambient compensated overload devices only when the motor is at a constant temperature and the controller is subject to a separate, varying temperature. Automatic reset overload devices are not permitted.
2. Accessories: Each magnetic motor controller shall include, "HAND-OFF-AUTO" selector switch, 120 volt coil (unless noted otherwise), red running pilot light, green off pilot light, 100VA (minimum) control transformer (except for 115 volt motors), surge suppression kit, with fused primary and secondary, two spare auxiliary interlock contacts and all other accessories required or noted.
3. Enclosures: Motor controllers shall be contained in an enclosure suitable for the environment in which the controller is mounted. Enclosures located in damp, moist locations and outdoors shall be NEMA 3R throughout.

C. Combination motor controller; motor starter and disconnect. Where equipment is under automatic control and is not provided with a disconnecting means in addition to a means of interface to the control system, provide combination motor starter and disconnect. Provide as specified above, and also include a disconnecting means. Shall be fused switch type (Class RK5), or motor circuit protector type rated for 22,000 RMS A.I.C. minimum unless noted otherwise and containing all accessories as listed above. If externally powered control circuits are used, provide an auxiliary switch on the disconnect switch or protector and fuse in lieu of the control transformer. Switch or protector shall be capable of being padlocked in the off position.

D. Manual Starters: Where equipment is under manual control, provide manual starter. Starter shall be toggle switch type, lockable in the "off" position, with overload relays, pilot light and enclosure per above.

E. Disconnects: Simple disconnects by Division 21.

F. Accepted Manufacturers: Allen Bradley or as accepted through prior approval.

2.03 EXPANSION SHELLS AND BOLTS

A. Expansion Shells for Rod Hangers
   1. Phillips, Gregory, Omark, or Fastite in holes drilled in concrete.

B. Expansion Bolts for Equipment
   1. USM or McCullough in holes drilled in concrete.
   2. No screwed adapters underground.

2.04 FORMED STEEL CHANNELS AT SLAB

A. Provide for all equipment; number and size per manufacturer's recommendations or as indicated.

2.05 ANCHOR BOLTS

A. Provide for all equipment; number and size per manufacturers' recommendations or as indicated.

2.06 SUPPLEMENTARY STEEL FRAMING

A. Standard structural steel shapes or Schedule 40 steel pipe, galvanized with extra-heavy finish.

2.07 SLEEVES

A. Materials, General Schedule: 40 galvanized steel pipe with unthreaded ends, or standard structural steel shapes.

B. Firestopping: Three-hour rated penetration sealing system per UL 1479 and ASTM E-814. 3M Fire Barrier, Dow Chemical RTV, Manville Cerafiber, or accepted.

C. Seal: Seal annulus with bolted compression type seal. Link Seal or accepted equal.

2.08 WELDING TO BUILDING STRUCTURAL MEMBERS

A. Not allowed except as indicated.

2.09 NAMEPLATES
A. Laminated black plastic with lettering cut through to white background. Plastic strips with raised letters made by a marking device are not acceptable.
2.10 VALVE TAGS
A. Shall be 0.030" thick brass, 1" diameter size; state the service and destination of the line controlled. Provide tag inscriptions made with a lettering device with 5/16" high cut lettering. Laminated plastic tags, construction similar to nameplates will also be acceptable.
B. Provide a valve tag list that assigns valve tag numbers to functions.
2.11 PIPING IDENTIFICATION
A. Self adhesive, pre-printed identification labels indicating direction of flow and pipe contents, using common industry abbreviations. Identify pipe at every change of direction.
B. Comply with the latest ANSI Pipe Marking Standards for letter height and label placement.
2.12 PAINTING
A. Paint all exposed fixtures and equipment in conformance with Division 10. Coordinate color with Architect. Refer to Architectural documents for paint and application requirements.
2.13 EQUIPMENT LISTING REQUIREMENTS
A. Whenever UL Standards exist for equipment provide UL-accepted equipment bearing the UL label.

PART 3 EXECUTION

3.01 INSPECTION
A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until any unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.
3.02 PREPARATION
A. Field Measurements: Field-verify locations of new and existing work prior to commencing work of this Section.
B. Protect surrounding areas and surfaces to preclude damage from work of this Section.
3.03 INSTALLATION, ERECTION, AND PERFORMANCE
A. Install, apply, erect, and perform the work in accordance with "Quality Assurance" provisions, specifications, and manufacturers' installation instructions and directions. Where these may be in conflict, the more-stringent requirements govern.
3.04 CLEANING
A. Promptly remove waste material and rubbish caused by fire protection construction work. At completion of the project, clean all equipment, piping and fixtures installed or provided under this Contract.
3.05 CUTTING AND PATCHING
A. Cut all openings and holes required for fire protection work. Carefully examine existing conditions prior to commencing work.
3.06 ACCESSIBILITY
A. Locate valves, controls, etc., to be easily accessible.
B. Install all equipment that requires periodic servicing or repairs to be readily accessible. Otherwise, obtain Architect's approval of location. Where valve and equipment is concealed behind access panels or by ceiling tiles, label panel or tile appropriately.
C. Provide access panels as required for piping, valve or equipment access. Refer to Architectural Documents to determine fire-rating requirements. The access panel size shall be in proportion to the equipment, piping, or valve requiring access. Minimum access panel size shall be 12" x 12". Due to the diagrammatic nature of the drawings, not all access panels are shown. Access panels are to be included as part of the base bid work.

3.07 SPECIAL PROTECTION

A. Exercise maximum precaution to provide positive protection for any existing building/structure and equipment from damage of any kind, and in particular prevent any water and dust seepage into the existing building.
B. Storage of materials: Make all necessary provisions to prevent damage or corrosion of materials. Coordinate on-site storage with General Contractor or make provisions to store off site.

3.08 EQUIPMENT INSTALLATION

A. General: Provide supports for all equipment and appurtenances as required, including braces as required for seismic restraint; these include frames or supports for pumps and air handlers and all fire protection equipment. Bracing shall conform with the requirements of IBC and IMC. Include the design, engineering and installation of these members is the responsibility of the contractor.
B. Suspended Equipment: Provide hangers from structure as required; span between structural members with additional structural steel as required to mount equipment in locations shown. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.
C. Floor-Mounted Equipment - General:
    1. Provide machine and floor or foundation fastenings; set equipment on concrete pads. Provide equipment base drawings, bolt-setting information, and anchors for all floor-mounted equipment. Provide concrete expansion anchors through concrete equipment pads, installed into existing structural concrete slabs.
    2. Install all equipment at the locations, and to the dimensions indicated. Set equipment accurately with principal centerlines and level, using manufacturers' leveling screws, blocks, shims, or wedges. Do not distort equipment or base plates.
    3. Install all equipment and piping such as to provide adequate access for service. This includes access to equipment covered in other divisions or sections of this specification.

3.09 PIPE SUPPORTS

A. Attach hangers and support rigidly to the building structure; provide supplementary steel framing and bracing at all changes in pipe direction to resist thrust of flowing water. Provide seismic bracing as required by codes. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.
B. Provide additional steel support for piping runs through tight confinements. Provide trapeze system with vibration isolation and seismic restraint for piping through joists and as applicable, due to accessibility equipment.

3.10 EXPANSION SHELLS AND BOLTS

A. Use only where necessary to support piping or equipment from existing concrete slabs or walls.

3.11 SLEEVES AND SEALING OF SLEEVES

A. Provide all sleeving and sealing of sleeves for pipes.
B. Provide annular clear space of approximately 1/4" to 1/2"; size to accommodate insulation passing through sleeve where applicable.
C. Wherever piping passes through any floor slab above occupied space or equipment, provide pipe sleeves extending 1" above floor.
D. Set sleeves in place prior to pouring of concrete in new construction; core drill and grout sleeves in place for unit masonry construction and existing construction.
E. Sealing of sleeves through floor slabs and firewalls: Provide firestop system by 3M or accepted equal.
F. Sealing of sleeves for below grade floors and walls: Provide Link Seal. Refer to 221000.

3.12 NAMEPLATES

A. Provide for all equipment; fasten mechanically. Label access panel or ceiling appropriately for concealed equipment.

3.13 VALVE TAGS

A. Provide on all new valves; fasten with brass chain to the valve stem.
B. Provide valve tag schedule (key) for identification of all system valves.

3.14 PIPING IDENTIFICATION

A. Provide pipe identification labels on not less than 10 foot centers, on both sides of a wall penetration, and at every change in direction, so that a label is visible from a standing position on the floor, not more than three feet from the wall.

3.15 PAINTING

A. General Paint exposed equipment, piping, and fire protection system appurtenances unless noted otherwise. Coordinate color with Architect. Refer also to Architectural Documents.
B. Application:
   1. Thoroughly clean surfaces to be painted to remove dirt, grease and scale. Wash galvanized surfaces with mild solution of acid prior to painting to effectively clean oils from surface and to etch zinc.
   2. Paint insulated surfaces and covered piping with one primer coat and two finish coats.
   3. Paint exposed equipment, pipes and supports with one primer coat and two finish coats. Paint factory painted equipment to match colors selected by the Architect. Touch up damaged areas with paint to match factory color.
   4. Paint the supporting devices for devices or systems specified to be painted.

3.16 MISCELLANEOUS EQUIPMENT AND FIXTURE CONNECTIONS

A. Provide piping and make all final connections in accordance with manufacturers' recommendations for Owner-furnished equipment and fixtures, and equipment and fixtures specified.
B. Perform on-site review and refer to manufacturers' shop drawings for details of connections. Provide rough-in at locations to conveniently serve items.

3.17 WIRING

A. Wiring shall conform to applicable sections of these specifications. Provide wiring from branch circuit over current device to motor controller to motor terminals, including installation of starter and all connections. Provide raceway and conductors as shown for remote control, or interlock connections. Coordinate other control wiring with Divisions 23 and 26 of the Specifications. Provide overload elements in controllers sized to match motor nameplate full load amperes. Space within controllers shall not be used as a junction box.
B. Provide resources for power for any fire suppression specific equipment, including but not limited to air-compressors, fire pumps, etc. Coordinate with Division 26.

END OF SECTION 21 05 00

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sleeves with waterstop.
   2. Stack-sleeve fittings.
   3. Grout.
   4. Silicone sealants.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 SLEEVES WITH WATERSTOP

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Advance Products & Systems, LLC.
   2. CALPICO, Inc.
   3. GPT; an EnPro Industries company.
   4. Metraflex Company (The).

B. Description: Manufactured stainless steel galvanized steel, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

2.02 STACK-SLEEVE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Jay R. Smith Mfg. Co; a division of Morris Group International.
   2. Wade; a subsidiary of McWane Inc.
   3. Zurn Industries, LLC.

B. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
   1. Underdeck Clamp: Clamping ring with setscrews.

2.03 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000 psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.04 SILICONE SEALANTS

A. Silicone, S, P, T, NT: Single-component, 100/50, pourable, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Pecora Corporation.
      b. Sika Corporation.
      c. The Dow Chemical Company.
      d. Tremco Incorporated.
   2. Standard: ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
   3. Verify sealant has a VOC content of 250 g/L or less.
   4. Verify sealant complies 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."

B. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Smooth-On or approved equal.
   2. Verify sealant has a VOC content of 250 g/L or less.
   3. Verify sealant complies 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."

PART 3 EXECUTION

3.01 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
   2. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.
D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.

2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078400 "Firestopping."

3.02 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.
B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
C. Secure nailing flanges to concrete forms.
D. Using grout or silicone sealant, seal space around outside of sleeves.

3.03 INSTALLATION OF STACK-SLEEVE FITTINGS

A. Install stack-sleeve fittings in new slabs as slabs are constructed.
1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 3 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using waterproof silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- or smoke-stop materials. Comply with requirements for firestopping specified in Section 078400 "Firestopping."

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bronze butterfly valves with indicators.
   2. Check valves.
   3. Bronze OS&Y gate valves.
   4. Indicator posts.
   5. Trim and drain valves.

1.2 DEFINITIONS

A. NRS: Nonrising stem.
B. OS&Y: Outside screw and yoke.
C. SBR: Styrene-butadiene rubber.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

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 valves open to minimize exposure of functional surfaces.
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. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
D. Protect flanges and specialties from moisture and dirt.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
   1. Fire Main Equipment: HAMV - Main Level.
      a. Indicator Posts, Gate Valve: HCBZ - Level 1.
      b. Ball Valves, System Control: HLUG - Level 3.
      c. Butterfly Valves: HLXS - Level 3.
      d. Check Valves: HMER - Level 3.
      e. Gate Valves: HMRZ - Level 3.
   2. Sprinkler System and Water Spray System Devices: VDGT - Main Level.
      a. Valves, Trim and Drain: VQGU
B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
   1. Automated Sprinkler Systems:
      a. Indicator posts.

b. Valves.
    1) Gate valves.
    2) Check valves
    3) Miscellaneous valves.

C. NFPA Compliance for valves:
    1. Comply with NFPA 13, NFPA 14, NFPA 20, and NFPA 24.
D. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher, as required by system pressures.
E. Valve Sizes: Same as upstream piping unless otherwise indicated.
F. Valve Actuator Types:
    1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
    2. Handwheel: For other than quarter-turn trim and drain valves.
    3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.2 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. ALEUM USA.
    2. Globe Fire Sprinkler Corporation.
    3. Milwaukee Valve Company.
B. Description:
    1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
    2. Minimum: Pressure rating: 175 psig.
    3. Body Material: Bronze.
    4. Seat Material: EPDM.
    5. Stem Material: Bronze or stainless steel.
    6. Disc: Bronze .
    7. Actuator: Worm gear.
    8. Supervisory Switch: Internal or external.
    9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
    10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

2.3 CHECK VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
    2. FEBCO; A WATTS Brand.
    3. NIBCO INC.
    4. Reliable Automatic Sprinkler Co., Inc. (The).
    5. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
B. Description:
    1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
    2. Minimum Pressure Rating: 175 psig.
    3. Type: Single swing check.
    4. Body Material: Cast iron, ductile iron, or bronze.

5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.4 BRONZE OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. NIBCO INC.
B. Description:
   1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
   2. Minimum Pressure Rating: 175 psig.
   3. Body and Bonnet Material: Bronze or brass.
   4. Wedge: One-piece bronze or brass.
   5. Wedge Seat: Bronze.
   6. Stem: Bronze or brass.
   7. Packing: Non-asbestos PTFE.
   8. Supervisory Switch: External.
   9. End Connections: Threaded.

2.5 INDICATOR POSTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Cast Iron Pipe Company.
   2. Mueller Co.
   3. NIBCO INC.
B. Description:
   1. Standard: UL 789 and FM Global standard for indicator posts.
   2. Type: Upright.
   3. Base Barrel Material: Cast or ductile iron .
   4. Extension Barrel: Cast or ductile iron.
   5. Cap: Cast or ductile iron.
   6. Operation: Handwheel.

2.6 TRIM AND DRAIN VALVES

A. Ball Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. NIBCO INC.
      c. Potter Roemer LLC; a Division of Morris Group International.
      d. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
   2. Description:
      a. Pressure Rating: 250 psig .
      b. Body Design: Two piece.
      c. Body Material: Forged brass or bronze.

d. Port size: Full or standard.
e. Seats: PTFE.
f. Stem: Bronze or stainless steel.
g. Ball: Chrome-plated brass.
h. Actuator: Handlever.
i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Globe Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. NIBCO INC.
b. United Brass Works, Inc.
2. Description:
a. Pressure Rating: 250 psig .
b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
C. Examine threads on valve and mating pipe for form and cleanliness.
D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION, GENERAL

A. Comply with requirements in the following Sections for specific valve-installation requirements and applications:
1. Section 211200 "Fire-Suppression Standpipes" for application of valves in fire-suppression standpipes.
2. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
3. Section 211316 "Dry-Pipe Sprinkler Systems" for application of valves in dry-pipe, fire-suppression sprinkler systems.
4. Section 211339 "Foam-Water Systems" for application of valves in AFFF piping.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply, except from fire-department connections. Install permanent identification signs, indicating portion of system controlled by each valve.
C. Install double-check valve assembly in each fire-protection water-supply connection.
D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
E. Install valves in horizontal piping with stem at or above the pipe center.
F. Install valves in position to allow full stem movement.
G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

END OF SECTION

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. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal hanger-shield inserts.
   5. Fastener systems.
   6. Equipment supports.

B. Related Requirements:
   1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
   2. Section 210516 "Expansion Fittings and Loops for Fire-Suppression Piping" for pipe guides and anchors.
   3. Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for vibration isolation devices and seismic restraints.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze pipe hangers.
   2. Metal framing systems.
   3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers 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. Detail fabrication and assembly of trapeze hangers.
   2. Include design calculations for designing trapeze hangers.

1.4 QUALITY ASSURANCE

A. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 13 .

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
   2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel .

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ABB, Electrification Business.
      b. Haydon Corporation.
      c. Unistrut; Atkore International.
   2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
   3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
   4. Channels: Continuous slotted carbon-steel channel with inturned lips.
   5. Channel Width: Selected for applicable load criteria.
   6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel .
   8. Paint Coating: Green epoxy, acrylic, or urethane .

2.5 THERMAL HANGER-SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CADDY; brand of nVent Electrical plc.
   2. National Pipe Hanger Corporation.
   3. Pipe Shields Inc.
B. Insulation-Insert Material: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi minimum compressive strength.
C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hilti, Inc.
      b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
      c. MKT Fastening, LLC.

B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cooper B-line; brand of Eaton, Electrical Sector.
      b. Empire Tool and Manufacturing Co., Inc.
      c. Hilti, Inc.
      d. MKT Fastening, LLC.
   2. Indoor Applications: Zinc-coated or Stainless steel.
   3. Outdoor Applications: Stainless steel.
   4. Natatorium/Pool: No stainless steel allowed in natatorium or pool mechanical spaces.

2.7 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.8 MATERIALS

A. Aluminum: ASTM B221.
B. Carbon Steel: ASTM A1011/A1011M.
C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.
D. Stainless Steel: ASTM A240/A240M.
E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout, suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
B. 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 shall be weight of supported components plus 200 lb .

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.

D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick 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. Install in accordance with approvals and listings.
   2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. 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.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. MSS SP-58, Type 39 Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. MSS SP-58, Type 40 Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 INSTALLATION OF EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
C. Field Welding: Comply with AWS D1.1/D1.1M 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 so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches .

3.6 PAINTING

A. Touchup:
   1. Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those 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 a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
F. Use corrosion-resistant attachments for hostile environment applications.
G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
H. Use thermal hanger-shield inserts for insulated piping and tubing.
I. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
    2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
    3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
    4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
    5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
    6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
    7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
    8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
    9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
    2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
K. Hanger-Rod Attachments: Comply with NFPA requirements.
L. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
    1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
    2. C-Clamps (MSS Type 23): For structural shapes.
    3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
M. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

N. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Elastomeric isolation pads.
   2. Elastomeric isolation mounts.
   3. Restrained elastomeric isolation mounts.
   4. Elastomeric hangers.
   5. Snubbers.
   6. Restraints - rigid type.
   7. Restraints - cable type.
   8. Restraint accessories.

B. Related Requirements:
   1. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.
   2. Section 230548 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.02 DEFINITIONS

A. Designated Seismic System: A fire-suppression component that requires design in accordance with ASCE/SEI 7, Ch. 13 and for which the Component Importance Factor is greater than 1.0.

B. IBC: International Building Code.

C. OSHPD: Office of Statewide Health Planning and Development (for the State of Washington).

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   2. Include load rating for each wind-load-restraint fitting and assembly.
   3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component.
   4. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by UL product listing.
   5. Annotate to indicate application of each product submitted and compliance with requirements.
   6. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:
   1. Detail fabrication and assembly of equipment bases.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated Design Submittal:

1. For each seismic-restraint device, including seismic-restrained mounting, pipe-riser resilient support, snubber, seismic restraint, seismic-restraint accessory, and concrete anchor and insert that is required by this Section or is indicated on Drawings, submit the following:
    a. Seismic-Restraint Selection: Select seismic restraints complying with performance requirements, design criteria, and analysis data.
    b. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and seismic loads. Include certification by professional engineer that riser system was examined for excessive stress and that none exists.
    c. Post-Installed Concrete Anchors and Inserts: Include calculations showing anticipated seismic loads. Include certification that device is approved by an NRTL for seismic reinforcement use.
    d. Seismic Design Calculations: Submit all input data and loading calculations prepared under "Seismic Design Calculations" Paragraph in "Performance Requirements" Article.
    e. Wind-Load Design Calculations: Submit all static and dynamic loading calculations prepared under "Wind-Load Design Calculations" in "Performance Requirements" Article.
    f. Qualified Professional Engineer: All designated-design submittals for seismic calculations are to be signed and sealed by qualified professional engineer responsible for their preparation.
2. Seismic-Restraint Detail Drawing:
    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Coordinate seismic restraint details with wind-load restraint details required for equipment mounted outdoors. Comply also with requirements in other Sections for equipment mounted outdoors.
3. Product Listing, Preapproval, and Evaluation Documentation: By UL , showing maximum ratings of restraint items and the basis for approval (tests or calculations).
4. All delegated design submittals for seismic-restraint detail Drawings are to be signed and sealed by qualified professional engineer responsible for their preparation.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.

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: UL product listing .

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic control system.
   1. Seismic Performance: Equipment must be designed and secured to withstand the effects of earthquake motions determined in accordance with NFPA 13 and ASCE/SEI 7-16.
   2. Wind-Load Performance: Equipment must be designed and secured to withstand the effects of high wind events determined in accordance with ASCE/SEI 7-16.

B. Seismic Design Calculations:
   1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in NFPA 13. Where "ASCE/SEI 7" is used throughout this Section, it is to be understood that the edition referred to in this subparagraph is the edition intended as reference throughout the Section Text.
      a. Data indicated below to be determined by Delegated Design Contractor must be obtained by Contractor and must be included in individual component submittal packages.
      b. Coordinate seismic design calculations with wind-load calculations for equipment mounted outdoors. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.
   2. Calculation Factors, ASCE/SEI 7-16, Ch. 13 - Seismic Design Requirements for Nonstructural Components: All section, paragraph, equation, and table numbers refer to ASCE/SEI 7-16 unless otherwise noted.
      a. Horizontal Seismic Design Force F(p): Value is to be calculated by Delegated Design Contractor using Equation 13.3-1.
      b. Vertical Seismic Design Force: Calculated by Delegated Design Contractor using method explained in ASCE/SEI 7-16, Paragraph 13.3.1.2.
      c. Seismic Relative Displacement D(pl): Calculated by Delegated Design Contractor using methods explained in ASCE/SEI 7-16, Paragraph 13.3.2.
      d. Component Fundamental Period T(p): Calculated by Delegated Design Contractor using methods explained in ASCE/SEI 7-16, Paragraph 13.3.3

C. Consequential Damage: Provide additional seismic and wind-load restraints for suspended fire-suppression system components or anchorage of floor-, roof-, or wall-mounted fire-suppression system components as indicated in ASCE/SEI 7-16 so that failure of a non-essential or essential fire-suppression system component will not cause the failure of any other essential architectural, mechanical, or electrical building component.

D. Component Supports:
   1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
   2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7-16 Section 13.6.

2.02 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CADDY; brand of nVent Electrical plc.
   b. Kinetics Noise Control, Inc.
   c. Mason Industries, Inc.
2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
5. Surface Pattern: Smooth, ribbed, or waffle pattern.
6. Load-bearing metal plates adhered to pads.
7. Sandwich-Core Material: Elastomeric .
   a. Surface Pattern: Smooth, ribbed, or waffle pattern.
   b. Infused nonwoven cotton or synthetic fibers.

2.03 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CADDY; brand of nVent Electrical plc.
      b. Kinetics Noise Control, Inc.
      c. Mason Industries, Inc.
   2. Mounting Plates:
      a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
      b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
   3. Elastomeric Material: Molded, oil- and water-resistant neoprene rubber, silicone rubber, or other elastomeric material.

2.04 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CADDY; brand of nVent Electrical plc.
      b. Kinetics Noise Control, Inc.
      c. Mason Industries, Inc.
   2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
      a. Housing: Cast-ductile iron or welded steel.
      b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.05 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CADDY; brand of nVent Electrical plc.
      b. Kinetics Noise Control, Inc.
      c. Mason Industries, Inc.
   2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
   3. Damping Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel-to-steel contact.

2.06 SNUBBERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CADDY; brand of nVent Electrical plc.
   2. Kinetics Noise Control, Inc.
   3. VMC GROUP.

B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
   1. Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be seismically prequalified in accordance with ACI 355.2 testing and designated in accordance with ACI 318-14 Ch. 17.
   2. Preset Concrete Inserts: Seismically prequalified in accordance with ICC-ES AC446 testing.
   3. Anchors in Masonry: Design in accordance with TMS 402.
   4. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
   5. Resilient Cushion: Maximum 1/4-inch air gap, and minimum 1/4 inch thick.

2.07 RESTRAINTS - RIGID TYPE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CADDY; brand of nVent Electrical plc.
   2. Hilti, Inc.
   3. VMC GROUP.

B. Description: Shop- or field-fabricated bracing assembly made of AISI S110-07-S1 slotted steel channels, ANSI/ASTM A53/A53M steel pipe as per NFPA 13, 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.

2.08 RESTRAINTS - CABLE TYPE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CADDY; brand of nVent Electrical plc.
   2. Gripple Inc.
   3. VMC GROUP.
B. Seismic-Restraint Cables: ASTM A492 stainless 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.
C. Restraint cable assembly with cable fittings must comply with ASCE/SEI 19. All 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.

2.09 RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CADDY; brand of nVent Electrical plc.
   2. Hilti, Inc.
   3. Mason Industries, Inc.
B. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod. Non-metallic stiffeners are unacceptable.
C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid restraints and restraint cables.
D. 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.
E. 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.
F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
B. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry calculated static and seismic loads within specified loading limits.

3.03 INSTALLATION OF VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICES

A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Fire-Suppression Vibration Isolation, Seismic, and Wind-Load-Restraint Schedule, where indicated on Drawings, or where the Specifications indicate they are to be installed on specific equipment and systems.
B. Provide seismic-restraint devices for systems and equipment where indicated in Equipment Schedules or Vibration Isolation, Seismic, and Wind-Load-Restraint Schedules, where indicated on Drawings, where the Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
C. 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."
D. Installation of vibration isolators and seismic restraints must not cause any stresses, misalignment, or change of position of equipment or piping.
E. Comply with installation requirements of NFPA 13 for installation of all seismic-restraint devices.
F. Comply with requirements in Section 077200 "Roof Accessories" for installation of equipment supports and roof penetrations.
G. Equipment Restraints:
    1. Install snubbers on fire-suppression equipment mounted on vibration isolators. 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 where clearance between anchor and adjacent surface exceeds 0.125 inch.
    3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
H. Piping Restraints:
    1. Comply with all requirements in NFPA 13.
    2. Design piping sway bracing in accordance with NFPA 13.
        a. Maximum spacing of all sway bracing to be no greater than indicated in NFPA 13.
        b. Design loading of all sway bracing not to exceed values indicated in NFPA 13.
I. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
J. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

K. 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.
L. 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.
M. 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 the 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 to be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
    4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
    5. Set anchors to manufacturer's recommended torque, using a torque wrench.
    6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross structural seismic joints and other points where differential movement may occur, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 211200 "Fire-Suppression Standpipes, and " Section 211313 "Wet-Pipe Sprinkler Systems," for piping flexible connections.

3.05 ADJUSTING

A. Adjust isolators after system is at operating weight.
B. 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.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Warning tape.
   4. Pipe labels.
   5. Valve tags.
   6. Warning tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

C. Valve-numbering scheme.

D. Valve Schedules: Provide for fire-suppression piping system. Include in operation and maintenance manuals.

PART 2 PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Champion America.
      c. Craftmark Pipe Markers.
      d. Seton Identification Products; a Brady Corporation company.
   2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
   3. Letter and Background Color: As indicated for specific application under Part 3.
   4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   7. Fasteners: Stainless steel rivets or self-tapping screws.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Champion America.
   3. Craftmark Pipe Markers.

4. Marking Services Inc.
5. Seton Identification Products; a Brady Corporation company.
6. Stranco, Inc.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
C. Letter and Background Color: As indicated for specific application under Part 3.
D. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
G. Fasteners: Stainless steel rivets or self-tapping screws.
H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
I. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA 70E , and other applicable codes and standards.
J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 WARNING TAPE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Craftmark Pipe Markers.
   3. Seton Identification Products; a Brady Corporation company.
B. Material: Vinyl.
C. Minimum Thickness: 0.005 inch.
D. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.
E. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.
F. Maximum Temperature: 160 deg F.
G. Minimum Width: 4 inches.

2.4 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Champion America.
   3. Craftmark Pipe Markers.
   4. Marking Services Inc.
   5. Seton Identification Products; a Brady Corporation company.
B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.
C. Letter and Background Color: As indicated for specific application under Part 3.
D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to circumference of pipe and to attach to pipe without fasteners or adhesive.
E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
F. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include the following:

1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: Size letters in accordance with ASME A13.1 for piping .

2.5 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Champion America.
   3. Craftmark Pipe Markers.
   4. Marking Services Inc.
   5. Seton Identification Products; a Brady Corporation company.
B. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.04 inch thick, with predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass beaded chain .
C. Letter and Background Color: As indicated for specific application under Part 3.
D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Include valve-tag schedule in operation and maintenance data.

2.6 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brady Corporation.
   2. Champion America.
   3. Craftmark Pipe Markers.
   4. Marking Services Inc.
   5. Seton Identification Products; a Brady Corporation company.
B. Description: Preprinted accident-prevention tags, of plasticized card stock.
   1. Size: 3 by 5-1/4 inches minimum .
   2. Fasteners: Brass grommet and wire .
   3. Nomenclature: Large-size primary caption, such as "DANGER," "CAUTION," or "DO NOT OPERATE."
   4. Letter and Background Color: As indicated for specific application under Part 3.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
B. Coordinate installation of identifying devices with locations of access panels and doors.
C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of fire-suppression equipment.
B. Sign and Label Colors:
   1. White letters on an ANSI Z535.1 safety-red background .
C. Locate equipment labels where accessible and visible.
D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E , and other applicable codes and standards.

3.4 INSTALLATION OF WARNING TAPE

A. Warning Tape Color and Pattern: Yellow background with black diagonal stripes .
B. Install warning tape on pipes and ducts, with cross-designated walkways providing less than 6 ft. of clearance.
C. Locate tape so as to be readily visible from the point of normal approach.

3.5 INSTALLATION OF PIPE LABELS

A. Piping Color Coding: Painting of piping is specified in [Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."]
B. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
C. Stenciled Pipe-Label Option: Stenciled labels showing service and flow direction may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.
   1. Identification Paint: Use for contrasting background.
   2. Stencil Paint: Use for pipe marking.
D. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Within 3 ft. of each valve and control device.
   2. At access doors, manholes, and similar access points that permit a view of concealed piping.
   3. Within 3 ft. of equipment items and other points of origination and termination.
   4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.
E. Flow- Direction Arrows: Provide arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
F. Fire-Suppression Pipe Label Color Schedule:
   1. Fire-Suppression Pipe Labels: White letters on an ANSI Z535.1 safety-red background .

3.6 INSTALLATION OF VALVE TAGS

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule in the operating and maintenance manual. Include the identification "FSV" on all fire-suppression system valve tags.
B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below.
   1. Valve-Tag Size and Shape:
      a. Fire-Suppression Standpipe: 1-1/2 inches , round .
      b. Wet-Pipe Sprinkler System: 1-1/2 inches , round .
   2. Valve-Tag Color: White letters on an ANSI Z535.1 safety-red background .

3.7 INSTALLATION OF WARNING TAGS

A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background .
B. Attach warning tags, with proper message, to equipment and other items where required by the AHJ.

END OF SECTION 210553

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Steel pipe and fittings.
2. Specialty valves.
3. Air vent.
4. Sprinkler piping specialties.
5. Sprinklers.
6. Alarm devices.
7. Pressure gauges.

B. Related Requirements:
1. Section 331100 "Water Utilities" for application of valves in fire-suppression water-service piping.

1.02 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig .

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.
1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler system plans and sections, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.

B. Field Test Reports:
1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by NICET Level III-certified technician, "Water-Based Systems Layout."

PART 2 PRODUCTS

2.01 PERFORMANCE 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. Sprinkler system equipment, specialties, accessories, installation, and testing to comply with NFPA 13.

C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

D. High-Pressure Piping System Component: Listed for 300-psig working pressure.

E. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Available fire-hydrant flow test records indicate the following conditions:
    a. No available data.
2. Margin of Safety for Available Water Flow and Pressure: 20 percent, including losses through water-service piping, valves, and backflow preventers.
3. Sprinkler Occupancy Hazard Classifications:
4. Minimum Density for Automatic-Sprinkler Piping Design:
    a. Residential (Dwelling) Occupancy: 0.05 gpm/sq. ft. over 400 sq. ft. area.
    b. Light-Hazard Occupancy: 0.10 gpm/sq. ft. over 1500 sq. ft. area.
    c. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/sq. ft. over 1500 sq. ft. area.
    d. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm/sq. ft. over 1500 sq. ft. area.
    e. Extra-Hazard, Group 1 Occupancy: 0.30 gpm/sq. ft. over 2500 sq. ft. area.
    f. Extra-Hazard, Group 2 Occupancy: 0.40 gpm/sq. ft. over 2500 sq. ft. area.
    g. Special Occupancy Hazard: As determined by authorities having jurisdiction.
5. Maximum protection area per sprinkler according to UL listing.
6. Maximum Protection Area per Sprinkler:
    a. Residential Areas: 400 sq. ft. .
    b. Office Spaces: 120 sq. ft. .
    c. Storage Areas: 130 sq. ft. .
    d. Mechanical Equipment Rooms: 130 sq. ft. .
    e. Electrical Equipment Rooms: 130 sq. ft. .
    f. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

F. Obtain documented approval of sprinkler system design from authorities having jurisdiction.

2.02 STEEL PIPE AND FITTINGS

A. Standard-Weight Steel Pipe: Galvanized- and black-steel pipe, ASTM A53/A53M, Grade B . Pipe ends may be factory or field formed to match joining method.

B. Schedule 30 Steel Pipe: Galvanized- and black-steel pipe, ASTM A135/A135M; ASTM A795/A795M, ; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Thinwall Steel Pipe: Galvanized- and black-steel pipe, ASTM A135/A135M or ASTM A795/A795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

E. Nonstandard OD, Thinwall Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M thinwall with plain ends and wall thickness less than Schedule 10.

F. Hybrid Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5.
G. Schedule 5 Steel Pipe: ASTM A135/A135M or ASTM A795/A795M lightwall with plain ends.
H. Steel Pipe Nipples: Galvanized and black steel, ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.
I. Steel Couplings: Galvanized and uncoated steel, ASTM A865/A865M, threaded.
J. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
    1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.
        a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
        b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
    2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
K. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.
    1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
L. Grooved-Joint, Steel-Pipe Appurtenances:
    1. Manufacturers: Subject to compliance with requirements, provide products by the following:
        a. CPS Products, Inc.
        b. Tyco Fire Products
        c. Or approved equal.
    2. Pressure Rating: 250-psig minimum.
    3. Grooved-End Fittings for Steel Piping: Galvanized grooved-end fittings, ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
    4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.03 COVER SYSTEM FOR SPRINKLER PIPING

A. Manufacturers: Subject to compliance with requirements, undefined:
    1. DecoShield Systems, Inc, or approved equal.
B. Description: System of support brackets and covers made to protect sprinkler piping.
C. Brackets: Glass-reinforced nylon.
D. Covers: Extruded-PVC sections of length, shape, and size required for size and routing of CPVC piping.

2.04 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
B. Pressure Rating:
    1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
    2. High-Pressure Piping Specialty Valves: 300-psig.
C. Body Material: Cast or ductile iron.
D. Size: Same as connected piping.
E. End Connections: Flanged or grooved.
F. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Globe Fire Sprinkler Corporation.
   b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
   c. Viking Group Inc.
2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, and fill-line attachment with strainer.
5. Drip cup assembly pipe drain with check valve to main drain piping.
6. 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.

G. Automatic (Ball Drip) Drain Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America, or approved equal.
2. Standard: UL 1726.
3. Pressure Rating: 175-psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.05 AIR VENT

A. Automatic Air Vent:
1. Manufacturers: Subject to compliance with requirements, undefined:
   a. CLA-VAL.
   b. Metraflex Company (The), or approved equal.
2. Description: Automatic air vent that automatically vents trapped air without human intervention.
3. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler systems.
4. Vents oxygen continuously from system.
5. Float valve to prevent water discharge.
6. Minimum Water Working Pressure Rating: 175 psig.

2.06 SPRINKLER PIPING SPECIALTIES

A. Flow Detection and Test Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. AGF Manufacturing, Inc.
   b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America, or approved equal.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 300 psig.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

B. Sprinkler Inspector's Test Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AGF Manufacturing, Inc.
      b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
      c. Viking Group Inc.
   2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
   3. Pressure Rating: 300 psig.
   4. Body Material: Cast- or ductile-iron housing with sight glass.
   5. Size: Same as connected piping.
   6. Inlet and Outlet: Threaded.

2.07 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Globe Fire Sprinkler Corporation.
   2. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
   3. Viking Group Inc.
B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
C. Pressure Rating for Residential Sprinklers: 175-psig maximum.
D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
E. Pressure Rating for High-Pressure Automatic Sprinklers: 300 psig.
F. Automatic Sprinklers with Heat-Responsive Element:
   1. Early-Suppression, Fast-Response Applications: UL 1767 .
   2. Nonresidential Applications: UL 199 .
   3. Residential Applications: UL 1626 .
   4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
G. Sprinkler Finishes: Chrome plated .
H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
   1. Ceiling Mounting: Chrome-plated steel, one piece, flat .
   2. Sidewall Mounting: Chrome-plated steel Plastic, white finish, one piece, flat.
I. Sprinkler Guards:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
      b. Victaulic Company.
      c. Viking Group Inc.
   2. Standard: UL 199.
   3. Type: Wire cage with fastening device for attaching to sprinkler.

2.08 ALARM DEVICES

A. Alarm-device types to match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Globe Fire Sprinkler Corporation.
   b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
   c. Viking Group Inc.
2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 8-1/2-inches diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4.
8. Outlet: NPS 1 drain connection.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ITT McDonnell & Miller.
   b. Viking Group Inc, or approved equal.
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Barksdale, Inc.
   b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
   c. Viking Group Inc.
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

E. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Fire-Lite Alarms; Honeywell International, Inc, or approved equal.
2. Standard: UL 346.
3. Type: Electrically supervised.

4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. 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.

2.09 PRESSURE GAUGES

A. Manufacturers: Subject to compliance with requirements, undefined:
   1. AMETEK, Inc, or approved equal.
B. Standard: UL 393.
C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
D. Pressure Gauge Range: 0- to 250-psig minimum.
E. Label: Include "WATER" label on dial face.

PART 3 EXECUTION

3.01 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
B. Report test results promptly and in writing.

3.02 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 331100 "Water Utilities" for exterior piping.
B. Install shutoff valve, check valve, pressure gauge, and drain at connection to water service.

3.03 INSTALLATION OF PIPING

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
   1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
   2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
H. Install sprinkler piping with drains for complete system drainage.
I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.
L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
M. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.
N. Fill sprinkler system piping with water.
O. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing.
P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.04 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    1. Apply appropriate tape or thread compound to external pipe threads.
    2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
I. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
    1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
M. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
N. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
O. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.
P. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
Q. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
R. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
    1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
    2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.

3.05 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 or NFPA 13R for supports.

3.06 INSTALLATION OF VALVES AND SPECIALTIES

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
D. Specialty Valves:
    1. Install valves in vertical position for proper direction of flow, in main supply to system.
    2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
    3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gauges, priming chamber attachment, and fill-line attachment.
E. Air Vent:
    1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping.
    2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.

3. Pipe from outlet of air vent to drain.

3.07 INSTALLATION OF SPRINKLERS

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.
B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.08 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.09 PAINTING

A. Paint all pipe as noted in the drawings or specification.
B. Refer to architectural plans for paint colors. If no colors are noted then follow guidance of applicable NFPA code.
C. Where exposed to corrosive materials or environments all pipe shall be coated in a corrosion resistant paint, primer, or a top coat.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.11 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
C. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2 and Smaller, to be one of the following:
    1. Black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
    2. or standard-weight black-steel pipe with grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
    3. or black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
    4. or black-steel pipe with plain ends; welding fittings; and welded joints.
D. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2-1/2 to NPS 4, to be one of the following:
    1. Black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
    2. or Standard-weight black-steel pipe with grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
    3. or black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
    4. or black-steel pipe with plain ends; welding fittings; and welded joints.
E. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 5 and Larger, to be one of the following:

1. Black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

1. or standard-weight black-steel pipe with grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
2. or black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. or black-steel pipe with plain ends; welding fittings; and welded joints.

3.12 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
   1. Rooms without Ceilings: Upright sprinklers.
   2. Rooms with Suspended Ceilings: Pendent sprinklers Recessed sprinklers Flush sprinklers Concealed sprinklers Pendent, recessed, flush, and concealed sprinklers as indicated.
   3. Wall Mounting: Sidewall sprinklers.
   4. Spaces Subject to Freezing: Upright sprinklers Pendent, dry sprinklers Sidewall, dry prinklers Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
   5. Special Applications: .

B. Provide sprinkler types in subparagraphs below with finishes indicated.
   1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
   2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
   3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
   4. Residential Sprinklers: Dull chrome.
   5. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

DIVISION 22

Plumbing

PART 1 GENERAL

1.1 WORK INCLUDED

A. Work includes the following: Provide all materials, equipment, labor, supervision, tools and items necessary for the construction, installation, connection, testing and operation of all mechanical work for this project.

B. Work includes the following:
   1. Motors
   2. Motor Control equipment
   3. Supports and support accessories
   4. Anchoring Hardware
   5. Identification
   6. Balancing work

1.2 DEFINITIONS AND ABBREVIATIONS

A. The word "provide", as used in these specifications, means "furnish and install".

B. The word "accepted", as used in these specifications, means the acceptance of the Engineer.

C. Definitions and abbreviations of all terms shall be in accordance with applicable definitions of:

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating & Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CISPI	Cast Iron Soil Pipe Institute
FM	Factory Mutual Engineering Corporation
HI	Hydraulic Institute
MSS	Manufacturers' Standardization Society of the Valve and Fittings Industry, Inc.
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
SMACNA	Sheet Metal and Air-Conditioning Contractors' National Association
UL	Underwriters' Laboratories, Inc.
IBC	Washington State Building Code
UPC	Uniform Plumbing Code
IMC	Washington State Mechanical Code
WAC	Washington Administrative Code
WSEC	Washington State Energy Code
WISHA	Washington Industrial Safety & Health Act
WSPSC	Washington Swimming Pool and Spa Code

D. Refer also to Division 1 for additional acronyms and for additional definitions and explanations of terms.

E. Some of these abbreviations may not be used. All other abbreviations shall have the definition commonly associated with them by the trade or industry. Confirm the meaning of any unclear or unknown definitions with the Architect before proceeding with any work.

1.3 PLANS AND SPECIFICATIONS

A. The drawings and specifications are intended to cover all mechanical work, unless otherwise shown. Provide all materials that are necessary for the proper completion of the installation or operation of the equipment.

B. The drawings are diagrammatic and do not show exact or complete piping configurations or the necessary number and types of fittings. Provide all labor and materials required to complete the work indicated.

C. Any questions occurring during bidding or construction shall be resolved by direction in writing from the Architect. Any issues not so resolved or any conflicts shall result with the contractor bidding, furnishing and installing the most stringent condition. No exceptions.

1.4 LAW AND ORDINANCES

A. General:
   1. All mechanical work specified under this contract shall be in strict accordance with the latest rules and regulations of all applicable codes.
   2. Contractor is not relieved from furnishing and installing work shown or specified which may be beyond requirements of ordinances, laws, regulations, and codes. This work shall be included within the construction contract.

B. Approval: File necessary plans, prepare documents and obtain necessary approval of governmental departments having jurisdiction and required certificates of inspection for work and deliver same to Architect before requesting acceptance and final payment for work.

C. Permits, Certificates and Taxes: Procure and pay for all the necessary permits, certificates, and taxes for all work as required in the General and Supplementary Conditions. In addition, perform all ordinance and performance tests in the presence of the Architect, and be responsible for advance notification. Submit copies of signed and accepted permits to the Architect.

1.5 MATERIAL REVIEW, SUBMITTALS AND SHOP DRAWINGS:

A. General:
   1. Provide submittals for all equipment and systems indicated and specified by the Contract Documents.

B. Prepare and distribute submittals:
   1. Identify each transmittal using the 6-digit specification section number and section title.
   2. Pay for all costs associated with materials, reproduction, and distribution.

C. Submittals shall be complete, containing the information describing the equipment and systems of all trades. All submittals and submittal information shall be submitted at the same time, organized as described below.

D. The project construction schedule, beginning with the acceptance of the bid and confirmation of the successful bidder, is not the responsibility of the Architect / Engineer. The contractor's schedule shall recognize and accommodate the review intervals specified herein. The schedule shall identify and accommodate the specified submittal and re-submittal review and response period. The contractor shall not anticipate or base the construction schedule on expedited reviews or reviews of partial submittals. Submittals shall be organized and delivered as specified. No exceptions.

E. Review all items prior to submission. Submittals shall bear the General Contractors stamp, certifying that the contractor has:

1. Verified all field dimensions and quantities.
2. Verified all field construction criteria, materials, catalog numbers and similar data.
3. Reviewed and coordinated submittal data with requirements of the work and the Contract Documents.

F. Indicate any item, component, material or portion of work which deviates from Contract Documents and completely describe and illustrate nature and extent of deviation. Unless such departures are accepted as indicated in paragraph "Engineer Review", such departures shall not be permitted.

G. Make submittals sufficiently in advance of required acceptance date to allow Architect / Engineer 10 working days for each review and resubmission if necessary.
1. Items submitted without Contractor's review stamp will be returned without action, for resubmission.
2. Items not submitted in accordance with provisions of this section will be returned, without action, for re-submittal.
3. Submission of items not accepted as specified by the project manual or addenda will be rejected.

H. Do not place orders for materials, fixtures, or equipment until acceptance is obtained from Architect/Engineer in writing. Oral acceptance will not be considered.

1.6 SUBMITTALS AND SHOP DRAWINGS

A. Submit:
1. Provide five copies of the submittals in 3-ring notebook(s), organized by specification section, large enough to accept total volume of material. Reference project information shall include:
a. Project title,
b. Project number and Location,
c. Architect,
d. Engineer,
e. Contractor,
f. Subcontractor(s),
g. Submission date,
h. Specification sections submitted.
2. Label cover and binder end. Clearly indicate any items not included with submitted assemblies. Architect / Engineer will not take responsibility for collating submitted information into notebooks. Submittals not bound and organized as specified will be rejected.
3. The contractor shall make every attempt to respond to the Architect and Engineer comments in a timely manner. Submittal material requiring more than three Engineering reviews will be considered non-responsive. The Architect / Engineer may elect to charge the contractor on an hourly basis for additional consultation as required to secure a responsive submittal.

B. Standards Compliance and Certification:
1. Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI), American Society for Mechanical Engineers (ASME), Underwriters Laboratories Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA) that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and accepted.

2. Submit certification for the product submitted and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply the product does not meet all requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; "equal or exceed the service and performance of the specified material." Simply state that the product conforms to the requirements specified.

C. Substitution of Materials:
1. Substitutions of materials will only be considered where specified materials can not be obtained. All work and equipment required incidental to the substitution is the responsibility of the Contractor. Substitutions are only permitted if approved in writing by the Owner. Verbal approvals shall not be binding.
2. Refer also to Division 1.

D. Shop Drawings:
1. Submit in mailing tube if drawing cannot be shipped flat. Do not fold.
2. Submit drawings 8-1/2" x 11", 11" x 17" or 24" x 36" unless size of the items depicted makes such sizes impractical. Scale of drawings shall match that of the construction documents.
3. Prepare shop drawings on a background furnished by the Architect.
4. Prior to any installation or fabrication of the system components, the contractor shall submit five complete sets of shop drawings to the Architect for approval by the Architect, Engineer and the Owner.
5. Contractor shall schedule submittal to Architect and include sufficient resources with bid to accommodate an additional revision and re-submittal.
6. Incomplete shop drawings will be rejected unless prior approval is requested and given from the Architect and Owner for partial submittals.
7. Review of the shop drawings by the Architect, Owner, or AHJ does not relieve the contractor from coordinating the installation of the work with all other trades, nor from compliance with all applicable codes and standards.

E. Engineer Review:
1. Review is general and does not:
   a. Permit departure from Contract Documents.
   b. Relieve Contractor from responsibility for error in detail, quantities, dimensions or related items.
   c. Accepted departure from previous instructions or detail.
   d. Relieve Contractor of responsibility to provide all components, wiring, etc., required to make item operational or usable.
   e. Imply acceptance of items for which no data is submitted.
   f. Work which requires submittals shall not be started without Architect's / Engineer 's review.
   g. Allow ten working days for engineering review.
   h. Acceptance will be indicated by a signed stamp affixed to the submittal, or a letter over the Architect's / Engineer's signature. No exceptions.

F. Re-submittals:
1. Items of materials, fixtures and equipment not accepted by Architect shall be resubmitted within 30 days after engineering review. If Contractor fails to submit items listed below for approval or resubmit in the event of disapproval within specified time, Contractor shall provide materials, fixtures and equipment as scheduled on drawings. Where equipment is not scheduled the Contractor shall provide materials, fixtures and equipment as identified in the specifications.

G. Decision of Architect shall be final and binding and items shall be provided without change in contract price or time.

H. Electronic submittals are acceptable in lieu of physical copies noted above. If electronic submittals are disorganized or illegible they shall be rejected and physical copies will be requested.

1.7 SAFETY AND PROTECTION:

A. Drive Guards: Provide OSHA-accepted drive and shaft guards for all exposed, rotating shafts and drive connections between motors and driven equipment. Include steel frames securely fastened for easy removal to the equipment frame. Provide tachometer cut-out at shafts where applicable.

B. Head Protection: Where pipe hangers, equipment support angles, etc., are exposed in walkways, or in access ways for any maintenance, cover all such potentially injurious protrusions less than 7' 2" above the floor with padding; secure and permanently fasten, and finish to match adjacent finishes.

1.8 TESTING, DEMONSTRATION AND COMMISSIONING

A. Demonstrate that all equipment operates as indicated and in accordance with manufacturer's recommendations. Support the inspections and testing of components and systems called for to commission the mechanical system. Commissioning shall be by the Owner, coordinate efforts and support required with the Owner's project manager. Perform tests in the presence of the Architect and Owner's Project Manager; give minimum one-week notice prior to test. Provide all instruments and personnel required to conduct the tests. Refer to Section 230800 for additional Commissioning requirements.

1.9 OPERATIONS AND MAINTENANCE MANUALS

A. Furnish operations and maintenance (O&M) manuals to the Architect before conducting owner instruction session in accordance with Section 017700. Furnish copies of the O & M manuals for review in accordance with Section 017700.

B. O & M manuals shall include full descriptions of all systems and products installed under this contract. Furnish complete narrative descriptions, product and originals of equipment descriptions with exploded diagrams, parts lists including part numbers, disassembly and assembly instructions and control wiring diagrams.

1.10 RECORD DOCUMENTS

A. Maintain record documents as construction commences. Evaluation of pay requests shall be partially based on the level of completion indicated by the record documents.

B. Mechanical Subcontractor shall transfer marks from the jobsite record set to electronic records (AutoCAD) and furnish a reproducible plan set and electronic records (As-Built Drawings) at the conclusion of the contract. This includes but is not limited to detailed and accurate drawings of all site and building piping, equipment, and appurtenances.

1.11 INSTRUCTION PERIODS FOR OWNER'S PERSONNEL

A. Description: Following installation of all mechanical equipment and prior to acceptance of the mechanical work, conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance and operation to Owner's Project Manager. Refer also to the requirements of Section 017700.

1.12 PUNCH LIST & WARRANTY

A. Refer to the requirements of Section 017700 and Section 017800.

B. INDUSTRY STANDARDS, CODES AND SPECIFICATIONS

C. All materials, equipment, and systems shall conform to the following applicable industry standards, codes and specifications:

ANSI	AWS	IBC	NEMA	SMACNA	WISHA
ASHRAE	CISPI	IMC	NFPA	UL	WSEC
ASME	FM	MSS	NSI	UPC	
ASTM	HI	NEC	OSHA	WAC	

D. Where differences occur between state laws, local ordinances, industry standards, utility company regulations and contract documents, the most stringent shall govern.

1.13 QUALITY ASSURANCE:

A. Regulatory Requirements: Comply with all applicable City, County, and State codes and ordinances. In case of conflict with drawings or specifications, the more stringent requirements govern.

B. All equipment specified herein, including but not limited to motors, motor control equipment, starters, panels, etc., shall be UL listed. European standard shall not be considered as an equivalent.

C. Basis: Washington State Building Code, Uniform Plumbing Code; Washington State Mechanical Code and local amendments to the same.

D. Installing Contractor Qualifications: Plumbing and piping systems shall be installed by experienced, licensed plumbing contractors and licensed installers. The installation of fixtures, piping and plumbing systems shall be by journeyman plumbers or by journeyman plumbers supervising apprentice plumbers. Installers shall be employed directly by the contractor, and not subcontracted. Journeymen shall have minimum 5 years of experience successfully installing plumbing and piping systems similar to those described by these contract documents.

PART 2 PRODUCTS

2.1 GENERAL

A. Comply with "Quality Assurance" provisions, Specifications, and Manufacturers' Data. Where these may be in conflict, the more stringent requirements govern. Coordinate work with Division 26.

2.2 MOTORS

A. Provide motors conforming to the following unless noted otherwise:
   1. Design and Construction: Unless otherwise indicated, provide electric motors and enclosures described by this specification conforming to the applicable definitions and requirements of NEMA MG-1.
   2. Standard Commercial Product: Provide motors of manufacturers' standard commercial product. A standard commercial product is a product which has been or will be sold on the commercial market through advertisements or manufacturers' catalogs or brochures, and represents the latest production model(s).
   3. Nameplates: Provide all motors with readily visible nameplates containing the information required in NEMA MG-1.

2.3 MOTOR REQUIREMENTS:

A. Manufacturer: General Electric, Lincoln, Allis-Chalmers, Goulds or U.S. Motors or accepted equal.

B. Type: Furnish High Efficiency motors. Motor efficiencies shall meet or exceed the efficiency values required by the Washington State Energy Code.

2.4 MOTOR CONTROL EQUIPMENT

A. General: The mechanical contractor is responsible for providing and installing motor control equipment as required for mechanical equipment and systems, unless otherwise indicated or directed. Refer also to the requirements of Division 26. Motor control equipment shall be comprised of and comply with the following:
   1. Magnetic motor starters: Where equipment is under automatic control and is furnished with a disconnecting means, provide magnetic motor starters. Starters shall conform to or contain items called for below and unless noted otherwise, shall be full voltage non-reversing for NEMA size 3 and under. No starters smaller than NEMA size 0 and no half size starters are permitted. Provide starters with protection for phase loss, phase imbalance, overload, and ground fault. Wye-delta type must have motor designed for this use. Coordinate work as required.
      a. Overload devices: Melting alloy or bimetallic type. One overload shall be provided for each phase. Provide ambient compensated overload devices only when the motor is at a constant temperature and the controller is subject to a separate, varying temperature. Automatic reset overload devices are not permitted.
      b. Accessories: Each magnetic motor controller shall include, "HAND-OFF-AUTO" selector switch, 120 volt coil (unless noted otherwise), red running pilot light, green off pilot light, 100VA (minimum) control transformer (except for 115 volt motors), surge suppression kit, with fused primary and secondary, two spare auxiliary interlock contacts and all other accessories required or noted.
      c. Enclosures: Motor controllers shall be contained in an enclosure suitable for the environment in which the controller is mounted. Enclosures located in damp, moist locations and outdoors shall be NEMA 3R throughout.

B. Combination motor controller Motor starter and disconnect. Where equipment is under automatic control and is not provided with a disconnecting means, provide combination motor starter and disconnect. Provide as specified above, and also include a disconnecting means. Shall be fused switch type (Class RK5), or motor circuit protector type rated for 22,000 RMS A.I.C. minimum unless noted otherwise and containing all accessories as listed above. If externally powered control circuits are used, provide an auxiliary switch on the disconnect switch or protector and fuse in lieu of the control transformer. Switch or protector shall be capable of being padlocked in the off position.

C. Manual Starters: Where equipment is under manual control, provide manual starter. Starter shall be toggle switch type, lockable in the "off" position, with overload relays, pilot light and enclosure per above.

D. Accepted Manufacturers: Allen Bradley or as accepted through prior approval.

2.5 EXPANSION SHELLS AND BOLTS

A. Expansion Shells for Rod Hangers
   1. Phillips, Gregory, Omark, or Fastite in holes drilled in concrete.

B. Expansion Bolts for Equipment
   1. USM or McCullough in holes drilled in concrete.
   2. No screwed adapters underground.

2.6 FORMED STEEL CHANNELS AT SLAB

A. Provide for all equipment; number and size per manufacturer's recommendations or as indicated.

2.7 ANCHOR BOLTS

A. Provide for all equipment; number and size per manufacturers' recommendations or as indicated.

2.8 SUPPLEMENTARY STEEL FRAMING

A. Standard structural steel shapes or Schedule 40 steel pipe, galvanized with extra-heavy finish.

2.9 SLEEVES

A. Refer to Specification Section 221116

2.10 WELDING TO BUILDING STRUCTURAL MEMBERS

A. Not allowed except as indicated.

2.11 NAMEPLATES

A. Laminated black plastic with lettering cut through to white background. Plastic strips with raised letters made by a marking device are not acceptable.

2.12 VALVE TAGS

A. Shall be 0.030" thick brass, 1" diameter size; state the service and destination of the line controlled. Provide tag inscriptions made with a lettering device with 5/16" high cut lettering. Laminated plastic tags, construction similar to nameplates will also be acceptable.

2.13 PIPING IDENTIFICATION

A. Self adhesive, pre-printed identification labels indicating direction of flow and pipe contents, using common industry abbreviations. Identify pipe at every change of direction.

2.14 SPECIAL MAINTENANCE MATERIALS

A. Provide for equipment requiring frequent replacement of maintenance materials. Provide an extra set of filters, and belts; together with application devices and instructions.

2.15 PAINTING

A. Paint all exposed fixtures and equipment in conformance with Division 9. Coordinate color with Architect. Refer to Architectural documents for paint and application requirements.

2.16 EQUIPMENT LISTING REQUIREMENTS

A. Whenever UL Standards exist for equipment provide UL-accepted equipment bearing the UL label.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until any unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 PREPARATION

A. Field Measurements: Field-verify locations of new and existing work prior to commencing work of this Section.
B. Protect surrounding areas and surfaces to preclude damage from work of this Section.

3.3 INSTALLATION, ERECTION, AND PERFORMANCE

A. Install, apply, erect, and perform the work in accordance with "Quality Assurance" provisions, Specifications, and manufacturers' installation instructions and directions. Where these may be in conflict, the more-stringent requirements govern.

3.4 CLEANING

A. Promptly remove waste material and rubbish caused by mechanical construction work. At completion of the project, clean all equipment, piping and fixtures installed or provided under this Contract.

3.5 CUTTING AND PATCHING

A. Cut all openings and holes required for mechanical work. Carefully examine existing conditions prior to commencing work.

3.6 ACCESSIBILITY

A. Locate valves, controls, etc., to be easily accessible.
B. Install all equipment that requires periodic servicing or repairs to be readily accessible. Otherwise, obtain Architect's approval of location. Where valve and equipment is concealed behind access panels or by ceiling tiles, label panel or tile appropriately.
C. Provide access panels as indicated or required for piping, valve or equipment access. Refer to Architectural Documents to determine fire-rating requirements. The access panel size shall be in proportion to the equipment, piping, or valve requiring access. Minimum access panel size shall be 12" x 12".

3.7 SPECIAL PROTECTION

A. Exercise maximum precaution to provide positive protection for the existing building and equipment from damage of any kind, and in particular prevent any water and dust seepage into the existing building.
B. Storage of materials: Make all necessary provisions to prevent damage or corrosion of materials.

3.8 EQUIPMENT INSTALLATION

A. General: Provide supports for all equipment and appurtenances as required, including braces as required for seismic restraint; these include frames or supports for pumps and air handlers and all mechanical equipment. Bracing shall conform with the requirements of IBC and IMC. Include the design, engineering and installation of these members is the responsibility of the contractor.
B. Suspended Equipment: Provide hangers from structure as required; span between structural members with additional structural steel as required to mount equipment in locations shown. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.
C. Floor-Mounted Equipment - General:
    1. Provide machine and floor or foundation fastenings; set equipment on concrete pads. Provide equipment base drawings, bolt-setting information, and anchors for all floor-mounted equipment. Provide concrete expansion anchors through concrete equipment pads, installed into existing structural concrete slabs.

2. Install all equipment at the locations, and to the dimensions indicated. Set equipment accurately with principal centerlines and level, using manufacturers' leveling screws, blocks, shims, or wedges. Do not distort equipment or base plates.
3. Install all equipment and piping such as to provide adequate access for service. This includes access to equipment covered in other divisions or sections of this specification.

3.9 PIPE SUPPORTS

A. Attach hangers and support rigidly to the building structure; provide supplementary steel framing and bracing at all changes in pipe direction to resist thrust of flowing water. Provide seismic bracing as required by codes. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.

B. Provide additional steel support for piping runs through tight confinements. Provide trapeze system with vibration isolation and seismic restraint for piping through joists and as applicable, due to accessibility of ductwork and mechanical equipment.

C. Where pipe is located below slab on grade, or structure on grade, provide support of pipe from structure such that pipe is protected from damage or displacement should the ground settle away from the structure.

3.10 EXPANSION SHELLS AND BOLTS

A. Use only where necessary to support piping or equipment from existing concrete slabs or walls.

3.11 SLEEVES AND SEALING OF SLEEVES

A. Provide all sleeving and sealing of sleeves for pipes.

B. Provide annular clear space of approximately 1/4" to 1/2"; size to accommodate insulation passing through sleeve where applicable.

C. Wherever piping passes through any floor slab above occupied space or equipment, provide pipe sleeves extending 1" above floor.

D. Set sleeves in place prior to pouring of concrete in new construction; core drill and grout sleeves in place for unit masonry construction and existing construction.

E. Sealing of sleeves through floor slabs and firewalls: Provide firestop system by 3M or accepted equal.

F. Sealing of sleeves for below grade floors and walls: Provide Link Seal. Refer to 221000.

3.12 NAMEPLATES

A. Provide for all equipment; fasten mechanically. Label access panel or ceiling appropriately for concealed equipment.

3.13 VALVE TAGS

A. Provide on all new valves; fasten with brass chain to the valve stem.

B. Provide a framed valve map based on the as-built locations of all new pipe, as well as the field verified arrangement of the existing pipe, and coordinate location of valve map with Owner.

3.14 PIPING IDENTIFICATION

A. Provide pipe identification labels on not less than 10 foot centers, on both sides of a wall penetration, and at every change in direction, so that a label is visible from a standing position on the floor, not more than three feet from the wall.

B. Provide valve location indicators on exposed finish side of adjacent surfaces. Labeling color and style shall be at the discretion of Architect.

3.15 PAINTING

A. General Paint exposed equipment, piping, and mechanical system appurtenances unless noted otherwise. Coordinate color with Architect. Refer also to Division 9.

B. Application:
   1. Thoroughly clean surfaces to be painted to remove dirt, grease and scale. Wash galvanized surfaces with mild solution of acid prior to painting to effectively clean oils from surface and to etch zinc.
   2. Paint insulated surfaces and covered piping with one primer coat and two finish coats.
   3. Paint exposed equipment, pipes and supports with one primer coat and two finish coats. Paint factory painted equipment to match colors selected by the Architect: touch up damaged areas with paint to match factory color.
   4. Paint the supporting devices for mechanical devices or systems specified to be painted.

3.16 MISCELLANEOUS EQUIPMENT AND FIXTURE CONNECTIONS

A. Provide piping and make all final mechanical connections in accordance with manufacturers' recommendations for Owner-furnished equipment and fixtures, and equipment and fixtures specified.

B. Perform on-site review and refer to manufacturers' shop drawings for details of connections. Provide rough-in at locations to conveniently serve items.

3.17 BALANCING WORK

A. General: The Mechanical Subcontractor shall provide all support for balancing and testing work. Coordinate with Section 230593.

B. Work by Mechanical Subcontractor:
   1. Provide the balancing subcontractor with access to all equipment installed under this contract requiring balancing. Provide ladders, scaffolding, lifts as required to permit the Subcontractor to complete their work.
   2. Operate the mechanical systems and be responsible for all equipment until the balancing and testing is complete. Before balancing and testing commences, check all rotating equipment for proper rotation and lubricate per the manufacturers' recommendations.
   3. Do not assume that equipment is shipped from the factory configured to meet specified volumes and quantities. Include belt, sheave, starter heater and other equipment changes, and all work as required as part of this contract in order to permit balancing to required values.
   4. Before balancing and testing commences, operate all pumps and auxiliary equipment for a minimum of one hour. During this period, check out and calibrate all control components under operating service.

C. Work Coordinated With Owner:
   1. Coordinate balancing with other work and building occupancy to ensure no interruptions occur.

3.18 WIRING

A. Wiring shall conform to applicable sections of these specifications. Provide wiring from branch circuit over current device to motor controller to motor terminals, including installation of starter and all connections. Provide raceway and conductors as shown for remote control, or interlock connections. Coordinate other control wiring with Divisions 23 and 26 of the Specifications. Provide overload elements in controllers sized to match motor nameplate full load amperes. Space within controllers shall not be used as a junction box.

END OF SECTION

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. Sleeves.
   2. Sleeve-seal systems.
   3. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.1 SLEEVES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Advance Products & Systems, Inc.
   2. CALPICO, Inc.
   3. GPT; an EnPro Industries company.

B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.

D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

E. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

F. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

G. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Metraflex Company (The).

B. Description:
   1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   2. Designed to form a hydrostatic seal of 20 psig minimum.
   3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   4. Pressure Plates: Carbon steel .
   5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

2.3 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. GE Construction Sealants; Momentive Performance Materials Inc.
   b. Sherwin-Williams Company (The).
   c. The Dow Chemical Company.
2. Verify sealant has a VOC content of 250 g/L or less.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. May National Associates, Inc.; a subsidiary of Sika Corporation.
   2. Verify sealant has a VOC content of 250 g/L or less.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Smooth-On.
   2. Verify sealant has a VOC content of 250 g/L or less.

PART 3 EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
   1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   2. Using silicone sealant, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:
   1. Exterior Concrete Walls above Grade:
      a. Piping Smaller Than NPS 6: Steel pipe sleeves
   2. Exterior Concrete Walls below Grade:
      a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   3. Concrete Slabs-on-Grade:
      a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   4. Concrete Slabs above Grade:
      a. Piping Smaller Than NPS 6: Steel pipe sleeves.
   5. Interior Partitions:
      a. Piping Smaller Than NPS 6: Steel pipe sleeves.

END OF SECTION 220517

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. Escutcheons.
   2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. BrassCraft Manufacturing Co.; a Masco company.
   2. ProFlo; a Ferguson Enterprises, Inc. brand.

2.2 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.
C. One-Piece, Cast-Brass Type: With polished, chrome-plated polished brass finish and setscrew fastener.
D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
   1. Escutcheons for New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
      b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
      c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with finish.
      d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel with polished, chrome-plated finish.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel with polished, chrome-plated finish.

C. Install floor plates for piping penetrations of equipment-room floors.
D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   1. New Piping: One-piece, floor plate.

END OF SECTION 220518

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Liquid-in-glass thermometers.
2. Pressure gages.
3. Gage attachments.
4. Test plugs.
5. Test-plug kits.

B. Related Requirements:
1. Section 221119 "Domestic Water Piping Specialties" for water meters.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Trerice, H. O. Co.
2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch nominal size.
4. Case Form: Straight unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: Glass or plastic.
8. Stem: Aluminum or brass and of length to suit installation.
   a. Design for Thermowell Installation: Bare stem.
9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. WATTS.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn stee ; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.

10. Ring: Stainless steel.
11. Accuracy: Grade B, plus or minus 2 percent of middle half of scale range.

2.3 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston -type surge-dampening device. Include extension for use on insulated piping.
B. Valves: Brass or stainless steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.4 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Peterson Equipment Co., Inc.
   2. WATTS.
B. Description: Test-station fitting made for insertion into piping tee fitting.
C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
F. Core Inserts: EPDM self-sealing rubber.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
B. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
C. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
D. Install remote-mounted pressure gages on panel.
E. Install valve and snubber in piping for each pressure gage for fluids.
F. Install test plugs in piping tees.
G. Install thermometers in the following locations:
   1. Inlet and outlet of each water heater.
   2. Inlet and outlet of each domestic hot-water storage tank.
H. Install pressure gages in the following locations:
   1. Building water service entrance into building.
   2. Inlet and outlet of each pressure-reducing valve.
   3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 220519

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Bronze ball valves.
   3. Steel ball valves.
   4. CPVC ball valves.

1.2 DEFINITIONS

A. CWP: Cold working pressure.
B. RPTFE: Reinforced polytetrafluoroethylene.
C. WOG: Water, oil, gas.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and soldered ends.
   3. Set ball valves open to minimize exposure of functional surfaces.
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. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of valve from a single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Standards:
   1. Domestic water valves intended to convey or dispense water for human consumption must comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or must be certified to be in compliance with NSF 61 and NSF 372 (by an ANSI-accredited third-party certification body) that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.5 for flanges on steel valves.
   4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   5. ASME B16.18 for cast copper solder-joint connections.
   6. ASME B16.22 for wrought copper and copper alloy solder-joint connections.
   7. ASME B16.34 for flanged and threaded end connections
   8. ASME B31.9 for building services piping valves.
C. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.
F. Valve Actuator Type:
   1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
   2. Hand Lever: For quarter-turn valves smaller than .
G. Valves in Insulated Piping:
   1. Provide 2-inch extended neck stems.
   2. Extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
   3. Memory stops that are fully adjustable after insulation is applied.

2.3 BRASS BALL VALVES

A. Brass Ball Valves, Two Piece with Full Port and Brass Trim, Threaded or Soldered Ends:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. WATTS.
   2. Standard: MSS SP-110; MSS SP-145.
   3. CWP Rating: 600 psig.
   4. Body Design: Two piece.
   5. Body Material: Forged brass.
   6. Ends: Threaded or soldered.
   7. Seats: PTFE.
   8. Stem: Brass.
   9. Ball: Chrome-plated brass.
   10. Port: Full.

2.4 BRONZE BALL VALVES

A. Bronze Ball Valves, Two Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. NIBCO INC.
      c. WATTS.
      d. Zurn Industries, LLC.
   2. Standard: MSS SP-110; MSS SP-145.
   3. CWP Rating: 600 psig.
   4. Body Design: Two piece.
   5. Body Material: Bronze.
   6. Ends: Threaded or soldered.
   7. Seats: PTFE.
   8. Stem: Bronze or brass.
   9. Ball: Chrome-plated brass.
   10. Port: Full.

2.5 STEEL BALL VALVES

A. Steel Ball Valves with Regular Port, Class 150, Flanged or Threaded Ends:
   1. Manufacturers: Subject to compliance with requirements, undefined:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. NIBCO INC.
      c. Stockham; a Crane Co. brand.
   2. Standard: MSS SP-72; MSS SP-110.

3. CWP Rating: 285 psig.
4. Body Design: Uni-body.
5. Body Material: Carbon steel, ASTM A216/A216M, Type WCB.
6. Ends: Flanged or threaded.
7. Seats: PTFE.
8. Stem: Stainless steel.
9. Ball: Stainless steel, vented.
10. Port: Regular.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
C. Examine threads on valve and mating pipe for form and cleanliness.
D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
E. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow space for service, maintenance, and equipment removal without system shutdown.
B. Provide support to piping adjacent to valves such that no force is imposed upon valves.
C. Locate valves for easy access.
D. For valves in horizontal piping, install valves with stem at or above center of pipe.
E. Install valves in position to allow full valve actuation movement.
F. Valve Tags: Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
G. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves exhibiting leakage.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, provide the same types of valves with higher CWP ratings.
B. Select valves with the following end connections:
    1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
    2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
    3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
    4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
    5. For Stainless Steel Piping, NPS 2 and Smaller: Threaded ends.
    6. For Stainless Steel Piping,NPS 2-1/2to NPS 4: Flanged ends.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Brass ball valve, one piece. Provide with [**threaded**] solder [**or**] -joint ends.
   2. Bronze ball valve, one piece with bronze trim. Provide with [**threaded**] solder [**or**] -joint ends.

B. Pipe NPS 2-1/2 and Larger:
   1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
   2. Steel ball valves, Class 150 with regular port.

C. CPVC Pipe NPS 2 and Smaller: Union Non-union ball valve.

END OF SECTION 220523.12

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bronze, swing check valves.
   2. Iron, swing check valves.

1.2 DEFINITIONS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene-diene terpolymer.
C. NBR: Nitrile butadiene rubber (also known as Buna-N).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, press connections, and weld ends.
   3. Set 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. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use stems or other components as lifting or rigging points unless specifically indicated for this purpose in manufacturer's instructions.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:
   1. Domestic water piping check valves intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372, or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.5 for flanges for metric standard piping.
   4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   5. ASME B16.18 for cast-copper solder joint.
   6. ASME B16.22 for wrought copper solder joint.
   7. ASME B16.51 for press joint.
   8. ASME B31.9 for building services piping valves.
C. AWWA Compliance: Comply with AWWA C606 for groove-end connections.
D. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are unacceptable.
E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE SWING CHECK VALVES

A. Bronze, Swing Check Valves with Nonmetallic Disc, Class 125:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. Crane Valves; a Crane Co. brand.
      c. Milwaukee Valve Company.
      d. NIBCO INC.
   2. Description:
      a. Standard: MSS SP-80, Type 4.
      b. CWP Rating: 200 psig.
      c. Body Design: Horizontal flow.
      d. Body Material: ASTM B62, bronze.
      e. Ends: Threaded or soldered. See valve schedule articles.
      f. Disc: PTFE.

2.3 IRON, SWING CHECK VALVES

A. Iron, Swing Check Valves with Nonmetallic-to-Metal Seats, Class 125:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cooper Valves.
      b. Crane Valves; a Crane Co. brand.
   2. Description:
      a. Standard: MSS SP-71, Type I.
      b. CWP Rating: 200 psig.
      c. Body Design: Clear or full waterway.
      d. Body Material: ASTM A126, gray iron with bolted bonnet.
      e. Ends: Flange or threaded. See valve schedule articles.
      f. Trim: Composition.
      g. Seat Ring: Bronze.
      h. Disc Holder: Bronze.
      i. Disc: PTFE.
      j. Gasket: Asbestos free.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
C. Examine threads on valve and mating pipe for form and cleanliness.
D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
E. Examine press fittings to verify they have been properly press.
F. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
B. Provide support of piping adjacent to valves such that no force is imposed upon valves.
C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.
D. Install valves so that stems are horizontal or slope upward from centerline of pipe.
E. Install valves in position that does not project into aisles or block access to other equipment.
F. Install valves in position to allow full stem and manual operator movement.
G. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.
H. Check Valves: Install check valves for proper direction of flow.
   1. Swing Check Valves: In horizontal position with hinge pin level.
I. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
J. Adhere to manufacturer's installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
   1. Pump-Discharge Check Valves:
      a. NPS 2 and Smaller: Bronze, swing check valves with nonmetallic disc.
B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
C. End Connections:
   1. For Copper Tubing, NPS 2 and Smaller: Threaded, soldered, or press-end connections.
   2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flange or threaded.
   3. For Copper Tubing, NPS 5 and Larger: Flange.
   4. For Steel Piping, NPS 2 and Smaller: Threaded.
   5. For Steel Piping, NPS 2-1/2 to NPS 4: Flange or threaded.
   6. For Steel Piping, NPS 5 and Larger: Flange.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Bronze, swing check valves with nonmetallic disc, Class 125, with soldered or threaded end connections.
B. Pipe NPS 2-1/2 and Larger:
   1. Iron, swing check valves with nonmetallic-to-metal seats, Class 125, with threaded or flange end connections.

END OF SECTION 220523.14

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bronze gate valves.
   2. Iron gate valves.

1.2 DEFINITIONS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene-diene terpolymer.
C. NRS: Nonrising stem.
D. OS&Y: Outside screw and yoke.
E. RS: Rising stem.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, press connections, and weld ends.
   3. Set gate valves closed to prevent rattling.
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. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels, stems, or other components as lifting or rigging points unless specifically indicated for this purpose in manufacturer's instructions.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:
   1. Domestic water piping check valves intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372, or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.5 for flanges on metric standard piping.
   4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   5. ASME B16.18 for cast-copper solder joint.
   6. ASME B16.22 for wrought copper solder joint.
   7. ASME B16.51 for press joint.
   8. ASME B31.9 for building services piping valves.
C. AWWA Compliance: AWWA C606 for groove-end connections.
D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valves in Insulated Piping: With 2-inch stem extensions.
G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE GATE VALVES

A. Bronze Gate Valves, RS, Class 125:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. Milwaukee Valve Company.
      c. NIBCO INC.
      d. WATTS.
   2. Description:
      a. Standard: MSS SP-80, Type 2.
      b. CWP Rating: 200 psig.
      c. Body Material: Bronze with integral seat and screw-in bonnet.
      d. Ends: Threaded or solder joint.
      e. Stem: Bronze.
      f. Disc: Solid wedge; bronze.
      g. Packing: Asbestos free.
      h. Handwheel: Malleable iron, bronze, or aluminum.

2.3 IRON GATE VALVES

A. Iron Gate Valves, OS&Y, Class 125:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. Milwaukee Valve Company.
      c. WATTS.
   2. Description:
      a. Standard: MSS SP-70, Type I.
      b. CWP Rating: 200 psig.
      c. Body Material: Gray iron with bolted bonnet.
      d. Ends: Flange.
      e. Trim: Bronze.
      f. Disc: Solid wedge.
      g. Packing and Gasket: Asbestos free.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
C. Examine threads on valve and mating pipe for form and cleanliness.
D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
E. Examine press joint surfaces. Verify they are clean and free from dents and burrs, and that o-ring seals are in place and undamaged.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
B. Provide support of piping adjacent to valves such that no force is imposed upon valves.
C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.
D. Install valves so that stems are horizontal or slope upward from centerline of pipe.
E. Install valves in position that does not project into aisles or block access to other equipment.
F. Install valves in position to allow full stem and manual operator movement.
G. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.
H. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
I. Adhere to manufacturer's installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. Use gate valves for shutoff service only.
B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
C. End Connections:
    1. For Copper Tubing, NPS 2 and Smaller: Threaded, soldered, or press-end connections.
    2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flange or threaded.
    3. For Copper Tubing, NPS 5 and Larger: Flange.
    4. For Steel Piping, NPS 2 and Smaller: Threaded.
    5. For Steel Piping, NPS 2-1/2 to NPS 4: Flange or threaded.
    6. For Steel Piping, NPS 5 and Larger: Flange.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
    1. Bronze gate valves, RS , Class 125 with soldered or threaded ends.
B. Pipe NPS 2-1/2 and Larger: Iron gate valves, OS&Y , Class 125 with flange ends.

END OF SECTION

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. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal hanger-shield inserts.
   5. Fastener systems.
   6. Pipe stands.
   7. Equipment supports.

B. Related Requirements:
   1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
   2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
   3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
   2. Environmental Product Declaration (EPD): For each product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
   1. Trapeze pipe hangers.
   2. Metal framing systems.
   3. Pipe stands.
   4. Equipment supports.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Stainless-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel .

B. Copper Pipe and Tube Hangers:
   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steelorstainless steel .

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Flex-Strut Inc.
      b. G-Strut.
      c. Unistrut; Atkore International.
   2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
   3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
   4. Channels: Continuous slotted stainless steel channel with inturned lips.
   5. Channel Width: Selected for applicable load criteria.
   6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   7. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel .
   8. Metallic Coating: No coating .

2.5 THERMAL HANGER-SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CADDY; brand of nVent Electrical plc.
   2. National Pipe Hanger Corporation.
   3. Pipe Shields Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Hilti, Inc.
B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Hilti, Inc.
   2. Indoor Applications: Zinc-coated or stainless steel.
   3. Outdoor Applications: Stainless steel.

2.7 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
B. Compact Pipe Stand:
   1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
   2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
      a. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50% percent.
   3. Hardware: Galvanized steel or polycarbonate.
   4. Accessories: Protection pads.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.9 MATERIALS

A. Aluminum: ASTM B 221.
B. Carbon Steel: ASTM A 1011/A 1011M.
C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.
D. Stainless Steel: ASTM A 240/A 240M.
E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. 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 shall be weight of supported components plus 200 lb .

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick 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.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
N. 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.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
      b. NPS 4: 12 inches long and 0.06 inch thick.
      c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
      d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
      e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
   5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
   6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
C. Field Welding: Comply with AWS D1.1/D1.1M 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 so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches .

3.6 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099600 "High-Performance Coatings."
C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.
G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
H. Use padded hangers for piping that is subject to scratching.
I. Use thermal hanger-shield inserts for insulated piping and tubing.
J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. C-Clamps (MSS Type 23): For structural shapes.

2. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb.
   b. Medium (MSS Type 32): 1500 lb.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   2. Thermal Hanger-Shield Inserts: For supporting insulated pipe.
O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
Q. Use powder-actuated fasteners [**or**] mechanical-expansion anchors instead of building attachments where required in concrete construction.
R. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Elastomeric isolation mounts.
   2. Housed-spring isolators.
   3. Pipe-riser resilient support.
   4. Resilient pipe guides.
   5. Elastomeric hangers.
   6. Spring hangers.
   7. Snubbers.
   8. Vibration isolation equipment bases.

B. Related Requirements:
   1. Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
   2. Section 230548 "Vibration and Seismic Controls for HVAC" for devices for HVAC equipment and systems.

1.03 DEFINITIONS

A. Designated Seismic System: A plumbing component that requires design in accordance with ASCE/SEI 7, Ch. 13 and for which the Component Importance Factor is greater than 1.0.

B. IBC: International Building Code.

C. OSHPD: Office of Statewide Health Planning and Development (for the State of California owned and regulated medical facilities).

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   2. Include load rating for each wind-force-restraint fitting and assembly.
   3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device and seismic-restraint component.
   4. Annotate types and sizes of seismic restraints and accessories, complete with listing markings or report numbers and load rating in tension and compression as evaluated by UL product listing.
   5. Annotate to indicate application of each product submitted and compliance with requirements.
   6. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:
   1. Detailed fabrication and assembly of equipment bases.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic control system.
   1. Seismic Performance: Equipment shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7-16.

B. Consequential Damage: Provide additional seismic and wind-force restraints for suspended plumbing components or anchorage of floor, roof or wall mounted plumbing components as indicated in ASCE/SEI 7-16 so that failure of a non-essential or essential plumbing component will not cause the failure of any other essential architectural, mechanical or electrical building component.

C. 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.

D. Component Supports:
   1. Load Ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.
   2. All component support attachments must comply with force and displacement resistance requirements of ASCE/SEI 7-16 Section 13.6.

2.02 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts: .
   1. Manufacturers: Subject to compliance with requirements, undefined:
      a. CADDY; brand of nVent Electrical plc.
      b. Kinetics Noise Control, Inc.
      c. Mason Industries, Inc.
   2. Mounting Plates:
      a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
      b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
   3. Elastomeric Material: Molded, oil- and water-resistant neoprene rubber, silicone rubber, or other elastomeric material.

2.03 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing: .
   1. Manufacturers: Subject to compliance with requirements, undefined:
      a. CADDY.
      b. Kinetics Noise Control, Inc.
      c. Mason Industries, Inc.
   2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of the 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. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Top housing with threaded mounting holes and internal leveling device.

2.04 PIPE-RISER RESILIENT SUPPORT

A. All-Directional, Acoustical Pipe Anchor Consisting of Two Steel Tubes Separated by a Minimum 1/2-inch- Thick Neoprene.
1. Manufacturers: Subject to compliance with requirements, undefined:
a. Kinetics Noise Control, Inc.
b. Mason Industries, Inc.
c. Vibration Eliminator Co., Inc.
2. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
3. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.05 RESILIENT PIPE GUIDES

A. Telescopic Arrangement of Two Steel Tubes or Post and Sleeve Arrangement Separated by a Minimum 1/2-inch- Thick Neoprene: .
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Kinetics Noise Control, Inc.
b. Mason Industries, Inc.
c. Vibration Eliminator Co., Inc.
2. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.06 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: .
1. Manufacturers: Subject to compliance with requirements, undefined:
a. CADDY
b. Kinetics Noise Control, Inc.
c. Mason Industries, Inc.
2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Damping Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel-to-steel contact.

2.07 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
1. Manufacturers: Subject to compliance with requirements, undefined:
a. CADDY
b. Kinetics Noise Control, Inc.
c. Mason Industries, Inc.
2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.08 SNUBBERS

A. Manufacturers: Subject to compliance with requirements, undefined:
   1. CADDY
   2. Kinetics Noise Control, Inc.
   3. Mason Industries, Inc.
B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
   1. Post-installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be seismically prequalified in accordance with ACI 355.2 testing and designated in accordance with ACI 318-14 Ch. 17 for 2015 or 2018 IBC. Preset concrete inserts: Seismically prequalified in accordance with ICC-ES AC446 testing.
   2. Anchors in Masonry: Design in accordance with TMS 402.
   3. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
   4. Resilient Cushion: Maximum 1/4-inch air gap, and minimum 1/4 inch thick.

2.09 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Kinetics Noise Control, Inc.
   2. Mason Industries, Inc.
   3. Vibration Eliminator Co., Inc.
B. Steel Rails: Factory-fabricated, welded, structural-steel rails.
   1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.
      a. Include supports for suction and discharge elbows for pumps.
   2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A36/A36M. Rails shall have shape to accommodate supported equipment.
   3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength is adequate to carry static and seismic load within specified loading limits.

3.03 INSTALLATION OF VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICES

A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Device Schedules, where indicated on Drawings, or where the Specifications indicate they are to be installed on specific equipment and systems.
B. Provide seismic-restraint devices for systems and equipment where indicated in Equipment Schedules or Seismic-Restraint Devices Schedules, where indicated on Drawings, where the Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
C. 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."
D. Installation of vibration isolators and seismic restraints must not cause any stresses, misalignment, or change of position of equipment or piping.
E. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
F. Equipment Restraints:
    1. Install snubbers on plumbing equipment mounted on vibration isolators. 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 where clearance between anchor and adjacent surface exceeds 0.125 inch.
    3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
G. Piping Restraints:
    1. Comply with requirements in MSS SP-127.
    2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
    3. Brace a change of direction longer than 12 feet.
H. Install seismic-restraint cables so they do not bend across edges of adjacent equipment or building structure.
I. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
J. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
K. 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.
L. 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.
M. 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 Project 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 shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.04 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Provide flexible connections in piping systems where they cross structural seismic joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7. Comply with requirements in Section 221116 "Domestic Water Piping" and Section 221119 "Domestic Water Piping Specialties" for piping flexible connections.

3.05 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT BASES

A. 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."
B. Coordinate dimensions of steel equipment rails, bases, and concrete inertia bases, with requirements of isolated equipment specified in this and other Sections. Where dimensions of bases are indicated on Drawings, they may require adjustment to accommodate actual isolated equipment.

3.06 ADJUSTING

A. Adjust isolators after system is at operating weight.
B. 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.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Pipe labels.
   3. Valve tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
B. Samples: For color, letter style, and graphic representation required for each identification material and device.
C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
D. Valve-numbering scheme.
E. Valve Schedules: For each piping system. Include in operation and maintenance manuals.

PART 2 PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brimar Industries, Inc.
      b. Craftmark Pipe Markers.
      c. Seton Identification Products; a Brady Corporation company.
   2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
   3. Letter and Background Color: As indicated for specific application under Part 3.
   4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   7. Fasteners: Stainless steel rivets or self-tapping screws.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brimar Industries, Inc.
   2. Craftmark Pipe Markers.
   3. Seton Identification Products; a Brady Corporation company.
B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.
C. Letter and Background Color: As indicated for specific application under Part 3.

D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to circumference of pipe and to attach to pipe without fasteners or adhesive.
E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
F. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:
   1. Pipe size.
   2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
   3. Lettering Size: Size letters in accordance with ASME A13.1 for piping.

2.3 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brimar Industries, Inc.
   2. Craftmark Pipe Markers.
   3. Seton Identification Products; a Brady Corporation company.
B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.04-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass beaded chain .
C. Letter and Background Color: As indicated for specific application under Part 3.
D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Include valve-tag schedule in operation and maintenance data.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Coordinate installation of identifying devices with locations of access panels and doors.
C. Install identifying devices before installing acoustical ceilings and similar concealment.
D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of plumbing equipment.
B. Sign and Label Colors.
   1. White letters on an ANSI Z535.1 safety-green background .
C. Locate equipment labels where accessible and visible.
D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where are-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E.

3.4 INSTALLATION OF PIPE LABELS

A. Piping Color Coding: Painting of piping is specified in Section 099600 "High-Performance Coatings."
B. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Within 3 ft. of each valve and control device.
   2. At access doors, manholes, and similar access points that permit view of concealed piping.
   3. Within 3 ft. of equipment items and other points of origination and termination.
   4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.
D. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.
E. Flow-Direction Flow Arrows: Use arrows, in compliance with ASME A13.1, to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
F. Pipe-Label Color Schedule:
   1. Domestic Cold-Water Piping: White letters on an ANSI Z535.1 safety-green background .
   2. Domestic Hot-Water Piping: White letters on an ANSI Z535.1 safety-green background
   3. Domestic Hot-Water Return Piping White letters on an ANSI Z535.1 safety-green background .
   4. Sanitary Waste [**and**] Piping: White letters on a black background .

3.5 INSTALLATION OF VALVE TAGS

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule in the operating and maintenance manual.
B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
   1. Valve-Tag Size and Shape:
      a. Domestic Cold Water: 1-1/2 inches , round .
      b. Domestic Hot Water: 1-1/2 inches , round .
      c. Domestic Hot-Water Return: 1-1/2 inches , round .
   2. Valve-Tag Colors:
      a. For each piping system, use the same lettering and background coloring system on valve tags as used in the piping system labels and background.

END OF SECTION 220553

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. TAB of domestic water system.
   2. TAB of plumbing equipment:
      a. Condensate Pumps
      b. Trap Primers
   3. Pipe-leakage test verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.
B. NEBB: National Environmental Balancing Bureau.
C. TAB: Testing, adjusting, and balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
F. TDH: Total dynamic head.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 90 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
B. Certified TAB reports.
C. Sample report forms.
D. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.
   5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by AABC:
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
   2. TAB Technician: Employee of the TAB specialist and certified by AABC.
B. TAB Specialists Qualifications, Certified by NEBB:
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB.
   2. TAB Technician: Employee of the TAB specialist and certified by NEBB.
C. ASHRAE 111 Compliance: Requirements in ASHRAE 111 applicable to analogous domestic water system and plumbing equipment balancing.
D. Code and Authorities Having Jurisdiction Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following :
   1. Neudorfer .
   2. Hardin and Sons

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, and balancing valves and fittings. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
C. Examine approved submittals for plumbing systems and equipment.
D. Examine design data, including plumbing system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about plumbing system and equipment controls.
E. Examine equipment performance data, including pump curves.
   1. Relate performance data to Project conditions and requirements, including pump system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate pump system-effect factors to reduce performance ratings of plumbing equipment when installed under conditions different from the conditions used to rate equipment performance. Compare results with the design data and installed conditions.
F. Examine system and equipment installations, and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
G. Examine test reports specified in individual system and equipment Sections.
H. Examine plumbing equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
I. Examine temporary and permanent strainers. Verify that temporary strainer screens used during system cleaning and flushing have been removed and permanent strainers are installed and clean.
J. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.
K. Examine system pumps to ensure absence of entrained air in the suction piping.
L. Examine operating safety interlocks and controls on plumbing equipment.
M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:
   1. Equipment and systems to be tested.
   2. Strategies and step-by-step procedures for balancing the systems.
   3. Instrumentation to be used.
   4. Sample forms with specific identification for all equipment.
B. Perform system-readiness checks of plumbing systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
   1. Domestic Water System:
      a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed in accordance with applicable code and authority having jurisdiction.
      b. Water heaters are installed and functioning.

c. Piping is complete and all points of outlet are installed.
d. Water treatment is complete.
e. Systems are flushed, filled, and air purged.
f. Strainers are clean.
g. Control valves are functioning in accordance with the sequence of operation.
h. Shutoff and balance valves are 100 percent open.
i. hot-water circulating pumps are operational and proper rotation is verified.
j. Pump gauge connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
k. Variable-frequency controllers' startup is complete and safeties are verified.
l. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
B. Cut insulation, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
   1. Where holes for probes are required in piping or equipment, install pressure and temperature test plugs to seal systems.
   2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 220716 "Plumbing Equipment Insulation" and Section 220719 "Plumbing Piping Insulation."
C. Mark equipment and balancing devices, including valve position indicators and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 GENERAL PROCEDURES FOR PLUMBING EQUIPMENT

A. Test, adjust, and balance plumbing equipment indicated on Drawings, including, but not limited to, the following:
   1. Motors.
   2. Domestic water in-line pumps.
   3. Domestic water heaters.

3.6 PROCEDURES FOR DOMESTIC WATER SYSTEMS

A. Prepare test reports for pumps and other equipment. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required equipment flow rates with system design flow rates.
B. Prepare schematic diagrams of systems' Record drawings piping layouts.
C. In addition to requirements in "Preparation" Article, prepare domestic water systems for testing and balancing as follows:
   1. Check expansion tank for proper setting.
   2. Check water heater for proper discharge temperature setting.
   3. Check remotest point of outlet for adequate pressure.
   4. Check flow-control valves for proper position.
   5. Locate start-stop and disconnect switches, electrical interlocks, and motor controllers.
   6. Verify that motor controllers are equipped with properly sized thermal protection.
   7. Check that air has been purged from the system.
D. Measure and record upstream and downstream pressure of each piece of equipment.

E. Measure and record upstream and downstream pressure of pressure-reducing valves.
F. Check settings and operation of automatic temperature-control valves, self-contained control valves, and pressure-reducing valves. Record final settings.
G. Check settings and operation of each safety valve. Record settings.

3.7 PROCEDURES FOR DOMESTIC HOT-WATER CIRCULATING INLINE PUMP

A. Balance system with manual or automatic balancing valves by setting at design flow.
   1. Measure flow in main and branch pipes.
   2. Adjust main and branch balance valves for design flow.
   3. Re-measure each main and branch after all have been adjusted.
B. Adjust pump to deliver total design flow.
   1. Measure pump TDH as follows:
      a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
      b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
      c. Convert pressure to head and correct for differences in gauge heights.
      d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
   2. Monitor motor performance during procedures, and do not operate motor in an overloaded condition.
   3. Mark final settings and verify that all memory stops have been set.
   4. Verify final system conditions as follows:
      a. Re-measure and confirm that total flow is within design.
      b. Re-measure final pumps' operating data, TDH, volts, amps, speed, and static profile.
      c. Mark final settings.

3.8 PROCEDURES FOR WATER HEATERS

A. Electric Water Heaters:
   1. Measure and record entering- and leaving-water temperatures.
   2. Measure and record water flow.
   3. Measure and record pressure drop.
   4. Measure and Record relief valve(s) pressure setting.
   5. Capacity: Calculate in Btu/h of heating output.
   6. Efficiency: Calculate operating efficiency for comparison to submitted equipment.

3.9 TOLERANCES

A. Set plumbing system's flow rates within the following tolerances:
   1. Domestic Water Flow Rate: Plus 10 percent or minus 5 percent . If design value is less than 10 gpm, within 10 percent.

3.10 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.
   3. Certify validity and accuracy of field data.
B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Pump curves.

2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
2. Name and address of the TAB specialist.
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 supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents, including the following:
a. Indicated versus final performance.
b. Notable characteristics of systems.
c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Notes to explain why certain final data in the body of reports vary from indicated values.
14. Test conditions for pump performance forms, including the following:
a. Variable-frequency controller settings for variable-flow hydronic systems.
b. Settings for pressure controller(s).
c. Other system operating conditions that affect performance.

D. Electric Water Heater Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:
1. Unit Data:
a. System identification.
b. Location.
c. Model number and unit size.
d. Manufacturer's serial number.
e. Output capacity in Btu/h.
f. Number of stages.
g. Connected volts, phase, and hertz.
h. Rated amperage.
2. Test Data (Indicated and Actual Values):
a. Heat output in Btu/h.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. High-temperature-limit setting in deg F.
e. Operating set point in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

E. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves, and include the following:
1. Unit Data:
a. Unit identification.

b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water-pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump speed.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):
a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

F. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.

B. Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day .

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 20 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.

E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
   1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
   2. If the second final inspection also fails, Owner may pursue other Contract options to complete TAB work.
F. Prepare test and inspection reports.

END OF SECTION 220593

PART 1 GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing equipment that is not factory insulated:
   1. Domestic water, pumps.
   2. Domestic water storage tanks.

B. Related Sections:
   1. Section 220719 "Plumbing Piping Insulation."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

1.3 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include, the name of the manufacturer, fabricator, type, description, and size , as well as ASTM standard designation, and maximum use temperature.

1.4 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

C. Coordinate installation and testing of heat tracing.

1.5 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
   1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. All Insulation Installed Indoors; Outdoors-Installed Insulation in Contact with Airstream: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Domestic Water Boiler Breeching Insulation Schedule" and "Indoor Equipment Insulation Schedule" articles for where insulating materials are to be applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
F. Calcium Silicate: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C533, Type I or Type II.
   1. Prefabricated Fitting Covers: Comply with ASTM C450 and ASTM C585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.
      a. Manufacturers: Subject to compliance with requirements, provide products by the following:
         1) Johns Manville; a Berkshire Hathaway company.
G. Flexible Elastomeric: Closed-cell or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type II for sheet materials.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Aeroflex USA.
      b. Armacell LLC.
H. Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 450 deg F in accordance with ASTM C411). Comply with ASTM C553, Type II, and ASTM C1290, Type II, with factory-applied vinyl jacket . Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Certainteed; SAINT-GOBAIN.
      b. Johns Manville; a Berkshire Hathaway company.
      c. Knauf Insulation.
      d. Owens Corning.
I. High-Temperature, Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin, unfaced; suitable for maximum use temperature up to 1000 deg F. Comply with ASTM C553, Type V.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Certainteed; SAINT-GOBAIN.
      b. Johns Manville; a Berkshire Hathaway company.
      c. Knauf Insulation.
      d. Owens Corning.
J. Glass-Fiber Board: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between 35 deg F and 250 deg F for jacketed and between 35 deg F and 450 deg F for unfaced in accordance with ASTM C411. Comply with ASTM C612, Type IA or Type IB. Provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Certainteed; SAINT-GOBAIN.
      b. Johns Manville; a Berkshire Hathaway company.
      c. Knauf Insulation.
      d. Owens Corning.
K. High-Temperature, Glass-Fiber Board: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 1000 deg F in accordance with ASTM C411. Comply with ASTM C612, Type III, unfaced.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Certainteed; SAINT-GOBAIN.
   b. Johns Manville; a Berkshire Hathaway company.
   c. Knauf Insulation.
   d. Owens Corning.

2.3 INSULATING CEMENTS

A. Glass-Fiber and Mineral Wool Insulating Cement: Comply with ASTM C195.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Ramco Insulation, Inc.

2.4 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
   2. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.
   3. Verify adhesive complies 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."
C. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Johns Manville; a Berkshire Hathaway company.
   2. Adhesive: As recommended by Adhesive - PVC Jacket manufacturer and with a VOC content of 50 g/L or less.
   3. Verify adhesive complies 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."

2.5 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.
   1. Mastics: As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.
   2. Verify mastics 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."
B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
      c. Knauf Insulation.

2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: 0 to plus 180 deg F .

2.6 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and be compatible with insulation materials, jackets, and substrates.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
   2. Verify adhesive is as recommended by insulation manufacturer and has a VOC content of 50 g/L or less.
   3. Verify adhesive complies 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."
   4. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over insulation.
   5. Service Temperature Range: 20 to plus 180 deg F.
   6. Color: White.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.
B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Johns Manville; a Berkshire Hathaway company.
   2. Adhesive: As recommended by jacket material manufacturer.
   3. Color: White.
   4. Factory-fabricated tank heads and tank side panels.
C. Metal Jacket:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Johns Manville; a Berkshire Hathaway company.

2.8 TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. 3M Industrial Adhesives and Tapes Division.
   2. Width: 2 inches.
   3. Thickness: 6 mils.
   4. Adhesion: 64 ounces force/inch in width.
   5. Elongation: 500 percent.
   6. Tensile Strength: 18 lbf/inch in width.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
   2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of equipment, as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.
G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
H. Install insulation with least number of joints practical.
I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
   3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or area of compression in the insulation.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 2 inches o.c.
      a. For below-ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints.
L. Cut insulation in a manner to avoid compressing insulation.
M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.
O. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Manholes.
   5. Handholes.
   6. Cleanouts.

3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

A. Glass-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
   1. Apply adhesives in accordance with manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
   2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
   3. Protect exposed corners with secured corner angles.
   4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
      a. Do not weld anchor pins to ASME-labeled pressure vessels.
      b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
      c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints and 16 inches o.c. in both directions.
      d. Do not compress insulation during installation.
      e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
      f. Impale insulation over anchor pins, and attach speed washers.
      g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable and replaceable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

3.5 INSTALLATION OF CALCIUM SILICATE INSULATION

A. Insulation Installation on Domestic Water Boiler Breechings:
1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation material.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.
3. On exposed applications without metal jacket, finish insulation surface with a skim coat of mineral-fiber, hydraulic-setting cement. When cement is dry, apply flood coat of lagging adhesive and press on one layer of glass cloth. Overlap edges at least 1 inch. Apply finish coat of lagging adhesive over glass cloth. Thin finish coat to achieve smooth, uniform finish.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Install in accordance with manufacturer's written installation instructions and ASTM C1710.

B. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:
1. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
2. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.8 FINISHES

A. Equipment Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless steel jackets.

3.9 FIELD QUALITY CONTROL

A. Tests and Inspections: Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to one location(s) for each type of equipment defined in the "Indoor Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

B. All insulation applications will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 INDOOR EQUIPMENT INSULATION SCHEDULE

A. Insulate indoor and outdoor equipment that is not factory insulated.

B. Domestic hot-water storage tank insulation is the following, of thickness to provide an R-value of 12.5 :
1. Glass-Fiber Blanket 6 lb/cu. ft. nominal density.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces of up to 72 Inches:
    1. None.
    2. PVC : 20 mils thick.

END OF SECTION 220716

PART 1 GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Domestic cold-water piping.
   2. Domestic hot-water piping.
   3. Domestic recirculating hot-water piping.
   4. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:
   1. Section 220716 "Plumbing Equipment Insulation" for equipment insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.3 QUALITY ASSURANCE

A. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of the manufacturer, fabricator, type, description, and size, as well as ASTM standard designation and maximum use temperature.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
   1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials are applied.
B. Products do not contain asbestos, lead, mercury, or mercury compounds.
C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
F. Flexible Elastomeric: Closed-cell or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I for tubular materials.
    1. Manufacturers: Subject to compliance with requirements, provide products by the following:
        a. Armacell LLC.
G. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.
    1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
        a. Johns Manville; a Berkshire Hathaway company.
        b. Knauf Insulation.
        c. Owens Corning.
    2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
    3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
    4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 INSULATING CEMENTS

A. Glass-Fiber and Mineral Wool Insulating Cement: Comply with ASTM C195.
    1. Manufacturers: Subject to compliance with requirements, provide products by the following:
        a. Ramco Insulation, Inc.

2.4 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
B. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
    1. Manufacturers: Subject to compliance with requirements, provide products by the following:
        a. Armacell LLC.
    2. Adhesive: As recommended by flexible elastomeric and polyolefin manufacturer and with a VOC content of 80 g/L or less.
    3. Verify adhesive complies 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."
    4. Flame-spread index is 25 or less and smoke-developed index is 50 or less as tested in accordance with ASTM E84.
    5. Wet Flash Point: Below 0 deg F.
    6. Service Temperature Range: 40 to 200 deg F.
    7. Color: Black.

C. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
   2. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.
   3. Verify adhesive complies 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."

2.5 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.
   1. Mastics: As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.
   2. Verify mastics 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."

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
      c. Knauf Insulation.
   2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
   3. Service Temperature Range: 0 to plus 180 deg F.

2.6 SEALANTS

A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
      c. Mon-Eco Industries, Inc.
   2. Permanently flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 58 to plus 176 deg F.
   4. Color: White or gray.
   5. Verify sealant has a VOC content of 420 g/L or less.
   6. Verify sealant complies 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 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Knauf Insulation.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. 3M Industrial Adhesives and Tapes Division.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.8 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Plumberex Specialty Products, Inc.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range of between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.
H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
I. Install insulation with least number of joints practical.
J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
    1. Install insulation continuously through hangers and around anchor attachments.
    2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
    3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
    4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
L. Install insulation with factory-applied jackets as follows:
    1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
    2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
    3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
        a. For below-ambient services, apply vapor-barrier mastic over staples.
    4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
    5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
M. Cut insulation in a manner to avoid compressing insulation.
N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Cleanouts.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate strainers using preformed fitting insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
   6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
   7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
   8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation conforms to the following:
   1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
   2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
   3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
   4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
   5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
   2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless steel jackets.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
2. Underground piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
   1. NPS 1 and Smaller: Insulation is the following:
      a. Flexible Elastomeric: 3/4 inch thick.
   2. NPS 1-1/4 and Larger: Insulation is the following:
      a. Flexible Elastomeric: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:
   1. NPS 1-1/4 and Smaller: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
   2. NPS 1-1/2 and Larger: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
   1. All Pipe Sizes: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:
   1. All Pipe Sizes: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Domestic Hot and Recirculated Hot Water:
   1. All Pipe Sizes: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:
   1. Aluminum, Stucco Embossed : 0.016 inch thick.

END OF SECTION 220719

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. PEX tube and fittings.
4. Piping joining materials.
5. Transition fittings.
6. Dielectric fittings.

1.2 ACTION SUBMITTALS

A. Product Data:
1. Pipe and tube.
2. Fittings.
3. Joining materials.
4. Transition fittings.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
B. System purging and disinfecting activities report.

1.4 WARRANTY

A. Polypropylene Piping (PP-R) Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.
1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.
2. Warranty is to be in effect only upon submission by the Contractor to the manufacturer of valid pressure/leak documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type KandASTM B88, Type L.
B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:
1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
B. Standard-Pattern, Mechanical-Joint Fittings:
1. AWWA C110/A21.10, ductile or gray iron.

2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:
1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Appurtenances for Grooved-End, Ductile-Iron Pipe:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Victaulic Company.
2. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions that match pipe.
3. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:
a. AWWA C606 for ductile-iron-pipe dimensions.
b. Ferrous housing sections.
c. EPDM-rubber gaskets suitable for hot and cold water.
d. Bolts and nuts.

2.4 PEX TUBE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Apollo Valves; a part of Aalberts Integrated Piping Systems.
2. IPEX USA LLC.
3. Uponor.
4. Zurn Industries, LLC.

B. Tube Material: PEX plastic according to ASTM F876 and ASTM F877.

C. Fittings: ASTM F1807, metal insert and copper crimp rings .

D. Push-Fit Fittings: ASSE 1061, push-fit fittings.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Zurn Industries, LLC.

E. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F876; with plastic or corrosion-resistant-metal valve for each outlet.

2.5 PIPING JOINING MATERIALS

A. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

B. Solder Filler Metals: ASTM B32, lead-free alloys.

C. Flux: ASTM B813, water flushable.

D. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

E. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F493.
1. Verify solvent cement has a VOC content of 490 g/L or less.
2. Verify adhesive complies 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."

2.6 TRANSITION FITTINGS

A. General Requirements:
1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
C. Plastic-to-Metal Transition Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Charlotte Pipe and Foundry Company.
      b. Uponor.
   2. Description:
      a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
      b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
D. Plastic-to-Metal Transition Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. NIBCO INC.
   2. Description:
      a. CPVC four-part union.
      b. Brass or stainless steel threaded end.
      c. Solvent-cement-joint or threaded plastic end.
      d. Rubber O-ring.
      e. Union nut.

2.7 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. WATTS.
      b. Zurn Industries, LLC.
   2. Standard: ASSE 1079.
   3. Pressure Rating: 125 psig minimum at 180 deg F .
   4. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
D. Aboveground domestic water piping, NPS 2 and smaller , shall be one of the following:
   1. Drawn-temper copper tube, ASTM B88, Type L ; cast- or wrought-copper, solder-joint fittings; and brazedorsoldered joints.
   2. CPVC, Schedule 40 ; socket fittings; and solvent-cemented joints.
   3. PEX tube, NPS 1 and smaller.
      a. Fittings for PEX tube:
         1) ASTM F1807, metal insert and copper crimp rings.
         2) ASTM F1960, cold expansion fittings and reinforcing rings.
         3) ASSE 1061, push-fit fittings.

E. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 , shall be one of the following:
   1. Drawn-temper copper tube, ASTM B88, Type L ; cast- or wrought-copper, solder-joint fittings; and brazedorsoldered joints.
   2. Stainless steel, Schedule 40 pipe; grooved-joint fittings, and grooved joints.
   3. CPVC, Schedule 40 ; socket fittings; and solvent-cemented joints.

3.2 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.3 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A674 or AWWA C105/A21.5.
E. Install valves according to the following:
   1. Section 220523.12 "Ball Valves for Plumbing Piping."
   2. Section 220523.13 "Butterfly Valves for Plumbing Piping."
   3. Section 220523.14 "Check Valves for Plumbing Piping."
   4. Section 220523.15 "Gate Valves for Plumbing Piping."
F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
G. Install domestic water piping level without pitch and plumb.
H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
L. Install piping to permit valve servicing.
M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
N. Install piping free of sags and bends.
O. Install fittings for changes in direction and branch connections.
P. Install PEX tubing with loop at each change of direction of more than 90 degrees.
Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
R. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220519 "Meters and Gages for Plumbing Piping."
S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    1. Apply appropriate tape or thread compound to external pipe threads.
    2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."
F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.
G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.
H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.

N. Joints for PEX Tubing, ASTM: Join according to ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.
O. Joints for PEX Tubing, ASSE: Join according to ASSE 1061 for push-fit fittings.
P. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.5 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.
B. Transition Fittings in Underground Domestic Water Piping:
   1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
   2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
C. Dielectric Fittings for NPS 2-1/2 to NPS 4 : Use dielectric unions .

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
B. Install hangers for copper ductile iron and stainless steel tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
C. Install vinyl-coated hangers for CPVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
D. Install vinyl-coated hangers for PEX tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
E. Support horizontal piping within 12 inches of each fitting.
F. Support vertical runs of copper ductile iron [**and**] stainless steel tubing and piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
G. Support vertical runs of CPVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
H. Support vertical runs of PEX tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.8 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
   2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
   4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.10 ADJUSTING

A. Perform the following adjustments before operation:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.
   4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
      a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
      b. Adjust calibrated balancing valves to flows indicated.
   5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
   6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
   7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
   8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
         1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
         2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
      c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
      d. Repeat procedures if biological examination shows contamination.
      e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Hose stations.
7. Hose bibbs.
8. Wall hydrants.
9. Roof hydrants.
10. Drain valves.
11. Water-hammer arresters.
12. Trap-seal primer device.
13. Trap-seal primer systems.
14. Flexible connectors.

B. Related Requirements:
1. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gauges, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.
3. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.

1.02 DEFINITIONS

A. AMI: Advanced Metering Infrastructure.
B. AMR: Automatic Meter Reading.
C. FKM: A family of fluroelastomer materials defined by ASTM D1418.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For domestic water piping specialties.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers :

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze.

2.04 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
   1. Standard: ASSE 1013.
   2. Operation: Continuous-pressure applications.
   3. Pressure Loss: 12 psig maximum, through middle third of flow range.
   4. Pressure Loss at Design Flow Rate: 5psig.
   5. Body: Bronze for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
   6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   7. Configuration: Designed for horizontal, straight-through flow.
   8. Accessories:
      a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
      b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
      c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double-Check, Backflow-Prevention Assemblies :
   1. Standard: ASSE 1015.
   2. Operation: Continuous-pressure applications unless otherwise indicated.
   3. Pressure Loss at Design Flow Rate: 5psig.
   4. Body: Bronze for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
   5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
   6. Configuration: Designed for horizontal, straight-through flow.
   7. Accessories:
      a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
      b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

2.05 WATER PRESSURE-REDUCING VALVES

A. Water Regulators :
   1. Standard: ASSE 1003.
   2. Pressure Rating: Initial working pressure of 150 psig.
   3. Body: Bronze for NPS 2 and smaller; bronze for NPS 2-1/2 and NPS 3.
   4. Valves for Booster Heater Water Supply: Include integral bypass.
   5. End Connections: Threaded or solder for NPS 2 and smaller; flanged or solder for NPS 2-1/2 and NPS 3.

2.06 BALANCING VALVES

A. Memory-Stop Balancing Valves :
   1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
   2. Pressure Rating: 400-psig minimum CWP.
   3. Size: NPS 2 or smaller.
   4. Body: Copper alloy.
   5. Port: Standard or full port.
   6. Ball: Chrome-plated brass or stainless steel.

7. Seats and Seals: Replaceable.
8. End Connections: Solder joint or threaded.
9. Handle: Vinyl-covered steel with memory-setting device.

2.07 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Primary, Electronic, Water Mixing Valve Assemblies :
1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Type: Exposed, electronically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded or solder joint inlets and outlet.
6. Accessories: Manual temperature override control, check stops on hot- and cold-water supplies, and automatic hot- and cold-water shutoff upon inlet supply failure.
7. Valve Finish: Bronze.
8. Temperature control and monitoring module.
a. Controls temperature within plus or minus 2 deg F.
b. User programmable at module or through BAS.
c. ASHRAE 188 compliance.
d. Local and remote monitoring.
e. BACNet protocol language(s).
f. 230 V ac, 60 Hz.
g. Battery backup.

2.08 HOSE STATIONS

A. Single-Temperature-Water Hose Stations :
1. Standard: ASME A112.18.1.
2. Cabinet: Stainless steel enclosure with exposed valve handle, hose connection, and hose rack. Include thermometer in front.
3. Hose-Rack Material: Stainless steel.
4. Body Material: Bronze with stainless steel wetted parts.
5. Body Finish: Rough bronze.
6. Mounting: Wall, with reinforcement .
7. Supply Fittings: NPS 3/4 gate, globe, or ball valve and check valve and NPS 3/4 copper, water tubing. Omit check valve if check stop is included with fitting.
8. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; 50 feet long.
9. Nozzle: With hand-squeeze, on-off control.
10. Vacuum Breaker:
a. Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
b. Garden-hose thread complying with ASME B1.20.7 on outlet.

2.09 HOSE BIBBS

A. Hose Bibbs :
1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.

6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle.
12. Operation for Service Areas: Wheel handle .
13. Operation for Finished Rooms: Wheel handle .
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants :
1. Standard: ASME A112.21.3M for concealed -outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet, Concealed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze .
9. Outlet, Exposed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze .
11. Operating Keys(s): Two with each wall hydrant.

2.11 ROOF HYDRANTS

A. Nonfreeze, Draining-Type Roof Hydrants :
1. Standard: ASME A112.21.3M.
2. Type: Nonfreeze, exposed-outlet roof hydrant with coated cast-iron head and lift handle with lock option. Provide with deck flange and under deck clamp.
3. Casing and Operating Rod: Bronze interior parts, galvanized-steel casing, and bronze valve housing designed with hole to drain.
4. Inlet: NPS 3/4 .
5. Outlet: Garden-hose thread complying with ASME B1.20.7.
6. Vacuum Breaker:
   a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
   b. Garden-hose thread complying with ASME B1.20.7 on outlet.

2.12 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves :
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.

5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.13 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters :
   1. Manufacturers: Sioux Chief, Watts, Oaty or approved equal.
   2. Standard: ASSE 1010 or PDI-WH 201.
   3. Type: Metal bellows Diaphragm.
   4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.14 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device :
   1. Standard: ASSE 1018.
   2. Pressure Rating: 125 psig minimum.
   3. Body: Bronze.
   4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
   5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
   6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.15 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems :
   1. Standard: ASSE 1044.
   2. Inlet Size: NPS 3/4, ASTM B88, Type L; copper, water tubing.
   3. Cabinet: Recessed -mounted steel box with stainless steel cover.
   4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120 V ac power.
      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.
   5. Vacuum Breaker: ASSE 1001.
   6. Number Outlets: Six .
   7. Size Outlets: NPS 1/2 .

2.16 FLEXIBLE CONNECTORS

A. Stainless Steel-Hose Flexible Connectors: Corrugated-stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.
   1. Working-Pressure Rating: Minimum 250 psig.
   2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
   3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 EXECUTION

3.01 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
   1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gauges on inlet and outlet.
C. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.
D. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
1. Install cabinet-type units recessed in or surface mounted on wall as specified.
E. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.
1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 1-1/2-by-3-1/2-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
F. Nonfreeze, Sanitary Yard Hydrants: Set with riser pipe in concrete or pavement. Do not encase canister in concrete.
G. Nonfreeze, Draining-Type Roof Hydrants: Install with drain connection piped to nearest floor drain or to the exterior.
H. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.
I. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
J. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.02 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.03 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.04 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.05 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Hose stations.
7. Wall hydrants.
8. Roof hydrants.
9. Trap-seal primer device.
10. Trap-seal primer systems.
11. Water meters.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.06 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.
B. Set field-adjustable flow set points of balancing valves.
C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.
D. Adjust each pressure vacuum breaker reduced-pressure-principle backflow preventer double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.

B. Related Requirements:
1. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.

1.02 ACTION SUBMITTALS

A. Product Data
1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.

B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.03 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:
1. Soil, Waste, and Vent Piping: 10 ft. head of water.
2. Waste, Force-Main Piping: 150 psig.

2.02 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AB & I Foundry; a part of the McWane family of companies.
2. Charlotte Pipe and Foundry Company.
3. Tyler Pipe; a part of McWane family of companies.

B. Pipe and Fittings:
1. Marked with CISPI collective trademark.
2. ASTM A74, service cast iron.

C. Gaskets: ASTM C564, rubber.

D. Caulking Materials: ASTM B29, pure lead and oakum or hemp fiber.

2.04 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AB & I Foundry; a part of the McWane family of companies.
2. Charlotte Pipe and Foundry Company.
3. Tyler Pipe; a part of McWane family of companies.

B. Pipe and Fittings:
1. Marked with CISPI collective trademark.
2. ASTM A888 or CISPI 301.

C. Single-Stack Aerator Fittings: ASME B16.45, hubless, cast-iron aerator and deaerator drainage fittings.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Conine Manufacturing Co., Inc.
b. SE Sovent, or approved equal.

D. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Charlotte Pipe and Foundry Company.
   b. Fernco Inc.
   c. Tyler Pipe; a subsidiary of McWane Inc.
2. Standards: ASTM C1277 and CISPI 310.
3. Description: Stainless steel corrugated shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

PART 3 EXECUTION

3.01 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312200 “Earthwrok"

3.02 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
   1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
E. Install piping to permit valve servicing.
F. Install piping at indicated slopes.
G. Install piping free of sags and bends.
H. Install fittings for changes in direction and branch connections.
I. Install piping to allow application of insulation.
J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
   1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
   2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
      a. Straight tees, elbows, and crosses may be used on vent lines.
   3. Do not change direction of flow more than 90 degrees.
   4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
      a. Reducing size of waste piping in direction of flow is prohibited.
K. Lay buried building waste piping beginning at low point of each system.
   1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
   2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
   3. Maintain swab in piping and pull past each joint as completed.
L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
   1. Building Sanitary Waste: Two percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Sanitary Waste Piping: Two percent downward in direction of flow.
   3. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
   1. Install encasement on underground piping in accordance with ASTM A674 or AWWA C105/A 21.5.
N. Install underground piping in accordance with ASTM D2321.
O. Install engineered soil and waste and vent piping systems as follows:
   1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
   2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
   3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
P. Install underground, ductile-iron, force-main piping according to AWWA C600.
   1. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints.
   2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
   3. Install encasement on piping in accordance with ASTM A674 or AWWA C105/A 21.5.
Q. Install underground, copper, force-main tubing in accordance with CDA's "Copper Tube Handbook."
   1. Install encasement on piping in accordance with ASTM A674 or AWWA C105/A 21.5.
R. Install force mains at elevations indicated.
S. Plumbing Specialties:
   1. Install backwater valves in sanitary waster gravity-flow piping.
      a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
   2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
      a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
      b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
   3. Install drains in sanitary waste gravity-flow piping.
      a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
U. Install sleeves for piping penetrations of walls, ceilings, and floors.
   1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."
V. Install sleeve seals for piping penetrations of concrete walls and slabs.
   1. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."
W. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.03 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
B. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.
C. Hubless, Cast-Iron Soil Piping Coupled Joints:
   1. Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
D. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.
   1. Cut threads full and clean using sharp dies.
   2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
c. Do not use pipe sections that have cracked or open welds.

E. Grooved Joints: Cut groove ends of pipe in accordance with AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
F. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
G. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join in accordance with ASTM D2235 and ASTM D2661 appendixes.
3. PVC Piping: Join in accordance with ASTM D2855 and ASTM D2665 appendixes.
H. Joint Restraints and Sway Bracing:
1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:
a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
b. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.04 INSTALLATION OF SPECIALTY PIPE FITTINGS
A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:
a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
b. NPS 2 and Larger: Pressure transition couplings.
B. Dielectric Fittings:
1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.05 INSTALLATION OF VALVES
A. General valve installation requirements for general-duty valve installation are specified in the following Sections:
1. Section 220523.12 "Ball Valves for Plumbing Piping."
2. Section 220523.14 "Check Valves for Plumbing Piping."
3. Section 220523.15 "Gate Valves for Plumbing Piping."
B. Shutoff Valves:
1. Install shutoff valve on each sewage pump discharge.
2. Install gate valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

3.06 INSTALLATION OF HANGERS AND SUPPORTS
A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" Section 220548 "Vibration Controls for Plumbing Piping and Equipment".

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42 clamps.
6. Install individual, straight, horizontal piping runs:
   a. 100 Ft. (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Ft. (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Ft. (30 m) if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs 100 Ft. (30 m) or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52 spring hangers.

B. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
C. Install hangers for piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
D. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
E. Support vertical runs of cast-iron soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
F. Support vertical runs of piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.07 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
C. Connect waste and vent piping to the following:
   1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
   4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
   5. Install horizontal backwater valves with cleanout cover flush with floor.
   6. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
   7. Equipment: Connect waste piping as indicated.
      a. Provide shutoff valve if indicated and union for each connection.
      b. Use flanges instead of unions for connections NPS 2-1/2 and larger.
D. Connect force-main piping to the following:
   1. Sewage Pump: To sewage pump discharge.
E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
F. Make connections in accordance with the following unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.08 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.09 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
B. Aboveground, soil and waste piping NPS 4 and smaller are to be the following:
   1. Service cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
   3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
C. Aboveground, soil and waste piping NPS 5 and larger are to be the following:
   1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
   3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
D. Aboveground, vent piping NPS 4 is to be the following:
   1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
   3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
E. Underground, soil, waste, and vent piping NPS 4 and smaller are to be the following:
   1. Service cast-iron soil piping; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
   3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
F. Underground, soil and waste piping NPS 5 and larger are to be the following:
   1. Service, cast-iron soil piping; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; coupled joints.
   3. PVC pipe, PVC socket fittings, and solvent-cemented joints.
   4. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:
   1. Section 076200 "Sheet Metal Flashing and Trim" for metal roof flashing assemblies.
   2. Section 077200 "Roof Accessories" for preformed flashings.
   3. Section 078400 "Firestopping" for through-penetration firestop assemblies.
   4. Section 221323 "Sanitary Waste Interceptors" for metal and concrete interceptors outside the building, grease interceptors, grease-removal devices, oil interceptors, and solids interceptors.
   5. Section 334000 "Storm Drainage Utilities" for storm drainage piping and piping specialties outside the building.

1.03 DEFINITIONS

A. ABS: Acrylonitrile butadiene styrene.

B. PVC: Polyvinyl chloride.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Show fabrication and installation details for frost-resistant vent terminals.

PART 2 PRODUCTS

2.01 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.02 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Jay R. Smith Mfg Co; a division of Morris Group International.
      b. Josam Company.
      c. MIFAB, Inc.
      d. WATTS; A Watts Water Technologies Company.
      e. Zurn Industries, LLC.
   2. Standard: ASME A112.36.2M.
   3. Size: Same as connected drainage piping
   4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
   5. Closure: Countersunk or raised-head , cast-iron plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Jay R. Smith Mfg Co; a division of Morris Group International.
      b. Josam Company.
      c. MIFAB, Inc.
      d. WATTS; A Watts Water Technologies Company.
      e. Zurn Industries, LLC.
   2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.

3. Size: Same as connected branch.
4. Type: Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Threaded.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Polished bronze.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Extra Heavy Duty.
13. Riser: ASTM A74, Extra-Heavy Class, cast-iron drainage pipe fitting and riser to cleanout.

2.03 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings:
   1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
   2. Size: Same as floor drain outlet with NPS 1/2 side inlet.
B. Floor-Drain, Inline Trap Seal:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Jay R. Smith Mfg Co; a division of Morris Group International.
      b. Josam Company.
      c. MIFAB, Inc.
   2. Description: Inline floor drain trap seal, forming a physical barrier to slow trap evaporation while not impeding flow from drain.
   3. Material: Polymer.
   4. Standard: Tested and certified in accordance with ASSE 1072.
   5. Listing: IAPMO listed.
   6. Size: Same as floor drain outlet or strainer throat.
C. Air-Gap Fittings:
   1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
   2. Body: Bronze or cast iron.
   3. Inlet: Opening in top of body.
   4. Outlet: Larger than inlet.
   5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
D. Stack Flashing Fittings:
   1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
   2. Size: Same as connected stack vent or vent stack.
E. Vent Caps:
   1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
   2. Size: Same as connected stack vent or vent stack.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
D. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.
E. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
F. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
G. Install vent caps on each vent pipe passing through roof.
H. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.
I. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
J. Install wood-blocking reinforcement for wall-mounting-type specialties.
K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to equipment, to allow service and maintenance.

3.03 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Hub-and-spigot, cast-iron soil pipe and fittings.
   2. Hubless, cast-iron soil pipe and fittings.

B. Related Requirements:
   1. Section 334000 "Storm Drainage Utilities" for storm drainage piping outside the building.

1.02 ACTION SUBMITTALS

A. Product Data:
   1. Hub-and-spigot, cast-iron soil pipe and fittings.
   2. Hubless, cast-iron soil pipe and fittings.

B. Shop Drawings: For controlled-flow roof drainage system. Include calculations, plans, sections, elevations, and details.

1.03 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and elevations or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.

1.04 QUALITY ASSURANCE

A. Provide materials bearing label, stamp, or other markings of specified testing agency.

1.05 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Components and installation are to be capable of withstanding the following minimum working pressure unless otherwise indicated:
   1. Storm Drainage Piping: 10-foot head of water.
   2. Storm Drainage, Force-Main Piping: 150 psig.

2.02 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. AB & I Foundry; a part of the McWane family of companies.
   2. Charlotte Pipe and Foundry Company.
   3. Tyler Pipe; a part of McWane family of companies.

B. Pipe and Fittings:
   1. Marked with CISPI collective trademark and NSF certification mark.
   2. Standard: ASTM A74.
   3. Class: Service weight cast iron.

C. Gaskets: ASTM C564, rubber.

D. Caulking Materials: ASTM B29, pure lead and oakum or hemp fiber.

2.04 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. AB & I Foundry; a part of the McWane family of companies.
   2. Charlotte Pipe and Foundry Company.

3. Tyler Pipe; a part of McWane family of companies.

B. Pipe and Fittings:
   1. Marked with CISPI collective trademark and NSF certification mark.
   2. Standards: ASTM A888 and CISPI 301.

C. Standard, Hubless-Piping Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Charlotte Pipe and Foundry Company.
      b. MIFAB, Inc.
      c. Tyler Pipe; a subsidiary of McWane Inc.

D. Marked with CISPI collective trademark and NSF certification mark.

E. Standards: ASTM C1277 and CISPI 310.

F. Description: Stainless steel corrugated shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

PART 3 EXECUTION

3.01 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312200 "Earthwork."

3.02 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

B. Install piping as indicated unless deviations from layout are approved on coordination drawings.

C. Install piping in concealed locations.
   1. Piping installed in equipment rooms, service areas, and where indicated may be exposed.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.
   1. Do not change direction of flow more than 90 degrees.
   2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
      a. Reducing size of drainage piping in direction of flow is prohibited.

L. Lay buried building piping beginning at low point of each system.
   1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
   2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
   3. Maintain swab in piping and pull past each joint as completed.

M. Install piping at the following minimum slopes unless otherwise indicated.
   1. Building Storm Drain: 1/4 inch per foot downward in direction of flow for piping NPS 3 and smaller; 1/4 inch per foot downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Storm Drainage Piping: 1/4 inch per foot downward in direction of flow.

N. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Ch IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping in accordance with ASTM A674 or AWWA C105/A 21.5.

O. Install steel piping in accordance with applicable plumbing code.
P. Install underground piping in accordance with ASTM D2321.
Q. Install engineered controlled-flow drain specialties and storm drainage piping in locations indicated.
   1. Install encasement on piping in accordance with ASTM A674 or AWWA C105/A 21.5.
R. Install force mains at elevations indicated.
S. Plumbing Specialties:
   1. Install backwater valves in storm drainage gravity-flow piping.
      a. Comply with requirements for backwater valves specified in Section 221414 "Storm Drainage Piping."
   2. Install cleanouts in storm drainage gravity-flow piping in accessible locations.
      a. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
      b. Comply with requirements for cleanouts specified in Section 221414 "Storm Drainage Piping."
   3. Install drains in storm drainage gravity-flow piping.
      a. Comply with requirements for drains specified in Section 221414 "Storm Drainage Piping."
T. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
U. Install sleeves for piping penetrations of walls, ceilings, and floors.
   1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."
V. Install sleeve seals for piping penetrations of concrete walls and slabs.
   1. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."
W. Install escutcheons for piping penetrations of walls, ceilings, and floors.
   1. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.03 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
B. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.
C. Hubless, Cast-Iron Soil Piping Coupled Joints: Join in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
D. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.
   1. Cut threads full and clean using sharp dies.
   2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
      a. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
      b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
      c. Do not use pipe sections that have cracked or open welds.
E. Grooved Joints: Cut groove ends of pipe in accordance with AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

F. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
G. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
   1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
H. Joint Restraints and Sway Bracing:
   1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:
      a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
      b. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
      c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
   1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
   2. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
   3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
   4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
   5. Vertical Piping: MSS Type 8 or Type 42, clamps.
   6. Install individual, straight, horizontal piping runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
   7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   8. Base of Vertical Piping: MSS Type 52, spring hangers.
B. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
C. Install hangers for piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
D. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
E. Support vertical cast-iron piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent, but as a minimum at base and at each floor.
F. Support vertical piping with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.05 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
C. Connect storm drainage piping to roof drains and storm drainage specialties.
   1. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

2. Install horizontal backwater valves with cleanout cover flush with floor.
3. Comply with requirements for cleanouts and drains specified in Section 221414 "Storm Drainage Piping."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
E. Make connections in accordance with the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.06 IDENTIFICATION
A. Identify exposed storm drainage piping.
B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.07 PROTECTION
A. Protect piping and drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
B. Place plugs in ends of uncompleted piping at end of day and when work stops.
C. Repair damage to adjacent materials caused by storm drainage piping installation.

3.08 PIPING SCHEDULE
A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
B. Aboveground storm drainage piping NPS 6 and smaller is to be any of the following:
1. Service weight, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
C. Aboveground, storm drainage piping NPS 8 and larger is to be any of the following:
1. Service weight, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
D. Underground storm drainage piping NPS 6 and smaller shall be any of the following:
1. Service weight, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.
E. Underground, storm drainage piping NPS 8 and larger is to be any of the following:
1. Service weight, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY
- A. Section Includes:
  1. Commercial, electric, storage, domestic-water heaters.
  2. Domestic-water heater accessories.

1.02 ACTION SUBMITTALS
- A. Product Data:
  1. Commercial, electric, storage, domestic-water heaters.
  2. Domestic-water heater accessories.
- B. Shop Drawings:
  1. Include diagrams for power, signal, and control wiring.

1.03 INFORMATIONAL SUBMITTALS
- A. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.

1.05 COORDINATION
- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.06 WARRANTY
- A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
     a. Structural failures including storage tank and supports.
     b. Faulty operation of controls.
     c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  2. Warranty Periods: From date of Substantial Completion.
     a. Commercial, Electric, Storage, Domestic-Water Heaters:
        1) Storage Tank: Three years.
        2) Controls and Other Components: Three years.
     b. Expansion Tanks: Five years.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS
- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. Seismic Performance: Commercial, electric, domestic-water heaters to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.
  1. 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."
  2. Component Importance Factor: 1.5.
- C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.02 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS
- A. Commercial, Electric Tankless, Storage, Domestic-Water Heaters:
  1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
  2. Standard: UL 1453.
  3. Special Requirements: NSF 5 construction.

2.03 DOMESTIC-WATER HEATER ACCESSORIES
- A. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.

B. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1 .
C. Heat-Trap Fittings: ASHRAE/IES 90.1 .
D. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
E. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

PART 3 EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."
   1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
   2. Maintain manufacturer's recommended clearances.
   3. Arrange units so controls and devices that require servicing are accessible.
   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 epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   7. Install anchor bolts to elevations required for proper attachment to supported equipment.
   8. Anchor domestic-water heaters to substrate.
B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
   1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
F. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
G. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
H. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric,

domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

I. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
J. Fill electric, domestic-water heaters with water.
K. Charge domestic-water expansion tanks with air to required system pressure.
L. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water to contain less than 0.25 percent of lead by weight.

3.02 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters. Training to be a minimum of two hour(s).

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Flushometer valves.
   2. Toilet seats.
   3. Supports.

1.02 DEFINITIONS

A. Standard-Efficiency Flush Volume: 1.6 gal. per flush.
B. High-Efficiency Flush Volume: 1.28 gal. or less per flush.
C. WaterSense Fixture: Water closet and/or flushometer valve/tank certified by the EPA to meet the WaterSense performance criteria.

1.03 ACTION SUBMITTALS

A. Product Data:
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Standards:
   1. Comply with ASME A112.19.2/CSA B45.1 for water closets.
   2. Comply with ASME A112.19.5/CSA B45.15 for flush valves and spuds for water closets and tanks.
   3. Comply with ASSE 1037/ASME A112.1037/CSA B125.37 for flush valves.
   4. Comply with IAMPO/ANSI Z124.5 for water-closet (toilet) seats.
   5. Comply with ASME A112.6.1M for water-closet supports.
   6. Comply with ICC A117.1 for ADA-compliant water closets.
   7. Comply with ASTM A1045 for flexible PVC gaskets used in connection of vitreous China water closets to sanitary drainage systems.
   8. Comply with ASME A112.4.3 for plastic fittings used in connection of vitreous China water closets to sanitary drainage systems.

2.02 FLUSHOMETER VALVES

A. Flushometer Valves - Piston, Lever Handle:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard.
      b. Kohler Co.
      c. Sloan Valve Company.
   2. Source Limitations: Obtain flushometer valve from single source from single manufacturer.
   3. Minimum Pressure Rating: 125 psig.

4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Style: Exposed.
7. Flushometer-Valve Finish: Chrome-plated.
8. Handle Finish: Antimicrobial.
9. Consumption: 1.28 gal. per flush.
10. Minimum Inlet: NPS 1.
11. Minimum Outlet: NPS 1-1/4.

2.03 TOILET SEATS

A. Toilet Seats:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard.
      b. Jones Stephens Corp.
      c. TOTO USA, INC.
   2. Source Limitations: Obtain toilet seat from single source from single manufacturer.
   3. Material: Plastic.
   4. Type: Commercial (Heavy duty).
   5. Shape: Elongated rim, open front.
   6. Hinge: Self-sustaining, check.
   7. Hinge Material: Noncorroding metal.
   8. Seat Cover: Not required.
   9. Color: White.
   10. Surface Treatment: Antimicrobial.

2.04 SUPPORTS

A. Water-Closet Carrier:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Jay R. Smith Mfg Co; a division of Morris Group International.
      b. MIFAB, Inc.
      c. WATTS; A Watts Water Technologies Company.
   2. Source Limitations: Obtain water-closet carrier from single source from single manufacturer.
   3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
B. Examine walls and floors for suitable conditions where water closets will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Water-Closet Installation:
   1. Install level and plumb.
   2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
   3. Install accessible, wall-mounted water closets at mounting height in accordance with ICC A117.1.
B. Support Installation:
   1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.

2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.
5. Measure support height installation from finished floor, not structural floor.

C. Flushometer-Valve Installation:
1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations easily reachable for people with disabilities.
5. Install new batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.
E. Install water hammer arrestor at each flush valve.
F. Wall Flange and Escutcheon Installation:
1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."

G. Joint Sealing:
1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 PIPING CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.04 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.
D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
1. Nameplate to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.05 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.
B. Connect control wiring in accordance with Division 25.

3.06 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
B. Adjust water pressure at flushometer valves to produce proper flow.
C. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.07 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
B. Install protective covering for installed water closets and fittings.
C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Vitreous-china, wall-mounted lavatories.
2. Manually operated lavatory faucets.
3. Supply fittings.
4. Waste fittings.
5. Lavatory supports.

1.02 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 lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.03 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
1. In addition to items specified in Section 017800 "Closeout Submittals," include the following:
a. Servicing and adjustments of automatic faucets.

1.04 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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 PRODUCTS

2.01 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory - Accessible, Rectangular, Vitreous China, Wall Mounted:
1. Fixture:
a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: Accessible.
c. Faucet-Hole Location: Top.
d. Color: White.
e. Mounting: For concealed-arm carrier.
2. Support: Type II, concealed-arm lavatory carrier with escutcheons.
3. Lavatory Mounting Height: In accordance with ICC A117.1.

2.02 MANUALLY OPERATED LAVATORY FAUCETS

A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Lavatory Faucets - Manual Type: Two-Handle Mixing, Commercial, :
1. Standard: ASME A112.18.1/CSA B125.1.
2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.

3. Body Type: .
4. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.
5. Finish: Polished chrome plate.

2.03 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.
B. Standard: ASME A112.18.1/CSA B125.1.
C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.
D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
E. Operation: Wheel handle.
F. Risers:
   1. NPS 3/8 .
   2. ASME A112.18.6/CSA B125.6, braided- or corrugated-stainless steel, flexible hose riser.

2.04 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.
B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
C. Trap:
   1. Size: NPS 1-1/2 by NPS 1-1/4 .
   2. Material:
      a. Chrome-plated, one-piece, cast-brass trap with swivel 0.029-inch- thick tubular brass wall bend; and chrome-plated, brass or steel wall flange.

2.05 LAVATORY SUPPORTS

A. Lavatory Carrier:
   1. Standard: ASME A112.6.1M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
B. Examine counters and walls for suitable conditions where lavatories will be installed.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install lavatories level and plumb in accordance with roughing-in drawings.
B. Install supports, affixed to building substrate, for wall-mounted lavatories.
C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, in accordance with ICC A117.1.
D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."
E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.
D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
    1. Nameplate must be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
    2. Nameplate to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.05 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.06 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.
B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
C. Provide protective covering for installed lavatories and fittings.
D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

DIVISION 23

Heating, Ventilation, and Air Conditioning

PART 1 GENERAL

1.1 WORK INCLUDED

A. Work includes the following: Provide all materials, equipment, labor, supervision, tools and items necessary for the construction, installation, connection, testing and operation of all mechanical work for this project.

B. Work includes the following:
   1. Motors
   2. Motor Control equipment
   3. Supports and support accessories
   4. Anchoring Hardware
   5. Identification
   6. Balancing work
   7. Painting

C. DEFINITIONS AND ABBREVIATIONS
   1. The word "provide", as used in these specifications, means "furnish and install".
   2. The word "accepted", as used in these specifications, means the acceptance of the Engineer.
   3. Definitions and abbreviations of all terms shall be in accordance with applicable definitions of:

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating & Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CISPI	Cast Iron Soil Pipe Institute
FM	Factory Mutual Engineering Corporation
HI	Hydraulic Institute
MSS	Manufacturers' Standardization Society of the Valve and Fittings Industry, Inc.
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
UL	Underwriters' Laboratories, Inc.
IBC	Washington State Building Code
UPC	Uniform Plumbing Code
IMC	Washington State Mechanical Code
WAC	Washington Administrative Code
WSEC	Washington State Energy Code
WISHA	Washington Industrial Safety & Health Act

D. Refer also to Division 1 for additional acronyms and for additional definitions and explanations of terms.

E. Some of these abbreviations may not be used. All other abbreviations shall have the definition commonly associated with them by the trade or industry. Confirm the meaning of any unclear or unknown definitions with the Architect before proceeding with any work.

1.2 PLANS AND SPECIFICATIONS

A. The drawings and specifications are intended to cover all mechanical work, unless otherwise shown. Provide all materials that are necessary for the proper completion of the installation or operation of the equipment.

B. The drawings are diagrammatic and do not show exact or complete ductwork and piping configurations or the necessary number and types of fittings. Provide all labor and materials required to complete the work indicated.

C. Any questions occurring during bidding or construction shall be resolved by direction in writing from the Architect. Any issues not so resolved or any conflicts shall result with the contractor bidding, furnishing and installing the most stringent condition. No exceptions.

1.3 LAW AND ORDINANCES

A. General:
   1. All mechanical work specified under this contract shall be in strict accordance with the latest rules and regulations of all applicable codes.
   2. Contractor is not relieved from furnishing and installing work shown or specified which may be beyond requirements of ordinances, laws, regulations, and codes. This work shall be included within the construction contract.

B. Approval: File necessary plans, prepare documents and obtain necessary approval of governmental departments having jurisdiction and required certificates of inspection for work and deliver same to Architect before requesting acceptance and final payment for work.

C. Permits, Certificates and Taxes: Procure and pay for all the necessary permits, certificates, and taxes for all work as required in the General and Supplementary Conditions. In addition, perform all ordinance and performance tests in the presence of the Architect, and be responsible for advance notification. Submit copies of signed and accepted permits to the Architect.

1.4 MATERIAL REVIEW, SUBMITTALS AND SHOP DRAWINGS: 01 30 00

A. General:
   1. Provide submittals for all equipment and systems indicated and specified by the Contract Documents.

B. Prepare and distribute submittals:
   1. Identify each transmittal using the 6-digit specification section number and section title.
   2. Pay for all costs associated with materials, reproduction, and distribution.

C. Submittals shall be complete, containing the information describing the equipment and systems of all trades. All submittals and submittal information shall be submitted at the same time, organized as described below.

D. The project construction schedule, beginning with the acceptance of the bid and confirmation of the successful bidder, is not the responsibility of the Architect / Engineer. The contractor's schedule shall recognize and accommodate the review intervals specified herein. The schedule shall identify and accommodate the specified submittal and re-submittal review and response period. The contractor shall not anticipate or base the construction schedule on expedited reviews or reviews of partial submittals. Submittals shall be organized and delivered as specified. No exceptions.

E. Review all items prior to submission. Submittals shall bear the General Contractors stamp, certifying that the contractor has:
   1. Verified all field dimensions and quantities.
   2. Verified all field construction criteria, materials, catalog numbers and similar data.

3. Reviewed and coordinated submittal data with requirements of the work and the Contract Documents.

F. Indicate any item, component, material or portion of work which deviates from Contract Documents and completely describe and illustrate nature and extent of deviation. Unless such departures are accepted as indicated in paragraph "Engineer Review", such departures shall not be permitted.

G. Make submittals sufficiently in advance of required acceptance date to allow Architect / Engineer 10 working days for each review and resubmission if necessary.
   1. Items submitted without Contractor's review stamp will be returned without action, for resubmission.
   2. Items not submitted in accordance with provisions of this section will be returned, without action, for re-submittal.
   3. Submission of items not accepted as specified by the project manual or addenda will be rejected.

H. Do not place orders for materials, fixtures, or equipment until acceptance is obtained from Architect/Engineer in writing. Oral acceptance will not be considered.

1.5 SUBMITTALS AND SHOP DRAWINGS: 01 30 00

A. Submit:
   1. Provide electronic copy of the submittals. Reference project information shall include:
      a. Project title,
      b. Project number and Location,
      c. Architect,
      d. Engineer,
      e. Contractor,
      f. Subcontractor(s),
      g. Submission date,
      h. Specification sections submitted.
   2. Label cover and binder end. Clearly indicate any items not included with submitted assemblies. Architect / Engineer will not take responsibility for collating submitted information into notebooks. Submittals not bound and organized as specified will be rejected.
   3. The contractor shall make every attempt to respond to the Architect and Engineer comments in a timely manner. Submittal material requiring more than three Engineering reviews will be considered non-responsive. The Architect / Engineer may elect to charge the contractor on an hourly basis for additional consultation as required to secure a responsive submittal.

B. Standards Compliance and Certification:
   1. Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI), American Society for Mechanical Engineers (ASME), Underwriters Laboratories Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA) that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and accepted.
   2. Submit certification for the product submitted and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply the product does not meet all requirements specified, such as "as good as"; "achieve the same end use and results as materials formulated in accordance with the referenced publications"; "equal or exceed the service and performance of the specified material." Simply state that the product conforms to the requirements specified.

1.6 SUBSTITUTION OF MATERIALS:

A. Substitutions of materials will only be considered where specified materials can not be obtained. All work and equipment required incidental to the substitution is the responsibility of the Contractor. Substitutions are only permitted if approved in writing by the Owner. Verbal approvals shall not be binding.

B. Refer also to Division 1.

1.7 SHOP DRAWINGS:

A. Submit in mailing tube if drawing cannot be shipped flat. Do not fold.

B. Submit drawings 8-1/2" x 11", 11" x 17" or 24" x 36" unless size of the items depicted makes such sizes impractical. Scale of drawings shall match that of the construction documents.

C. Prepare shop drawings on a background furnished by the Architect.

D. Prior to any installation or fabrication of the system components, the contractor shall submit five complete sets of shop drawings to the Architect for approval by the Architect, Engineer and the Owner.

E. Contractor shall schedule submittal to Architect and include sufficient resources with bid to accommodate an additional revision and re-submittal.

F. Incomplete shop drawings will be rejected unless prior approval is requested and given from the Architect and Owner for partial submittals.

G. Review of the shop drawings by the Architect, Owner, or AHJ does not relieve the contractor from coordinating the installation of the work with all other trades, nor from compliance with all applicable codes and standards.

H. Electronic submittals are acceptable in lieu of physical copies noted above. If electronic submittals are disorganized or illegible they shall be rejected and physical copies will be requested.

1.8 SUBMITTAL REVIEW:

A. Review is general and does not:
   1. Permit departure from Contract Documents.
   2. Relieve Contractor from responsibility for error in detail, quantities, dimensions or related items.
   3. Approve departure from previous instructions or detail.
   4. Relieve Contractor of responsibility to provide all components, wiring, etc., required to make item operational or usable.
   5. Imply approval of items for which no data is submitted.

B. Work which requires submittals shall not be started without Architect's / Engineer 's review.
   1. Allow ten working days for engineering review.
   2. Approval will be indicated by a signed stamp affixed to the submittal, or a letter over the Architect's / Engineer's signature. No exceptions.

1.9 RE-SUBMITTALS:

A. Items of materials, fixtures and equipment not accepted by Architect shall be resubmitted within 30 days after engineering review. If Contractor fails to submit items listed below for approval or resubmit in the event of disapproval within specified time, Contractor shall provide materials, fixtures and equipment as scheduled on drawings. Where equipment is not scheduled the Contractor shall provide materials, fixtures and equipment as identified in the specifications.

B. Decision of Architect shall be final and binding and items shall be provided without change in contract price or time

1.10 SAFETY AND PROTECTION:

A. Drive Guards: Provide OSHA-accepted drive and shaft guards for all exposed, rotating shafts and drive connections between motors and driven equipment. Include steel frames securely fastened for easy removal to the equipment frame. Provide tachometer cut-out at shafts where applicable.

B. Head Protection: Where pipe hangers, equipment support angles, etc., are exposed in walkways, or in access ways for any maintenance, cover all such potentially injurious protrusions less than 7' 2" above the floor with padding; secure and permanently fasten, and finish to match adjacent finishes.

1.11 TESTING, DEMONSTRATION AND COMMISSIONING

A. Demonstrate that all equipment operates as indicated and in accordance with manufacturer's recommendations. Support the inspections and testing of components and systems called for to commission the mechanical system. Commissioning shall be by the general contractor with construction administration oversight by the Architect / Engineer team. Perform tests in the presence of the Architect and Owner's Project Manager; give minimum one-week notice prior to test. Provide all instruments and personnel required to conduct the tests. Refer to Section 230800 for additional Commissioning requirements.

1.12 OPERATIONS AND MAINTENANCE MANUALS

A. Furnish operations and maintenance (O&M) manuals to the Architect before conducting owner instruction session in accordance with Section 017800. Furnish copies of the O & M manuals for review in accordance with Section 017800.

B. O & M manuals shall include full descriptions of all systems and products installed under this contract. Furnish complete narrative descriptions, product and originals of equipment descriptions with exploded diagrams, parts lists including part numbers, disassembly and assembly instructions and control wiring diagrams.

1.13 RECORD DOCUMENTS

A. Maintain record documents as construction commences. Evaluation of pay requests shall be partially based on the level of completion indicated by the record documents. Refer to Section 017800.

B. Mechanical Subcontractor shall transfer marks from the jobsite record set to electronic records and furnish a reproducible plan set and electronic records (As-Built Drawings) at the conclusion of the contract. This includes but is not limited to detailed and accurate drawings of all site and building piping, equipment, and appurtenances.

1.14 INSTRUCTION PERIODS FOR OWNER'S PERSONNEL

A. Description: Following installation of all mechanical equipment and prior to acceptance of the mechanical work, conduct demonstrations and instruction periods to point out locations of servicing points and required points of maintenance and operation to Owner's Project Manager. Refer also to the requirements of Section 017700.

1.15 PUNCH LIST & WARRANTY

A. Refer to the requirements of Section 017700 and Section 017800.

1.16 INDUSTRY STANDARDS, CODES AND SPECIFICATIONS

A. All materials, equipment, and systems shall conform to the following applicable industry standards, codes and specifications:

ANSI	AWS	IBC	NEMA	SMACNA	WISHA
ASHRAE	CISPI	IMC	NFPA	UL	WSEC
ASME	FM	MSS	NSI	UPC	
ASTM	HI	NEC	OSHA	WAC	

B. Where differences occur between state laws, local ordinances, industry standards, utility company regulations and contract documents, the most stringent shall govern.

1.17 QUALITY ASSURANCE:

A. Regulatory Requirements: Comply with all applicable City, County, and State codes and ordinances. In case of conflict with drawings or specifications, the more stringent requirements govern.

B. All equipment specified herein, including but not limited to motors, motor control equipment, starters, panels, etc., shall be UL listed. European standard shall not be considered as an equivalent.

C. Basis: Washington State Building Code, Uniform Plumbing Code; Washington State Mechanical Code and local amendments to the same.

D. Installing Contractor Qualifications: HVAC, sheetmetal and air moving equipment systems shall be installed by experienced, sheetmetal contractors and experienced installers. The installation of ductwork and air moving systems shall be by journeyman sheetmetal workers or by journeyman sheetmetal works supervising apprentices. Installers shall be employed directly by the contractor, and not subcontracted. Journeymen shall have minimum 5 years of experience successfully installing HVAC, sheetmetal and air moving equipment systems similar to those described by these contract documents.

PART 2 PRODUCTS

2.1 GENERAL

A. Comply with "Quality Assurance" provisions, Specifications, and Manufacturers' Data. Where these may be in conflict, the more stringent requirements govern. Coordinate work with Division 26.

2.2 MOTORS

A. Provide motors conforming to the following unless noted otherwise:
   1. Design and Construction: Unless otherwise indicated, provide electric motors and enclosures described by this specification conforming to the applicable definitions and requirements of NEMA MG-1.
   2. Standard Commercial Product: Provide motors of manufacturers' standard commercial product. A standard commercial product is a product which has been or will be sold on the commercial market through advertisements or manufacturers' catalogs or brochures, and represents the latest production model(s).
   3. Nameplates: Provide all motors with readily visible nameplates containing the information required in NEMA MG-1.

2.3 MOTOR REQUIREMENTS:

A. Manufacturer: General Electric, Lincoln, Allis-Chalmers, Goulds or U.S. Motors or accepted equal.

B. Type: Furnish High Efficiency motors. Motor efficiencies shall meet or exceed the efficiency values required by the Washington State Energy Code.

2.4 MOTOR CONTROL EQUIPMENT

A. General: The mechanical contractor is responsible for providing and installing motor control equipment as required for mechanical equipment and systems, unless otherwise indicated or directed. Refer also to the requirements of Division 26. Motor control equipment shall be comprised of and comply with the following:

B. Magnetic motor starters: Where equipment is under automatic control and is furnished with a disconnecting means, provide magnetic motor starters. Starters shall conform to or contain items called for below and unless noted otherwise, shall be full voltage non-reversing for NEMA size 3 and under. No starters smaller than NEMA size 0 and no half size starters are permitted. Provide starters with protection for phase loss, phase imbalance, overload, and ground fault. Wye-delta type must have motor designed for this use. Coordinate work as required.
   1. Overload devices: Melting alloy or bimetallic type. One overload shall be provided for each phase. Provide ambient compensated overload devices only when the motor is at a constant temperature and the controller is subject to a separate, varying temperature. Automatic reset overload devices are not permitted.
   2. Accessories: Each magnetic motor controller shall include, "HAND-OFF-AUTO" selector switch, 120 volt coil (unless noted otherwise), red running pilot light, green off pilot light, 100VA (minimum) control transformer (except for 115 volt motors), surge suppression kit, with fused primary and secondary, two spare auxiliary interlock contacts and all other accessories required or noted.
   3. Enclosures: Motor controllers shall be contained in an enclosure suitable for the environment in which the controller is mounted. Enclosures located in damp, moist locations and outdoors shall be NEMA 3R throughout.

C. Combination motor controller, motor starter and disconnect. Where equipment is under automatic control and is not provided with a disconnecting means, provide combination motor starter and disconnect. Provide as specified above, and also include a disconnecting means. Shall be fused switch type (Class RK5), or motor circuit protector type rated for 22,000 RMS A.I.C. minimum unless noted otherwise and containing all accessories as listed above. If externally powered control circuits are used, provide an auxiliary switch on the disconnect switch or protector and fuse in lieu of the control transformer. Switch or protector shall be capable of being padlocked in the off position.

D. Manual Starters: Where equipment is under manual control, provide manual starter. Starter shall be toggle switch type, lockable in the "off" position, with overload relays, pilot light and enclosure per above.

E. Accepted Manufacturers: Allen Bradley or as accepted through prior approval.

2.5 EXPANSION SHELLS AND BOLTS

A. Expansion Shells for Rod Hangers
   1. Phillips, Gregory, Omark, or Fastite in holes drilled in concrete.

B. Expansion Bolts for Equipment
   1. USM or McCullough in holes drilled in concrete.
   2. No screwed adapters underground.

2.6 FORMED STEEL CHANNELS AT SLAB

A. Provide for all equipment; number and size per manufacturer's recommendations or as indicated.

2.7 ANCHOR BOLTS

A. Provide for all equipment; number and size per manufacturers' recommendations or as indicated.

2.8 SUPPLEMENTARY STEEL FRAMING

A. Standard structural steel shapes or Schedule 40 steel pipe, galvanized with extra-heavy finish.

2.9 SLEEVES

A. Materials, General Schedule: 40 galvanized steel pipe with unthreaded ends, or standard structural steel shapes.

B. Firestopping: Three-hour rated penetration sealing system per UL 1479 and ASTM E-814. 3M Fire Barrier, Dow Chemical RTV, Manville Cerafiber, or accepted.

C. Seal: Seal annulus with bolted compression type seal. Link Seal or accepted equal.

2.10 WELDING TO BUILDING STRUCTURAL MEMBERS

A. Not allowed except as indicated.

2.11 NAMEPLATES

A. Laminated black plastic with lettering cut through to white background. Plastic strips with raised letters made by a marking device are not acceptable.

2.12 VALVE TAGS

A. Shall be 0.030" thick brass, 1" diameter size; state the service and destination of the line controlled. Provide tag inscriptions made with a lettering device with 5/16" high cut lettering. Laminated plastic tags, construction similar to nameplates will also be acceptable.

2.13 PIPING IDENTIFICATION

A. Self adhesive, pre-printed identification labels indicating direction of flow and pipe contents, using common industry abbreviations. Identify pipe at every change of direction.

2.14 SPECIAL MAINTENANCE MATERIALS

A. Provide for equipment requiring frequent replacement of maintenance materials. Provide an extra set of filters, and belts; together with application devices and instructions.

2.15 PAINTING

A. Paint all exposed fixtures and equipment in conformance with Section 109900. Coordinate color with Architect. Refer to Architectural documents for paint and application requirements.

2.16 EQUIPMENT LISTING REQUIREMENTS

A. Whenever UL Standards exist for equipment provide UL-accepted equipment bearing the UL label.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify installation conditions as satisfactory to receive work of this Section. Do not install until any unsatisfactory conditions are corrected. Beginning work constitutes acceptance of conditions as satisfactory.

3.2 PREPARATION

A. Field Measurements: Field-verify locations of new and existing work prior to commencing work of this Section.

B. Protect surrounding areas and surfaces to preclude damage from work of this Section.

3.3 INSTALLATION, ERECTION, AND PERFORMANCE

A. Install, apply, erect, and perform the work in accordance with "Quality Assurance" provisions, Specifications, and manufacturers' installation instructions and directions. Where these may be in conflict, the more-stringent requirements govern.

3.4 CLEANING

A. Promptly remove waste material and rubbish caused by mechanical construction work. At completion of the project, clean all equipment, piping and fixtures installed or provided under this Contract.

3.5 CUTTING AND PATCHING

A. Cut all openings and holes required for mechanical work. Carefully examine existing conditions prior to commencing work.

3.6 ACCESSIBILITY

A. Locate valves, dampers, controls, etc., to be easily accessible.

B. Install all equipment that requires periodic servicing or repairs to be readily accessible. Otherwise, obtain Architect's approval of location. Where valve and equipment is concealed behind access panels or by ceiling tiles, label panel or tile appropriately.

C. Provide access panels as indicated or required for piping, valve or equipment access. Refer to Architectural Documents to determine fire-rating requirements. The access panel size shall be in proportion to the equipment, piping, or valve requiring access. Minimum access panel size shall be 12" x 12". See Section 083100.

3.7 SPECIAL PROTECTION

A. Exercise maximum precaution to provide positive protection for the existing building and equipment from damage of any kind, and in particular prevent any water and dust seepage into the existing building.

B. Storage of materials: Make all necessary provisions to prevent damage or corrosion of materials.

3.8 EQUIPMENT INSTALLATION

A. General: Provide supports for all equipment and appurtenances as required, including braces as required for seismic restraint; these include frames or supports for pumps and air handlers and all mechanical equipment. Bracing shall conform with the requirements of IBC and IMC. Include the design, engineering and installation of these members is the responsibility of the contractor.

B. Suspended Equipment: Provide hangers from structure as required; span between structural members with additional structural steel as required to mount equipment in locations shown. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.

C. Floor-Mounted Equipment - General:

1. Provide machine and floor or foundation fastenings; set equipment on concrete pads. Provide equipment base drawings, bolt-setting information, and anchors for all floor-mounted equipment. Provide concrete expansion anchors through concrete equipment pads, installed into existing structural concrete slabs.
2. Install all equipment at the locations, and to the dimensions indicated. Set equipment accurately with principal centerlines and level, using manufacturers' leveling screws, blocks, shims, or wedges. Do not distort equipment or base plates.

3. Install all equipment, piping and ducting such as to provide adequate access for service. This includes access to equipment covered in other divisions or sections of this specification.

3.9 PIPE SUPPORTS

A. Attach hangers and support rigidly to the building structure; provide supplementary steel framing and bracing at all changes in pipe direction to resist thrust of flowing water. Provide seismic bracing as required by codes. Do not fasten hangers to metal deck. Do not use powder-actuated fasteners.

B. Provide additional steel support for piping runs through tight confinements. Provide trapeze system with vibration isolation and seismic restraint for piping through joists and as applicable, due to accessibility of ductwork and mechanical equipment.

3.10 EXPANSION SHELLS AND BOLTS

A. Use only where necessary to support piping or equipment from existing concrete slabs or walls.

3.11 SLEEVES AND SEALING OF SLEEVES

A. Provide all sleeving and sealing of sleeves for pipes and ducts.

B. Provide annular clear space of approximately 1/4" to 1/2"; size to accommodate insulation passing through sleeve where applicable.

C. Wherever piping passes through any floor slab above occupied space or equipment, provide pipe sleeves extending 1" above floor.

D. Set sleeves in place prior to pouring of concrete in new construction; core drill and grout sleeves in place for unit masonry construction and existing construction.

E. Sealing of sleeves through floor slabs and firewalls: Provide firestop system by 3M or accepted equal.

F. Sealing of sleeves for below grade floors and walls: Provide Link Seal. Refer to 232113.

3.12 NAMEPLATES

A. Provide for all equipment; fasten mechanically. Label access panel or ceiling appropriately for concealed equipment.

3.13 VALVE TAGS

A. Provide on all new valves; fasten with brass chain to the valve stem.

3.14 PIPING IDENTIFICATION

A. Provide pipe identification labels on not less than 10 foot centers, on both sides of a wall penetration, and at every change in direction, so that a label is visible from a standing position on The floor, not more than three feet from the wall. Refer also to this Section for pipe labeling requirements.

3.15 PAINTING

A. General Paint exposed equipment, ducts, piping, sheet metal work and mechanical system appurtenances unless noted otherwise. Coordinate color with Architect. Refer also Division 9.

B. Application:

1. Thoroughly clean surfaces to be painted to remove dirt, grease, and scale. Wash galvanized surfaces with mild solution of acid prior to painting to effectively clean oils from surface and to etch zinc.
2. Paint insulated surfaces and covered piping with one primer coat and two finish coats.
3. Paint exposed equipment, pipes and supports with one primer coat and two finish coats. Paint factory painted equipment to match colors selected by the Architect: touch up damaged areas with paint to match factory color.
4. Paint the supporting devices for mechanical devices or systems specified to be painted.

3.16 MISCELLANEOUS EQUIPMENT AND FIXTURE CONNECTIONS

A. Provide piping, ductwork, and make all final mechanical connections in accordance with manufacturers' recommendations for Owner-furnished equipment and fixtures, and equipment and fixtures specified.

B. Perform on-site review and refer to manufacturers' shop drawings for details of connections. Provide rough-in at locations to conveniently serve items.

3.17 BALANCING WORK

A. General: The Mechanical Subcontractor shall provide all support for balancing and testing work. Coordinate with Section 230593.

B. Work by Mechanical Subcontractor:
   1. Provide the balancing subcontractor with access to all equipment installed under this contract requiring balancing. Provide ladders, scaffolding, lifts as required to permit the Subcontractor to complete their work.
   2. Operate the mechanical systems and be responsible for all equipment until the balancing and testing is complete. Before balancing and testing commences, check all rotating equipment for proper rotation and lubricate per the manufacturers' recommendations.
   3. Do not assume that equipment is shipped from the factory configured to meet specified volumes and quantities. Include and provide belt, sheave, starter heater and other equipment changes, and all work as required as part of this contract in order to permit balancing to required values.
   4. Before balancing and testing commences, operate all pumps and auxiliary equipment for a minimum of one hour. During this period, check out and calibrate all control components under operating service.

C. Work Coordinated With Owner:
   1. Coordinate balancing with other work and building occupancy to ensure no interruptions occur.

3.18 WIRING

A. Wiring shall conform to applicable sections of these specifications. Provide wiring from branch circuit over current device to motor controller to motor terminals, including installation of starter and all connections. Provide raceway and conductors as shown for remote control, or interlock connections. Coordinate other control wiring with Division 23 of the Specifications. Provide overload elements in controllers sized to match motor nameplate full load amperes. Space within controllers shall not be used as a junction box.

END OF SECTION 230500

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Elastomeric isolation pads.
2. Restrained-spring isolators.
3. Elastomeric hangers.
4. Snubbers.
5. Restraints - cable type.

B. Related Requirements:
1. Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
2. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
1. Detail fabrication and assembly of equipment bases.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.03 QUALITY ASSURANCE

A. 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: UL product listing FM Approvals an agency acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Design Calculations:
1. Perform calculations to obtain force information necessary to properly select seismic-restraint devices, fasteners, and anchorage. Perform calculations using methods acceptable to applicable code authorities and as presented in ASCE/SEI 7-10 including supplement No. 1
a. Coordinate seismic design calculations with wind-load calculations for equipment mounted outdoors. Comply with requirements in other Sections in addition to those in this Section for equipment mounted outdoors.
b. Refer to Structural plans for project specific structural parameters.

2.02 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. CADDY; brand of nVent Electrical plc.
b. Kinetics Noise Control, Inc.
c. Mason Industries, Inc.
2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties. Neoprene rubber, silicone rubber, or other elastomeric material.
5. Surface Pattern: Smooth, ribbed, or waffle pattern.

6. Infused nonwoven cotton or synthetic fibers.

2.03 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CADDY; brand of nVent Electrical plc.
      b. Kinetics Noise Control, Inc.
      c. Mason Industries, Inc.
   2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
      a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
      b. Top plate with threaded mounting holes and elastomeric pad.
      c. Internal leveling bolt that acts as blocking during installation.
   3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
   4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.04 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. CADDY; brand of nVent Electrical plc.
      b. Kinetics Noise Control, Inc.
      c. Mason Industries, Inc.
   2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
   3. Damping Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.05 RESTRAINTS - CABLE TYPE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. CADDY; brand of nVent Electrical plc.
   2. Gripple Inc.
   3. Vibration Mountings & Controls, Inc.

B. Seismic-Restraint Cables: ASTM A1023/A1023M galvanized or 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.

C. Restraint cable assembly with cable fittings must comply with ASCE/SEI 19. All 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.

PART 3 EXECUTION

3.01 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.02 INSTALLATION OF VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICES

A. Provide vibration-control devices for systems and equipment where indicated in Equipment Schedules or Vibration-Control Devices Schedules, where indicated on Drawings, or where Specifications indicate they are to be installed on specific equipment and systems.
B. Provide seismic-restraint devices for systems and equipment where indicated in Equipment Schedules or Seismic-Restraint Devices Schedules, where indicated on Drawings, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.
C. 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."
D. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
E. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
F. Equipment Restraints:
    1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. 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 where clearance between anchor and adjacent surface exceeds 0.125 inch.
    3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
G. Piping Restraints:
    1. Comply with requirements in MSS SP-127.
    2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
    3. Brace a change of direction longer than 12 feet.
H. Install seismic- restraint cables so they do not bend across edges of adjacent equipment or building structure.
I. Install seismic- restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.
J. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
K. 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.
L. 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.
M. Mechanical Anchor Bolts:
    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. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall 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.

3.03 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Provide flexible connections in piping systems where they cross structural seismic joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Equipment labels.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

PART 2 PRODUCTS

2.01 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brimar Industries, Inc.
      b. Seton Identification Products; a Brady Corporation company, or approved equal.
   2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
   3. Letter and Background Color: As indicated for specific application under Part 3.
   4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   7. Fasteners: Stainless steel rivets or self-tapping screws.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.02 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brimar Industries, Inc.
   2. Seton Identification Products; a Brady Corporation company, or approved equal.
B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.
C. Letter and Background Color: As indicated for specific application under Part 3.
D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to circumference of pipe and to attach to pipe without fasteners or adhesive.
E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:
   1. Pipe size.
   2. Flow-Direction Arrows: Include flow-direction arrows on [**main**] distribution piping. Arrows may be either integral with label or applied separately.
   3. Lettering Size: .

PART 3 EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.02 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
B. Coordinate installation of identifying devices with locations of access panels and doors.
C. Install identifying devices before installing acoustical ceilings and similar concealment.
D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.03 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of mechanical equipment.
B. Sign and Label Colors:
   1. White letters on an ANSI Z535.1 safety-blue background.
C. Locate equipment labels where accessible and visible.
D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E **,** and other applicable codes and standards.

3.04 INSTALLATION OF PIPE LABELS

A. Piping Color Coding: Painting of piping is specified in Division 9.
B. Install pipe labels showing service and flow direction with permanent adhesive on pipes.
C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Within 3 ft. of each valve and control device.
   2. At access doors, manholes, and similar access points that permit view of concealed piping.
   3. Within 3 ft. of equipment items and other points of origination and termination.
   4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping, ductwork, and equipment.
D. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.
E. Flow-Direction Arrows: Use arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
F. Pipe-Label Color Schedule: To be submitted for approval.

END OF SECTION

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. Testing, Adjusting, and Balancing of Air Systems:
      a. Constant-volume air systems.
      b. Natatorium Dehumidification
      c. Natatorium Source Capture
      d. DOAS System
      e. VRF Systems
   2. Testing, adjusting, and balancing of condensate piping systems.
   3. Testing, adjusting, and balancing of equipment.
   4. Duct leakage tests verification.
   5. Pipe leakage tests verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.
B. NEBB: National Environmental Balancing Bureau.
C. TAB: Testing, adjusting, and balancing.
D. TABB: Testing, Adjusting, and Balancing Bureau.
E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
F. TDH: Total dynamic head.
G. UFAD: Underfloor air distribution.

1.4 ACTION SUBMITTALS

A. Sustainable Design Submittals:
   1. Air-Balance Report: Documentation indicating that Work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
   2. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.5 INFORMATIONAL SUBMITTALS

A. Certified TAB reports.
B. Sample report forms.
C. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.
   5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by AABC:
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
   2. TAB Technician: Employee of the TAB specialist and certified by AABC.
B. TAB Specialists Qualifications, Certified by NEBB:
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB.

2. TAB Technician: Employee of the TAB specialist and certified by NEBB.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
   1. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

E. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following :
   1. Neudorfer .
   2. Hardin and Sons

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data, including 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.

E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.

F. Examine equipment performance data, including fan and pump curves.
   1. 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.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
K. Examine temporary and permanent strainers. Verify that temporary strainer screens used during system cleaning and flushing have been removed and permanent strainer baskets are installed and clean.
L. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.
M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
N. Examine system pumps to ensure absence of entrained air in the suction piping.
O. Examine operating safety interlocks and controls on HVAC equipment.
P. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.
Q. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes the following:
   1. Equipment and systems to be tested.
   2. Strategies and step-by-step procedures for balancing the systems.
   3. Instrumentation to be used.
   4. Sample forms with specific identification for all equipment.
B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
   1. Airside:
      a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
      b. Duct systems are complete with terminals installed.
      c. Volume, smoke, and fire dampers are open and functional.
      d. Clean filters are installed.
      e. Fans are operating, free of vibration, and rotating in correct direction.
      f. Variable-frequency controllers' startup is complete and safeties are verified.
      g. Automatic temperature-control systems are operational.
      h. Ceilings are installed.
      i. Windows and doors are installed.
      j. Suitable access to balancing devices and equipment is provided.
   2. Hydronics:
      a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
      b. Piping is complete with terminals installed.
      c. Water treatment is complete.
      d. Systems are flushed, filled, and air purged.
      e. Strainers are pulled and cleaned.
      f. Control valves are functioning in accordance with the sequence of operation.
      g. Shutoff and balance valves have been verified to be 100 percent open.
      h. Pumps are started and proper rotation is verified.

i. Pump gauge connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
j. Variable-frequency controllers' startup is complete and safeties are verified.
k. Suitable access to balancing devices and equipment is provided.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
   3. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
   4. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.5 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
   1. Motors.
   2. Pumps.
   3. Fans and ventilators.
   4. Terminal units.
   5. Condensing units.
   6. Energy-recovery units.
   7. Heating and ventilating units.
   8. Variable-refrigerant-flow systems.

3.6 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
B. Prepare schematic diagrams of systems' Record drawings duct layouts.
C. For variable-air-volume systems, develop a plan to simulate diversity.
D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.
I. Check for airflow blockages.
J. Check condensate drains for proper connections and functioning.
K. Check for proper sealing of air-handling-unit components.

3.7 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
      b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
      c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
   2. Measure fan static pressures as follows:
      a. Measure static pressure directly at the fan outlet or through the flexible connection.
      b. Measure static pressure directly at the fan inlet or through the flexible connection.
      c. Measure static pressure across each component that makes up the air-handling system.
      d. Report artificial loading of filters at the time static pressures are measured.
   3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
   4. Obtain approval from Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
   5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
   1. Measure airflow of submain and branch ducts.
   2. Adjust submain and branch duct volume dampers for specified airflow.
   3. Re-measure each submain and branch duct after all have been adjusted.
C. Adjust air inlets and outlets for each space to indicated airflows.
   1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
   2. Measure inlets and outlets airflow.
   3. Adjust each inlet and outlet for specified airflow.
   4. Re-measure each inlet and outlet after they have been adjusted.
D. Verify final system conditions.
   1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
   2. Re-measure and confirm that total airflow is within design.
   3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
   4. Mark all final settings.

5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.8 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer's name, model number, and serial number.
   2. Motor horsepower rating.
   3. Motor rpm.
   4. Phase and hertz.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter size and thermal-protection-element rating.
   8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.9 PROCEDURES FOR AIR-COOLED CONDENSING UNITS

A. Verify proper rotation of fan(s).
B. Measure and record entering- and leaving-air temperatures.
C. Measure and record entering and leaving refrigerant pressures.
D. Measure and record operating data of compressor(s), fan(s), and motors.

3.10 DUCT LEAKAGE TESTS

A. Witness the duct leakage testing performed by Installer.
B. Verify that proper test methods are used and that leakage rates are within specified limits.
C. Report deficiencies observed.

3.11 PIPE LEAKAGE TESTS

A. Witness the pipe pressure testing performed by Installer.
B. Verify that proper test methods are used and that leakage rates are within specified limits.
C. Report deficiencies observed.

3.12 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 percent or minus 5 percent . If design value is less than 100 cfm, within 10 cfm.
   2. Air Outlets and Inlets: Plus 10 percent or minus 5 percent . If design value is less than 100 cfm, within 10 cfm.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.13 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-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.

B. Status Reports: Prepare biweekly progress 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. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.
   3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to 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; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
   1. Title page.
   2. Name and address of the TAB specialist.
   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 supervisor who certifies the report.
   10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
   11. Summary of contents, including the following:
      a. Indicated versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   12. Nomenclature sheets for each item of equipment.
   13. Data for terminal units, including manufacturer's name, type, size, and fittings.
   14. Notes to explain why certain final data in the body of reports vary from indicated values.
   15. Test conditions for fans performance forms, including the following:
      a. Settings for outdoor-, return-, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Heating coil, dry-bulb conditions.
      e. Face and bypass damper settings at coils.
      f. Fan drive settings, including settings and percentage of maximum pitch diameter.
      g. Variable-frequency controller settings for variable-air-volume systems.
      h. Settings for pressure controller(s).
      i. Other system operating conditions that affect performance.
   16. Test conditions for pump performance forms, including the following:
      a. Variable-frequency controller settings for variable-flow hydronic systems.
      b. Settings for pressure controller(s).
      c. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
   1. Quantities of outdoor, supply, return, and exhaust airflows.
   2. Water and steam flow rates.
   3. Duct, outlet, and inlet sizes.
   4. Pipe and valve sizes and locations.
   5. Terminal units.
   6. Balancing stations.
   7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units, include the following:
   1. Unit Data:
      a. Unit identification.
      b. Location.
      c. Make and type.
      d. Model number and unit size.
      e. Manufacturer's serial number.
      f. Unit arrangement and class.
      g. Discharge arrangement.
      h. Sheave make, size in inches, and bore.
      i. Center-to-center dimensions of sheave and amount of adjustments in inches.
      j. Number, make, and size of belts.
      k. Number, type, and size of filters.
   2. Motor Data:
      a. Motor make, and frame type and size.
      b. Horsepower and speed.
      c. Volts, phase, and hertz.
      d. Full-load amperage and service factor.
      e. Sheave make, size in inches, and bore.
      f. Center-to-center dimensions of sheave and amount of adjustments in inches.
   3. Test Data (Indicated and Actual Values):
      a. Total airflow rate in cfm.
      b. Total system static pressure in inches wg.
      c. Fan speed.
      d. Inlet and discharge static pressure in inches wg.
      e. For each filter bank, filter static-pressure differential in inches wg.
      f. Preheat-coil static-pressure differential in inches wg.
      g. Cooling-coil static-pressure differential in inches wg.
      h. Heating-coil static-pressure differential in inches wg.
      i. List for each internal component with pressure-drop, static-pressure differential in inches wg.
      j. Outdoor airflow in cfm.
      k. Return airflow in cfm.
      l. Outdoor-air damper position.
      m. Return-air damper position.

F. Apparatus-Coil Test Reports:
   1. Coil Data:
      a. System identification.
      b. Location.

c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in deg F.
k. Inlet steam pressure in psig.

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
1. Unit Data:
a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.
2. Test Data (Indicated and Actual Values):
a. Heat output in Btu/h.
b. Airflow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
a. System identification.
b. Location.
c. Make and type.
d. Model number and size.

e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:
a. Motor make, and frame type and size.
b. Horsepower and speed.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan speed.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:
a. System fan and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

J. Air-Terminal-Device Reports:

1. Unit Data:
a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.

d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

K. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.
2. Test Data (Indicated and Actual Values):
a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

L. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves, and include the following:
1. Unit Data:
a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump speed.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.
2. Test Data (Indicated and Actual Values):
a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.

j. Voltage at each connection.
k. Amperage for each phase.

M. Instrument Calibration Reports:
1. Report Data:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.15 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.

B. Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day .

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 20 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.

E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.

F. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB 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 TAB during near-peak summer and winter conditions.

END OF SECTION 230593

PART 1 GENERAL

1.01 SUMMARY

A. Section includes insulating the following duct services:
   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.
   3. Indoor, concealed return located in unconditioned space.
   4. Indoor, exposed return located in unconditioned space.
   5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
   6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
   7. Outdoor, exposed supply and return.

B. Related Sections:
   1. Section 230716 "HVAC Equipment Insulation”.
   2. Section 230719 "HVAC Piping Insulation."
   3. Section 233113 "Metal Ducts" for duct liners.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
   1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.02 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials are applied.
B. Products do not contain asbestos, lead, mercury, or mercury compounds.
C. Products that come in contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.
D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
F. Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 450 deg F in accordance with ASTM C411. Comply with ASTM C553, Type II, and ASTM C1290, Type II with factory-applied vinyl jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Manufacturers: Subject to compliance with requirements, undefined:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Knauf Insulation.
      c. Owens Corning.

2.03 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products, or approved equal.
2. Verify fiberglass adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).

C. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Johns Manville; a Berkshire Hathaway company, or approved equal.
2. Verify adhesive has a VOC content of 80 g/L or less when calculated in accordance with 40 CFR 59, Subpart D (EPA Method 24).

2.04 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.
1. VOC Content: 300 g/L or less.

B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below ambient services.
1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products.
   c. Knauf Insulation.
2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements
5. Color: White

2.05 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products, or approved equal.
2. Materials are compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. Verify sealant has a VOC content of 420 g/L or less.

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, undefined:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller Construction Products, or approved equal.
2. Materials are compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. Verify sealant has a VOC content of 420 g/L or less.

2.06 TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Manufacturers: Subject to compliance with requirements, undefined:
   a. 3M Industrial Adhesives and Tapes Division.
   b. Ideal Tape Co., Inc., an American Biltrite Company, or approved equal.
2. Width: 2 inches.

3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Manufacturers: Subject to compliance with requirements, undefined:
a. Knauf Insulation, or approved equal.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5] percent.
6. Tensile Strength: 34 lbf/inch in width.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Refer to Mechanical general drawings for additional energy code insulation requirements. All HVAC insulation shall comply with the State Energy Code.
B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
C. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
F. Install multiple layers of insulation with longitudinal and end seams staggered.
G. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents [, unless otherwise approved by the engineer of record].
H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
I. Install insulation with least number of joints practical.
J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [2 inches] [4 inches] o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.
N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.
B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
   1. Comply with requirements in Section 078400 " Firestopping" for firestopping and fire-resistive joint sealers.
D. Insulation Installation at Floor Penetrations:
   1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 " Firestopping."

3.04 INSTALLATION OF GLASS-FIBER AND MINERAL-WOOL INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
B. Comply with manufacturer's written installation instructions.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.05 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099000 " Painting and Coating".
    1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
        a. Finish Coat Material: Interior, flat, latex-emulsion size.
B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
C. Do not field paint aluminum or stainless-steel jackets.

3.06 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
    1. Indoor, concealed supply and outdoor air.
    2. Indoor, exposed supply and outdoor air.
    3. Outdoor, exposed supply and return.
B. Items Not Insulated:
    1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
    2. Factory-insulated plenums and casings.
    3. Flexible connectors.

3.07 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Round and Flat-Oval, Supply-Air Duct Insulation: glass-fiber blanket or polyolefin.
B. Concealed, Round and Flat-Oval, Return-Air Duct Insulation: glass-fiber blanket or polyolefin.
C. Concealed, Round and Flat-Oval, Outdoor-Air Duct Insulation: glass-fiber blanket or polyolefin.
D. Concealed, Round and Flat-Oval, Exhaust-Air Duct Insulation: glass-fiber blanket or polyolefin.
E. Concealed, Rectangular, Supply-Air Duct Insulation: glass-fiber blanket or polyolefin.
F. Concealed, Rectangular, Return-Air Duct Insulation: glass-fiber blanket or polyolefin.
G. Concealed, Rectangular, Outdoor-Air Duct Insulation: glass-fiber blanket or polyolefin.
H. Concealed, Rectangular, Exhaust-Air Duct Insulation between Isolation Damper and Penetration of Building Exterior: glass-fiber blanket or polyolefin.

I. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve two-hour fire rating.
J. Concealed, Supply-Air Plenum Insulation: glass-fiber blanket or polyolefin.
K. Concealed, Return-Air Plenum Insulation: glass-fiber blanket or polyolefin.
L. Concealed, Outdoor-Air Plenum Insulation: glass-fiber blanket or polyolefin.
M. Concealed, Exhaust-Air Plenum Insulation: glass-fiber blanket or polyolefin.
N. Exposed, Round and Flat-Oval, Supply-Air Duct Insulation: glass-fiber blanket or polyolefin.
O. Exposed, Round and Flat-Oval, Return-Air Duct Insulation glass-fiber blanket or polyolefin..
P. Exposed, Round and Flat-Oval, Outdoor-Air Duct Insulation: glass-fiber blanket or polyolefin.
Q. Exposed, Round and Flat-Oval, Exhaust-Air Duct Insulation: glass-fiber blanket or polyolefin.
R. Exposed, Rectangular, Supply-Air Duct Insulation: glass-fiber blanket or polyolefin.
S. Exposed, Rectangular, Return-Air Duct Insulation: glass-fiber blanket or polyolefin.
T. Exposed, Rectangular, Outdoor-Air Duct Insulation: glass-fiber blanket or polyolefin.
U. Exposed, Rectangular, Exhaust-Air Duct Insulation: glass-fiber blanket or polyolefin.
V. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve two-hour fire rating.
W. Exposed, Supply-Air Plenum Insulation: glass-fiber blanket or polyolefin.
X. Exposed, Return-Air Plenum Insulation: glass-fiber blanket or polyolefin.
Y. Exposed, Outdoor-Air Plenum Insulation: glass-fiber blanket or polyolefin.

3.08 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, Round and Flat-Oval, Supply-Air Duct Insulation: glass-fiber blanket.
B. Concealed, Round and Flat-Oval, Return-Air Duct Insulation: glass-fiber blanket.
C. Concealed, Round and Flat-Oval, Outdoor-Air Duct Insulation: glass-fiber blanket.
D. Concealed, Rectangular, Supply-Air Duct Insulation: glass-fiber blanket.
E. Concealed, Rectangular, Return-Air Duct Insulation: glass-fiber blanket.
F. Concealed, Supply-Air Plenum Insulation: glass-fiber blanket.
G. Concealed, Return-Air Plenum Insulation: glass-fiber blanket.
H. Exposed, Round and Flat-Oval, Supply-Air Duct Insulation: glass-fiber blanket.
I. Exposed, Round and Flat-Oval, Return-Air Duct Insulation: glass-fiber blanket.
J. Exposed, Rectangular, Supply-Air Duct Insulation: glass-fiber blanket.
K. Exposed, Rectangular, Return-Air Duct Insulation: glass-fiber blanket.
L. Exposed, Supply-Air Plenum Insulation: glass-fiber blanket.
M. Exposed, Return-Air Plenum Insulation: glass-fiber blanket.

3.09 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Ducts and Plenums, Concealed:
    1. PVC : 20 mils thick, color-coded by system.
D. Ducts and Plenums, Exposed:
    1. Painted aluminum: 0.032 inch thick

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
    1. Painted aluminum: 0.04 inch thick.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes insulation for HVAC piping systems.

B. Related Requirements:

1. Section 230713 "Duct Insulation" for duct insulation.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 QUALITY ASSURANCE

A. Mockups: Before installing insulation, build mockups for each type of insulation and finish to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by the Engineer.

1.04 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.05 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.02 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I for tubular materials, Type II, for sheet materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armacell LLC, or approved equal.

G. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Knauf Insulation.
      c. Owens Corning.
   2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
   3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
   4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Mineral Wool, Preformed Pipe: Mandrel-wound mineral wool fibers bonded with a thermosetting resin, unfaced; suitable for maximum use temperature up to 1200 deg F in accordance with ASTM C447. Comply with ASTM C547.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Owens Corning, or approved equal.
   2. Preformed Pipe Insulation: Type II, Grade A.
   3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.

I. Polyolefin: Polyethylene thermal plastic insulation. Comply with or ASTM C1427, Type I, Grade 1, for tubular materials and with Type II, Grade 1, for sheet materials, self-seal.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armacell LLC, or approved equal.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armacell LLC, or approved equal.
   2. Adhesive: As recommended by flexible elastomeric and polyolefin manufacturer and with a VOC content of 80 g/L or less.
   3. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
   4. Wet Flash Point: Below 0 deg F.
   5. Service Temperature Range: 40 to 200 deg F.
   6. Color: Black .

C. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products, or approved equal.
   2. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.

D. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Johns Manville; a Berkshire Hathaway company, or approved equal.
2. Adhesive: As recommended by Adhesive - PVC Jacket manufacturer and with a VOC content of 50 g/L or less.

2.04 MASTICS AND COATINGS
A. Materials shall be compatible with insulation materials, jackets, and substrates.
1. Mastics: As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.
B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products.
c. Knauf Insulation.
2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
5. Color: White.

2.05 SEALANTS
A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.
B. FSK and Metal Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products, or approved equal.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. Verify sealant has a VOC content of 420 g/L or less.
6. Verify sealant complies 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."
C. ASJ Flashing Sealants and PVDC and PVC Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller Construction Products, or approved equal.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. Verify sealant has a VOC content of 420 g/L or less.
6. Verify sealant complies 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."

2.06 FACTORY-APPLIED JACKETS
A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2.07 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Johns Manville; a Berkshire Hathaway company, or approved equal.
   2. Adhesive: As recommended by jacket material manufacturer.
   3. Color: Color as selected by Architect.
   4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Johns Manville; a Berkshire Hathaway company, or approved equal.
   2. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
      a. Sheet and roll stock ready for shop or field sizing.
      b. Finish and thickness are indicated in field-applied jacket schedules.
      c. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
      d. Factory-Fabricated Fitting Covers:
         1) Same material, finish, and thickness as jacket.
         2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
         3) Tee covers.
         4) Flange and union covers.
         5) End caps.
         6) Beveled collars.
         7) Valve covers.
         8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.08 TAPES

A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. 3M Industrial Adhesives and Tapes Division, or approved equal.
   2. Width: 2 inches.
   3. Thickness: 6 mils.
   4. Adhesion: 64 ounces force/inch in width.
   5. Elongation: 500 percent.
   6. Tensile Strength: 18 lbf/inch in width.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
   2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.02 GENERAL INSTALLATION REQUIREMENTS
A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.
C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.
D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.
E. Install multiple layers of insulation with longitudinal and end seams staggered.
F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.
H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
I. Install insulation with least number of joints practical.
J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
   3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
4. For below-ambient services, apply vapor-barrier mastic over staples.
5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.03 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

3.04 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using prefabricated fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with prefabricated fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
   2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.06 INSTALLATION OF GLASS-FIBER AND MINERAL WOOL INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
   4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fanges:
   1. Install prefabricated pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.07 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with the same material as jacket.
3. Secure jacket to insulate with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated and for horizontal applications, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

E. Where PVDC jackets are indicated, install as follows:
1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap pre-sized jackets around individual pipe insulation sections, with one end overlapping the previously installed sheet. Install pre-sized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral-wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch-circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap

seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.

5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.08 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.09 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size shall comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 3/4 inch thick.

B. Chilled Water / Condenser-Water Supply and Return / Heating-Hot-Water Supply and Return:
   1. NPS 2 and Smaller: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.
   2. NPS 3 and Larger: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

C. Refrigerant Suction / Liquid and Hot-Gas Piping:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 1 inch thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Chilled Water / Condenser-Water Supply and Return / Heating-Hot-Water Supply and Return:
   1. NPS 2 and Smaller: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
   2. NPS 3 and Larger: Insulation is the following:
      a. Glass-Fiber, Preformed Pipe Insulation, Type I: 3 inches thick.

B. Refrigerant Suction / Liquid and Hot-Gas Piping:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 2 inch thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Piping, Concealed:
   1. PVC color-coded by system: 20 mils thick.
D. Piping, Exposed:
   1. Painted Aluminum: 0.024 thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
B. If more than one material is listed, selection from materials listed is Contractor's option.
C. Piping, Exposed:
   1. Painted Aluminum: 0.024 thick.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. General: General Contractor is responsible for performing all commissioning activities required by Washington State Energy Code Section C408.

B. Section Includes
   1. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

C. Related Sections:
   1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.2 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority. General Contractor shall be the commissioning authority and perform the commissioning work themselves.

C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.3 CONTRACTOR'S RESPONSIBILITIES

A. General Contractor shall ensure participation by their mechanical sub-contractor in the following activities:
   1. Attend construction phase controls coordination meeting.
   2. Attend testing, adjusting, and balancing review and coordination meeting.
   3. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
   4. Provide information requested by the CxA for final commissioning documentation.
   5. Provide measuring instruments and logging devices to record test data and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.4 MECHANICAL CONTRACTORS RESPONSIBILITIES

A. Include cost of commissioning requirements in the contract price.

B. Commissioning work of Division 23 shall include, but not be limited to:
   1. Testing and start-up of the equipment.
   2. Cooperation with the Commissioning Authority.
   3. Providing qualified personnel for participation in commissioning tests, including seasonal testing required after the initial testing.
   4. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the commissioning process.
   5. Providing operation and maintenance manuals, and as-built drawings to the Commissioning Authority for verification.
   6. Providing training and demonstrations for the systems specified in this Division.

C. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems, and sub-systems. The following equipment and systems shall be evaluated:
   1. Exhaust Fans
   2. Electric Unit Heaters
   3. Fin Tube Rediators
   4. Air Compressor
   5. VRF System

6. Split System Heat Pump
7. Heat Recovery Ventilator
8. DDC integration with Division 23 systems

1.5 SUBMITTALS

A. Refer to 01 91 13 General Commissioning Requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TESTING PREPARATION

A. The controls integration meetings (CIM) shall be conducted after the building automation and lighting controls submittals are complete and the CxA has reviewed the submittals. The meeting is to be conducted prior to finalizing the functional test procedures and shall be lead by the CxA and attended by the BAS control contractor, the VRF control contractor, the lighting controls contractor, the mechanical/electrical engineers and a representative of the Owner's F&I group at a minimum; Owner's maintenance group shall be invited however attendance is optional.
B. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
C. Certify 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.
D. Certify that testing, adjusting, and balancing (TAB) procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
E. Set 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).
F. Inspect and verify the position of each device and interlock identified on checklists.
G. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
H. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 GENERAL TESTING REQUIREMENTS

A. Functional performance testing shall demonstrate the correct installation and operation of each component, system and system-to-system relationship in accordance with approved plans and specifications. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
B. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions as described in the Sequence of Operations. Verify proper response of building automation system controllers and sensors.
C. The CxA along with the HVAC&R Subcontractor, testing and balancing Subcontractor, and HVAC&R Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
D. Tests will be performed using design conditions whenever possible.
E. 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 CxA and

document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

F. The CxA may direct that set points be altered when simulating conditions is not practical.
G. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
H. 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.
I. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.3 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.
B. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

3.4 DEFICIENCY RESOLUTION

A. In some systems, improper adjustments, misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to commission the systems. This work shall be completed under the direction of the User, with input from the contractor, equipment supplier, and Commissioning Authority. Whereas all members shall have input and the opportunity to discuss, debate, and work out problems, the Design Professional shall have final jurisdiction over any additional work done to achieve performance.
B. Corrective work shall be completed in a timely fashion to permit the completion of the commissioning process. Experimentation to demonstrate system performance may be permitted. If the Commissioning Authority deems the experimentation work to be ineffective or untimely as it relates to the commissioning process, the Commissioning Authority shall notify the User, indicating the nature of the problem, expected steps to be taken, and suggested deadline(s) for completion of activities. If the deadline(s) pass without resolution of the problem, the User reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs incurred to solve the problems in an expeditious manner shall be the contractor's responsibility.

3.5 OPERATING AND MAINTENANCE TRAINING

A. The HVAC&R Contractor, and appropriate sub-contractors, shall provide comprehensive operating and maintenance instruction on building systems in accordance with the Contract Documents prior to delivery.
B. The contractor shall be responsible for organizing, arranging, and delivering in a manner and on a schedule agreeable to the User.
C. Refer to specification section 01 79 00 for training timeline requirements.

PART 4 MEASUREMENT AND PAYMENT – NOT USED

END OF SECTION 230800

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 requirements for equipment and systems not controlled by the VRF system packaged controls.

1.3 SUBMITTALS

A . Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

1. Each control device labeled with setting or adjustable range of control.

B . Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, and method of field assembly, components, and location and size of each field connection.

1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
3. Details of control panel faces, including controls, instruments, and labeling.
4. Written description of sequence of operation.
5. Schedule of dampers including size, leakage, and flow characteristics.
6. Schedule of valves including close-off and flow characteristics.
7. Trunk cable schematic showing programmable control unit locations and trunk data conductors.
8. Listing of connected data points, including connected control unit and input device.
9. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
10. System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

C . Samples: For each color required, of each type of thermostat cover.

D . Software and Firmware Operational Documentation: Include the following:

1. Engineering, Installation, Operation and Maintenance manuals.
2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
3. Device address list.

4. Printout of software application and graphic screens.
5. Licenses, guarantee, and warranty documents for all equipment and systems.

E . Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F . Maintenance Data: For systems to include in maintenance manuals specified in Division 1. Include the following:

1. Maintenance instructions and lists of spare parts for each type of control device and compressed air station.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
5. Calibration records and list of set points.

G . Qualification Data: For firms and persons specified in "Quality Assurance" Article.

H . Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.

1.4 QUALITY ASSURANCE

A . All bidders must be Systems Integrators and specialty control contractors in the business of installing direct digital temperature controls.

B . All bidders shall be factory owned branch office or factory authorized, independent installing contractor or Certified Systems Integrator of the manufacturers specified.

C . The system manufacturer shall, as a minimum, manufacture and supply the Custom Application Controller, Application Specific Controller, Equipment Direct Digital Controller, Unitary Equipment Controller, Advanced Application Controller, Graphical User Interface, damper actuators, and valve actuator assemblies.

D . All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the temperature control system manufacturer's local field office.

E . 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.

F . Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

PART 2 - SEQUENCE OF OPERATIONS

2.1 GENERAL

A . All setpoints, limits, etc. shall be accessible through the central CPU or the laptop computer connected to the system.

B . Control points for the hydronic system shall be able to be observed from the central CPU or laptop, and adjusted through the Mitsubishi interface.

C . Control points for the equipment controlled by the DDC EMCS system shall be able to be observed and adjusted through the central CPU or laptop.

2.2 DEFINITION

A . The following terms are utilized in the sequences:

1. Adjustable: Applies to values that the control system operator can change from the local computer graphical user interface.
2. Modulate: Adjust a damper, valve, or other control device incrementally to achieve a setpoint.
3. Monitor: Input a physical quantity or status into the control system and generate an alarm if the value of the measured quantity matches a pre-programmed alarm value or range of valves.
4. Reset: Programmatically change an intermediate setpoint in a cascaded control scheme to achieve the final desired temperature.
5. Sequence: Control multiple devices to maintain a single setpoint such that each device is assigned to control a different range within the control band above and below the setpoint. For instance, heating valves open and dampers close when the temperature is below setpoint, and dampers open and heating valves close when the temperature is above setpoint.
6. Setpoint: The target output value a loop control is attempting to achieve.
7. Interlock: Operation of one piece of equipment in direction correlation to the operating schedule of a related piece of equipment. May be accomplished through programming (software interlock) or via physical wiring (hardwired interlock). When not specified, software interlock shall be implied.

2.3 MECHANICAL EQUIPMENT AND SYSTEM CONTROLS

A . The building controls are a combination of locally controlled equipment (electric or electronic controls) and the VRF EMCS Control System. Refer to Section 23 34 00 HVAC Equipment for the VRF Controls.

B . Locally controlled equipment, electric or electronic controls: Domestic hot water circulation, data room air conditioner units, electric unit heaters, and baseboard heaters.

C . Equipment Controlled by the VRF EMCS System: VRF outdoor units, indoor units and heat recovery ventilators.

D . Natatorium air handlers shall be operated from their own stand alone controls. Provide controllers as required to maintain the sequences below. Integration in to the VRF control system for scheduling and enabling is allowed but the control of individual dampers, set points, and sensors shall be separate.

2.4 CONTROL SEQUENCES:

A . VRF:

1. Controlled by manufacturer's control system and integrated building wide.
    a. Schedule: Adjustable, 7-day programmable. Initially set to 8am to 6pm; daily.
    b. Where adjacent (neighboring) zones are controlled by separate thermostats, and are connected by permanent openings > 10% of either zone sf area, indicate controls configured to prevent adjacent zones from operating in conflicting modes (one in heat, other in cool).
2. Operation Of the Variable Refrigerant Flow (VRF) System Shall Be Regulated By Packaged Controls Native To The System.
3. Maintenance Mode (Not Scheduled but Available for Operator Command):
    a. All Units Are Disabled.
4. Unoccupied Mode (Not Scheduled but Available for Operator Command):
    a. System Follows Same Sequence of Operations for Occupied Mode With The Following Setpoints.
        1) Heating: 60 Degrees F
        2) Cooling: 85 Degrees F
5. Occupied Mode:
    a. General:
        1) VRF System Shall Be Enabled And Commanded To Operate. Command Signal From DDC To VRF Controller Shall Be Cycled Every 12 Hours (Adjustable).
    b. Heating
        1) When Space Temperature Is Below Occupied Heating Setpoint, 70 Degrees F (Adjustable); Unit Is Enabled And controlled By Packaged Controller To Maintain Setpoint.
        2) When Space Temperature Is Above Occupied Heating Setpoint (Adjustable); Unit Shuts Off.
    c. Cooling
        1) When Space Temperature Is Above Occupied Cooling Setpoint, 75 Degrees F (Adjustable); Unit Is Enabled And Controlled By Packaged Controller To Maintain Setpoint.
        2) When Space Temperature Is Below Occupied Cooling Setpoint (Adjustable); Unit Shuts Off.
6. Safeties/alarms
    a. Fault: If Unit Is In Fault At The VRF Central Controller, Alarm Is Generated.
    b. Communication Failure: If Communication With The Central Controller Or Individual Unit Is Lost, Alarm Is Generated.
    c. High Space Temperature: If Space Temperature Exceeds Setpoint By 5 Degrees F (Adjustable) For 5 Minutes, Alarm Is Generated.
    d. Low Space Temperature: If Space Temperature Is Below Setpoint By 5 Degrees F (Adjustable) For 5 Minutes, Alarm Is Generated

B . HEAT RECOVERY VENTILATION (DOAS-1):

1. The unit shall operate on the occupancy schedule.
    a. Schedule: Adjustable, 7-day programmable. Initially set to 8am to 6pm; daily.
2. The unit is supplied with simple terminal strip control, packaged VFDs and airflow monitoring. The DDC shall interface with the terminal strip control for on/off and bypass control as well as monitoring of points. The DDC shall also connect directly to the factory VFDs for control and monitoring.
3. Unoccupied/off mode/maintenance mode (not scheduled but available for operator command):
    a. Normal operation
        1) Unit is disabled
        2) Fans are off
        3) Dampers are closed
4. Occupied mode:
    a. Normal operation: discharge air temperature is within heat deadband.
        1) Unit is enabled
        2) Dampers open
        3) Supply fans start and runs continuously once damper proves open.
        4) Exhaust fans start and runs continuously once damper proves open.
        5) Heat recovery bypass damper positioned as described in heat recover bypass sequence.

C . NATATORIUM OUTSIDE AIR SYSTEM (AHU-1)

1. Modes:
    a. Unoccupied mode:
        1) Time frame: 6 PM- 6 AM
        2) OSA damper is closed
        3) Unit will be in circulation mode
        4) Exhaust fan will be adjusted to maintain a small negative air balance in the natatorium
    b. Occupied mode:
        1) Time frame: 6 AM – 6 PM
        2) OA volume will be established between 0 and 100% of the supply air volume
        3) OA is preheated as required to provide mixed air temperature at or above 64° F (space dew point)
        4) The preheater uses feedback modulating control algorithm. The space auxiliary heater is controlled based on zone sensors.
2. Set Points:
    a. Heating: 78 degrees F
    b. Cooling: 82 degrees F

c. Zone: 80 degrees F, 50% RH.

3. Heat recovery bypass

a. The heat recovery bypass damper shall open/close to divert air flow past the heat exchanger during the following conditions (user adjustable).

1) 68 degrees F < OSAT < 72 degrees F and;

a) EAT > 72 degrees F or;

b) EAT < 68 degrees F

2) 55 degrees F < OSAT < EAT and;

a) Call for cooling is present in the space.

D . SOURCE CAPTURE ENERGY RECOVERY (AHU-2)

1. Unit runs on internal controls. Unit must monitor the intake temperature and humidity within the space. Units internal logic then determines if engaging the heat pump recovery system is efficient.

a. Energy recovery to the pool water will take place when all of the following are true.

1) Pool water is requiring heat. Monitor water temperature at supply water pipe (in the parlance of pools at the: “pool return”).

2) Airflow measured at the fan inlet venture is greater than the minimum airflow for the unit. Checked internally by the unit’s controls.

3) The energy of the incoming air (enthalpy) is greater than the factory set minimum. Checked internally by the unit’s controls.

4) The source capture energy recovery unit shall coordinate with the dehumidifier to maintain ventilation air to the zone and a negative zone pressure.

2. Unit shall engage circulating pump to move pool water from the buffer tank through the unit when pool water heat recovery is available.

3. Interlock operation with AHU-1 to balance airflows when operating.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Copper tube and fittings.
2. Steel pipe and fittings.
3. Valves and specialties.
4. Refrigerants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and refrigerant piping specialty.

1.3 QUALITY ASSURANCE

A. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:
1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L .
B. Wrought-Copper Fittings, Solder-Joint: ASME B16.22.
C. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

2.3 VALVES AND SPECIALTIES

2.4 REFRIGERANTS

A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Arkema Inc.
b. DuPont Fluorochemicals Div.
c. Genetron Refrigerants; Honeywell International Inc.

PART 3 EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Hot-Gas and Liquid Lines , and Suction Lines for Heat-Pump Applications:
1. Copper, , annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
2. Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
3. Copper, , drawn-temper tubing and wrought-copper fittings with 95-5 tin-antimony soldered joints.
4. Copper, , drawn-temper tubing and wrought-copper fittings with Alloy HB soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install valves in suction and discharge lines of compressor.
B. Except as otherwise indicated, install valves on inlet and outlet side of filter dryers.
C. Install a full-size, three-valve bypass around filter dryers.
D. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:
   1. Compressor.
E. Install flexible connectors at compressors.
F. Provide refrigerant locking caps on refrigerant charging ports that are located outdoors unless otherwise protected from unauthorized access by a means acceptable to the authority having jurisdiction.

3.3 INSTALLATION OF PIPING, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
B. Install refrigerant piping according to ASHRAE 15.
C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
F. Install piping adjacent to machines to allow service and maintenance.
G. Install piping free of sags and bends.
H. Install fittings for changes in direction and branch connections.
I. Select system components with pressure rating equal to or greater than system operating pressure.
J. Refer to Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC" for solenoid valve controllers, control wiring, and sequence of operation.
K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
M. Install refrigerant piping in protective conduit where installed belowground.
N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
O. Slope refrigerant piping as follows:
   1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor.
   3. Install traps and double risers to entrain oil in vertical runs.
   4. Liquid lines may be installed level.
P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
R. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.
B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
C. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
    1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
    2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic restraints in Section 230548 "Vibration and Seismic Controls for HVAC."
B. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.
C. Install the following pipe attachments:
    1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
    2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
    3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
    4. Spring hangers to support vertical runs.
    5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
D. Install hangers for copper tubing, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
E. Support horizontal piping within 23 inches of each fitting.
F. Support vertical runs of copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
    1. Comply with ASME B31.5, Chapter VI.
    2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
    3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.

a. Fill system with nitrogen to the required test pressure.
b. System shall maintain test pressure at the manifold gage throughout duration of test.
c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
B. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
C. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

D. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 23 00

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Single-wall rectangular ducts and fittings.
   2. Single-wall round ducts and fittings.
   3. Sheet metal materials.
   4. Duct liner.
   5. Sealants and gaskets.
   6. Hangers and supports.
   7. Seismic-restraint devices.

B. Related Sections:
   1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
   2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
   1. Liners and adhesives.
   2. Sealants and gaskets.
   3. Seismic-restraint devices.

B. Shop Drawings:
   1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
   2. Factory- and shop-fabricated ducts and fittings.
   3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
   4. Elevation of top and bottom of ducts.
   5. Dimensions of all duct runs from building grid lines.
   6. Fittings.
   7. Reinforcement and spacing.
   8. Seam and joint construction.
   9. Penetrations through fire-rated and other partitions.
   10. Equipment installation based on equipment being used on Project.
   11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
   12. Hangers and supports, including methods for duct and building attachment, seismic restraints**,** and vibration isolation.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers, supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7
   1. Refer to Structural plans for project specific seismic data.

B. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.
C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."
D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
E. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.02 NATATORIUM DUCTWORK REQUIREMENTS

A. All duct work in the natatorium shall be constructed, and supported by, materials suitable for use in a corrosive environment.
B. The basis of design intent is to use plastic-coated galvanized sheet metal.
C. Plastic and FRP ductwork will be considered if offered up as a substitution. Substituted materials must result in the same or lower static pressure losses to the fan systems to which they are attached.

2.03 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
    1. Construct ducts of galvanized sheet steel unless otherwise indicated.
    2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
    1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.04 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
    1. Construct ducts of galvanized sheet steel unless otherwise indicated.
    2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.05 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. 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.

2.06 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Knauf Insulation.
      c. Owens Corning.
   2. Maximum Thermal Conductivity:
      a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg Fat 75 deg F mean temperature.
      b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg Fat 75 deg F mean temperature.
   3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
      a. Verify adhesive has a VOC content of 80 g/L or less.

B. Insulation Pins and Washers:
   1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
   2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized or stainless steel (to match associated duct material)]; with

beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.

2.07 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
B. Water-Based Joint and Seam Sealant:
    1. Application Method: Brush on.
    2. Solids Content: Minimum 65 percent.
    3. Shore A Hardness: Minimum 20.
    4. Water resistant.
    5. Mold and mildew resistant.
    6. VOC: Maximum 75 g/L (less water).
    7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
    8. Service: Indoor or outdoor.
    9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
    10. Verify sealant has a VOC content of 420 g/L or less.
    11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
    12. Service: Indoor or outdoor.
    13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
C. Flanged Joint Sealant: Comply with ASTM C 920.
    1. General: Single-component, acid-curing, silicone, elastomeric.
    2. Type: S.
    3. Grade: NS.
    4. Class: 25.
    5. Use: O.
    6. Verify sealant has a VOC content of 420 g/L or less.

2.08 HANGERS AND SUPPORTS

A. Hanger Rods: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
D. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
E. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
G. Trapeze and Riser Supports:
    1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
    2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
    3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.09 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Kinetics Noise Control, Inc.
    2. Mason Industries, Inc.

3. Unistrut; Atkore International.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
   1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
D. Restraint Cables: ASTM A 603, galvanized or ASTM A 492, stainless-steel cables with end connections made of galvanized-steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested in accordance with ASTM E 488/E 488M.

PART 3 EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
C. Install ducts in maximum practical lengths with fewest possible joints.
D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
J. Install fire dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 ADDITIONAL INSTALLATION REQUIREMENTS FOR KITCHEN GREASE HOOD EXHAUST DUCT

A. Install ducts in accordance with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operation"; SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; and SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines" unless otherwise indicated.
B. Install all ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
C. All ducts exposed to view shall be constructed of stainless steel as per "Duct Schedule" Article. All ducts concealed from view shall be stainless steel as per "Duct Schedule" Article.
D. All joints shall be welded and shall be telescoping, bell, or flange joint as per NFPA 96.
E. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings.
F. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction

3.04 ADDITIONAL INSTALLATION REQUIREMENTS FOR EXHAUST DUCTS SERVING WASHERS AND OTHER HIGH-HUMIDITY LOCATIONS

A. Install washer exhaust ducts and other exhaust ducts from wet, high-humidity locations without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to washer or toward drain.
B. Provide a drain pocket at each low point and at the base of each riser with a 1-inch trapped copper drain from each drain pocket to open site floor drain.
C. Minimize number of transverse seams.
D. Do not locate longitudinal seams on bottom of duct.

3.05 DUCTWORK EXPOSED TO WEATHER

A. All external joints are to have secure watertight mechanical connections. Seal all openings to provide weatherproof construction.
B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.
C. Single Wall:
    1. Ductwork shall be Type 304stainless steel.
    2. Where ducts have external insulation, provide weatherproof aluminum jacket. See Section 230713 "Duct Insulation."

3.06 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
    1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
    2. Outdoor, Supply-Air Ducts: Seal Class A.
    3. Outdoor, Exhaust Ducts: Seal Class C.
    4. Outdoor, Return-Air Ducts: Seal Class C.
    5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
    6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
    7. Unconditioned Space, Exhaust Ducts: Seal Class C.
    8. Unconditioned Space, Return-Air Ducts: Seal Class B.
    9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
    10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
    11. Conditioned Space, Exhaust Ducts: Seal Class B.
    12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.07 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
    1. Where practical, install concrete inserts before placing concrete.
    2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
    3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
    4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
    5. Do not use powder-actuated concrete fasteners for seismic restraints.
C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
D. Hangers Exposed to View: Threaded rod and angle or channel supports.
E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.08 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
C. Install cables so they do not bend across edges of adjacent equipment or building structure.
D. Install cable restraints on ducts that are suspended with vibration isolators.
E. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
F. Drilling for and Setting Anchors:
    1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify Architect 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. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall 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 applications and stainless-steel anchors for applications exposed to weather.

3.09 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.10 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099000 "Painting and Coating."

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.
B. Leakage Tests:
    1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
    2. Test the following systems:
        a. Outdoor-Air Ducts with a Pressure Class of 2 Inch wg or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
    3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
    4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
    5. Test for leaks before applying external insulation.
    6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system

at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

7. Give seven days' advance notice for testing.

C. Duct system will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

3.12 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.
B. Use duct cleaning methodology as indicated in NADCA ACR.
C. Use service openings for entry and inspection.
   1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
   2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
   3. Remove and reinstall ceiling to gain access during the cleaning process.
D. Particulate Collection and Odor Control:
   1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
   2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
E. Clean the following components by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
   4. Coils and related components.
   5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
   6. Supply-air ducts, dampers, actuators, and turning vanes.
   7. Dedicated exhaust and ventilation components and makeup air systems.
F. Mechanical Cleaning Methodology:
   1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
   2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
   3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
   4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
   5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
   6. Provide drainage and cleanup for wash-down procedures.

7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.13 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.14 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
   1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class.
   2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
      Exposed to View or Concealed: Type 304, stainless-steel sheet.
   3. Ducts Connected to Washers, Dryers and Other High-Humidity Locations:
      Exposed to View or Concealed: Type 304, stainless-steel sheet.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Turning vanes.
6. Duct Silencers.
7. Duct-mounted access doors.
8. Flexible connectors.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. For duct silencers, include pressure drop, dynamic insertion loss, and self-generated noise data. Include breakout noise calculations for high-transmission-loss casings.

1.03 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 90A and NFPA 90B.
B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Greenheck Fan Corporation.
3. Ruskin Company.
B. Description: Gravity balanced.
C. Performance:
1. Maximum Air Velocity: 2000 fpm.
2. Maximum System Pressure: 2 inches wg.
3. AMCA Certification: Test and rate in accordance with AMCA 511.
4. Leakage:
a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
b. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
c. Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.
d. Class III: Leakage shall not exceed 40 cfm/sq. ft. against 1-inch wg differential static pressure.
D. Construction:
1. Frame:
a. Hat shaped.

b. 16-gauge- thick, galvanized sheet, with welded or mechanically attached corners and mounting flange.

2. Blades:
   a. Multiple single-piece blades.
   b. Center] pivoted, maximum 6-inch width, 16-gauge- thick, galvanized sheet steel with sealed edges.
3. Blade Action: Parallel.

E. Blade Seals: Neoprene or vinyl, mechanically locked].
F. Return Spring: Adjustable tension.
G. Damper Actuator – Gravity/Counterweight:
H. Accessories:
1. Adjustment device to permit setting for varying differential static pressure.
2. Screen Mounting:
   a. mounted in sleeve.
      1) Sleeve Thickness: 20 gauge minimum.
      2) Sleeve Length: 6 inches minimum.
3. Screen Material: [Galvanized steel] [Aluminum].
4. Screen Type: Bird Insect.

2.03 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Warming and Ventilating; a Mestek Architectural Group company.
   b. Greenheck Fan Corporation.
   c. Ruskin Company.
2. Performance:
   a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.
3. Construction:
   a. Linkage out of airstream.
   b. Suitable for horizontal or vertical airflow applications.
4. Frames:
   a. Hat-shaped, 16-gauge- thick, galvanized sheet steel.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized steel; 16 gauge thick.
   e. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.
6. Tie Bars and Brackets: Galvanized steel.
7. Locking device to hold damper blades in a fixed position without vibration.

B. Jackshaft:
1. Size: 0.5 inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:
1. 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.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.04 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a Mestek Architectural Group company.
2. Greenheck Fan Corporation.
3. Ruskin Company.

B. General Requirements:
1. Unless otherwise indicated, use parallel-blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed-blade configuration.
2. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.

C. Performance:
1. AMCA Certification: Test and rate in accordance with AMCA 511.
2. Leakage:
a. Class IA: Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure.
b. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
c. Class II: Leakage shall not exceed 10 cfm/sq. ft. against 1-inch wg differential static pressure.
d. Class III: Leakage shall not exceed 40 cfm/sq. ft. against 1-inch wg differential static pressure.
3. Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to 3000 fpm.
5. Temperature: Minus 25 to plus 180 deg F.
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

D. Construction:
1. Linkage out of airstream.
2. Suitable for horizontal or vertical airflow applications.
3. Frames:
a. Hat, U, or angle shaped.
b. 16 gauge- thick, galvanized sheet steel.
c. Mitered and welded corners.
d. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:
a. Multiple blade with maximum blade width of 6 inches.
b. Parallel or Opposed blade design per 2.4.B.1.
c. Galvanized steel**.**
d. 16-gauge- thick single skin.
5. Blade Edging Seals:
a. Replaceable Closed-cell neoprene.
6. Blade Jamb Seal: Flexible stainless steel, compression type.

7. Blade Axles: 1/2-inch diameter; galvanized steel.
8. Blade-Linkage Hardware: Zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of air stream.

E. Damper Actuator - Electric:
1. Electric - 24 V ac or 120 V as applicable.
2. UL 873, plenum rated.
3. Two position or fully modulating, with spring return as applicable. Refer to sequence of operations on plans for applicability of actuator type.
   a. Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
   b. Minimum 90-degree drive rotation.
4. Clockwise or counterclockwise drive rotation as required for application.
5. Environmental Operating Range:
   a. Temperature: Minus 40 to plus 130 deg F.
   b. Humidity: 5 to 95 percent relative humidity noncondensing.
6. Environmental enclosure: NEMA 2.
7. Actuator to be factory mounted and provided with a single-point wiring connection.

F. Controllers, Electrical Devices, and Wiring:
1. Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
2. Electrical Connection: 24 V, 60 Hz.

2.05 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Greenheck Fan Corporation.
2. Ruskin Company, or approved equal.

B. Type: Dynamic; rated and labeled in accordance with UL 555 by an NRTL.
C. Fire Rating: 1-1/2 hours.
D. Frame: Curtain type with blades inside airstream; fabricated with roll-formed galvanized steel; with mitered and interlocking corners; gauge in accordance with UL listing.
E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel; gauge in accordance with UL listing.
F. Mounting Orientation: Vertical or horizontal as indicated.
G. Blades: Roll-formed galvanized sheet steel, interlocking. Material gauge is to be in accordance with UL listing.
H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
I. Heat-Responsive Device:
1. Electric, resettable link and switch package, factory installed, 165 deg F and 212 deg F rated.

2.06 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Duro Dyne Inc, or approved equal.

B. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
D. Vane Construction:
   1. Single wall.
   2. Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.07 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Duro Dyne Inc.
   2. Ruskin Company, or approved equal.
B. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2 (7-2M), "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."
   1. Door:
      a. Double wall, rectangular.
      b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
      c. Vision panel.
      d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
      e. Fabricate doors airtight and suitable for duct pressure class.
   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
      a. 24-gauge- thick galvanized steel or 0.032-inch- thick aluminum frame.

2.08 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Duro Dyne Inc, or approved equal.
B. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.
C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
D. Materials: Flame-retardant or noncombustible fabrics.
E. Coatings and Adhesives: Comply with UL 181, Class 1.
F. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
   1. Minimum Weight: 26 oz./sq. yd.
   2. Tensile Strength: 480 lbf/inch in the warp and [360 lbf/inch] <Insert value> in the filling.
   3. Service Temperature: Minus 40 to plus 200 deg F.
G. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
   1. Minimum Weight: 24 oz./sq. yd.
   2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
   3. Service Temperature: Minus 50 to plus 250 deg F.
H. Thrust Limits: 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 fan discharge and duct.
   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 the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the 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.

2.09 DUCT ACCESSORY HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Duro Dyne Inc, or approved equal.
B. Instrument 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. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.10 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A653/A653M.
   1. Galvanized Coating Designation: G90.
   2. Exposed-Surface Finish: Mill phosphatized.
B. Stainless Steel Sheets: Comply with ASTM A480/A480M, Type 304, and having a No.2 finish for concealed ducts and No.4 finish for exposed ducts.
C. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.
D. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.
E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116 for fibrous-glass ducts.
B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.
C. Install backdraft control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.
E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.
   2. Install aluminum volume dampers in aluminum ducts.
F. Set dampers to fully open position before testing, adjusting, and balancing.

G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.
H. Install fire dampers in accordance with UL listing.
I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
    1. On both sides of duct coils.
    2. Upstream and downstream from duct filters.
    3. At outdoor-air intakes and mixed-air plenums.
    4. At drain pans and seals.
    5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
    6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
    7. For grease ducts, install at locations and spacing as required by NFPA 96.
    8. Control devices requiring inspection.
    9. Elsewhere as indicated.
J. Install access doors with swing against duct static pressure.
K. Access Door Sizes:
    1. Two-Hand Access: 12 by 6 inches.
L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
M. Install flexible connectors to connect ducts to equipment.
N. For fans developing static pressures of 5 inches wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
O. Install duct test holes where required for testing and balancing purposes.
P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:
    1. Operate dampers to verify full range of movement.
    2. Inspect locations of access doors and verify that size and location of access doors are adequate to perform required operation.
    3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and that proper heat-response device is installed.
    4. Inspect turning vanes for proper and secure installation and verify that vanes do not move or rattle.
    5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mechanical dehumidification units and supporting equipment such as remote air-cooled condensers and low source capture equipment.

1.2 RELATED SECTIONS

A. Section 23 05 00 – Common Work Results for HVAC

B. Section 23 08 00 – Commissioning of HVAC

C. Section 23 23 00 – Refrigerant Piping

1.3 References

A. Abbreviations and Acronyms

B. Definitions

1. Exhaust Air Energy Recovery: Exhaust air energy recovery ventilation is a system which works between two air sources at different temperatures. Heat recovery is a method of heat pump energy capture which is used to reduce the heating requirement for a pool or natatorium.

2. Source Capture or Low Source Capture: A methodology to remove the byproducts of the disinfection process that results from chlorination of a pool. It is important to remove these byproducts from the building as they are hazardous to human health.

3. EC Motor: Electronically commutated motors are brushless, permanent-magnet motors that incorporate a built-in power inverter to convert AC to DC voltage.

4. AC Motor: An alternating current fan or motor that uses an electromagnetic induction.

C. Reference Standards

1. ASHRAE 90.1 – 2019

2. AHRI 910: Performance Rating Indoor Pool Dehumidifiers (As a method of calculating MRC and MRE)

3. ANSI/UL 1995, Standard for Heating and Cooling Equipment

4. CSA B52, Mechanical Refrigeration Code

5. CSA C22.1, Canadian Electrical Code

6. NFPA 90A, Installation of Air Conditioning and Ventilating Systems

7. Air Movement and Control Association (AMCA) Publication 511-13

8. NEMA MG1 Motors and Generators

9. ASTM B117 / DIN 53167 Salt Spray

10. ASTM A653/A653M (2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

1.4 Administrative Requirements

A. Pre-installation meeting: Convene minimum two weeks prior to starting work of this section with contractors, engineer and manufacturer.

B. Sequencing of construction: Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.5 Submittals

A. Product Data

1. Source Capture Energy Recovery performance shall include the following capacities provided for the design conditions specified on the equipment schedule

a. Exhaust Air CFM

1) Minimum cubic feet per minute (CFM)

2) Maximum cubic feet per minute (CFM)
3) Maximum energy recovery at room conditions in MBH.

B. Shop Drawings
1. Provide detailed physical layout for installation.
2. Provide wiring schematics for installation.

C. Manufacturer's Instructions
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Guidance on equipment rigging.
4. Installation methods.

1.6 Quality Assurance

A. Manufacturer Qualifications
1. Minimum 5-year experience manufacturing similar products.
2. Member in good standing in the Air Conditioning, Heating, and Refrigeration Institute (AHRI)

B. Installer Qualifications
1. Minimum 2-year experience installing similar products
2. North American Technician Excellence (NATE) Certification, HVAC Excellence Certification or equivalent certification.
3. Cost for startup assistance by manufacturer's personal or manufacturer's designated and trained third party must be included with each product specified.

C. Delivery, Storage and Handling
1. Handle materials as recommended by manufacturer to avoid damage.

1.7 Field 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 recommended limits.

B. Do not operate Source Capture Energy Recovery for exhaust air during construction.

PART 2 Products

2.1 Source Capture Energy Recovery

A. Manufacturer
1. Basis of Design: Desert Aire RecoverAire
2. Substitution Limitations: No Substitutions

B. The size and capacity shall be in accordance with the source capture energy recovery schedule and include the Performance Criteria identified in Section 1.6.

C. Source Capture Energy Recovery Unit Description
1. Cabinet
a. The unit shall be mountable on a slab or on equipment rail.
b. Units for outdoor installation shall include a rain hood and bird screen.
2. Electrical Compartment
a. The source capture energy recovery unit shall have an isolated electrical compartment that includes a hinged access door.
b. High and lower voltage electrical components shall have separate sections.
c. The unit shall have a single point power connection.

1) If the source capture energy recovery requires freeze protection an independent 120V power connection for the condenser heat tracing is factory installed. Contractor must field supply and field install a 120V connection to the heat tracing.

d. Electrical markings on the unit shall include, but not limited to the MCA (Minimum Circuit Ampacity), the MOPD (Maximum Over-Current Protection Device) and the SCCR

e. Electrical nameplate on the unit shall include, but not limited to the MCA (Minimum Circuit Ampacity), the MOPD (Maximum Over-Current Protection Device) and the SCCR

f. The unit shall be compatible with the electrical voltage, phase and hertz requirements as indicated on the source capture energy recovery schedule.

3. Refrigerant System
   a. The source capture energy recovery unit operating refrigerant shall be R-410A.
   b. Compressor
      1) The compressor shall be a heavy-duty scroll-type.
      2) The compressor shall be equipped with high- and low-pressure safety switches, with internal protection from overheating.
      3) Compressor shall include anti-short cycling timer to protect against compressor cycling.
      4) The compressor shall have a refrigerant sight glass.
      5) The compressor shall be externally vibration isolated using rubber-in-shear isolation.
4. Coil
   a. The coil shall be leak tested at the factory.
   b. The coil shall be coated to protect against corrosion.
5. Receiver
   a. The source capture energy recovery unit shall include a refrigerant receiver with rotolock service valves.
   b. The receivers shall be sized for full-system refrigerant circuit capacity to allow system pump down.
   c. The receiver shall be manufactured in accordance with ASME Sec. VIII, Div. 1 and comply with CSA B51
   d. The receiver shall have a Canadian Registration Number (CRN).
6. Fan
   a. The fan shall be driven by a direct-drive EC motor that can vary the amount of air that is exhausted.
   b. Single-sided intake, rear-curved motor impeller, energy-optimized for operation without spiral housing through special blade design with rotating, vaneless diffuser for high efficiency.
   c. Inlet nozzle with volume flow rate measuring equipment.
   d. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.
   e. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.
   f. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.
   g. The multiple direct driven supply air blower wheels shall be a parallel mounted array.
   h. The complete blower assembly shall be statically and dynamically balanced on

precision electronic balancers.

7. Filter

   a. The system shall be provided with MERV 10 disposable filters consisting of 4" pleated filter to keep the coil clean.

8. Pool Water Condenser

   a. The pool water condenser shall reject heat to the pool water loop.

   b. The condenser shall be wrapped in insulation and heat traced.

9. Control System:

   a. A digital control system using a 16-bit microprocessor shall be used to accurately and precisely control the low exhaust air amount. It shall communicate with the main dehumidification controller for complete integration of the two systems.

10. Sensors

    a. Unit shall be equipped with an airflow switch to prevent the compressors from starting or operating on loss of airflow.

11. Water Flow Switch

    a. The dehumidifier shall be equipped with a water flow switch.

    b. A water flow switch shall prevent condenser operation in the event of loss of water flow.

    c. The unit shall be able to exhaust air normally (low source capture exhaust air) when water flow is not present.

12. Sequence of Operation

    a. Whenever low exhaust air is required, the fan shall run to exhaust air.

    b. The unit monitors the intake temperature and humidity to determine if engaging the heat pump recovery system is efficient.

    c. Energy recovery to the pool water will take place when all of the following are true.

       1) Pool water is requiring heat.

       2) Airflow measured at the fan inlet venture is greater than the minimum airflow for the unit.

       3) The energy of the incoming air (enthalpy) is greater than the factory set minimum.

       4) The source capture energy recovery unit shall coordinate with the dehumidifier to maintain ventilation air to the zone and a negative zone pressure.

13. Materials

    a. Cabinet

       1) The base rails and supports shall be 12-gauge galvanneal steel channels.

       2) Corner posts and side posts shall be formed of 18-gauge galvanneal steel.

       3) Top panels and removable side panels shall be 16-gauge galvanneal steel.

       4) The cabinet shall be insulated with engineered polymer closed-cell foam insulation (EPFI). The thickness will be ¾ of an inch for outdoor units.

       5) The interior and exterior panels shall have a powder coat paint that is rated to meet a minimum of 1,000-hour salt spray test (ASTM B117).

    b. Coil

       1) The coil shall be fabricated from seamless drawn copper. The tubes shall be hydraulically expanded into the aluminum fins to form a permanent metal-to-metal bond for maximum heat transfer and stability.

       2) Fins shall be die-formed, aluminum and shall be damage resistant. Extruded fin

collars provide maximum heat transfer.

3) The refrigeration heat exchangers shall be coated with ElectroFin® E-Coat through electro-deposition immersion process for enhanced corrosion resistance on the complete coil assembly including casing, distributor tubes and header. Dry film thickness shall be 0.6-1.2 mils (15-25 µm). Heat transfer coefficient loss shall be less than 1% after coating. Minimum salt spray resistance per ASTM B117-97 / DIN 53167 after coating shall be 6,000 hours. Phenolic coatings or fin surface only coatings are not acceptable. Manual dip processes or spray application processes will not meet specification.

c. Fan

1) Centrifugal impeller made of high-strength composite material, coated steel, or aluminum.

2) Inlet nozzle shall be made of galvanized steel.

3) Plenum Fan Housing: Steel frame and panel; fabricated without fan scroll and volute housing.

d. Pool Water Condenser

1) The condenser shall be tube-in-tube coaxial heat exchanger with cupronickel construction for water path and steel outer tube with CPVC stub-outs.

PART 3 Execution

3.1 Examination

A. Do not begin installation until wall openings and rough-in have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 Preparation

A. Prepare conditions using the methods recommended by the manufacturer for achieving the best result for the operation under the project conditions.

3.3 Installation

A. Install in accordance with manufacturer's instructions. Test for proper operation and adjust as required until satisfactory results are obtained.

3.4 If specifically requested by the engineer or owner, a factory tour and equipment inspection at the factory shall be made available at an additional cost.

3.5 Factory Assisted Startup

A. Manufacturer is required to provide a technician on site to assist the installing contractor with the startup of the equipment. The cost of the factory assisted startup must be included in the price of the equipment.

3.6 Training

A. Owner/operator training shall be provided by factory technicians or factory authorized personnel to provide this training during the factory assisted startup.

B. Service technician training shall be periodically available to service contractors at the manufacturer’s factory.

3.7 Protection

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before substantial completion.

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Rectangular and square ceiling diffusers.
   2. Louver face diffusers.
   3. Linear slot diffusers.

B. Related Requirements:
   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
   2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Anemostat Products; a Mestek company.
   2. Price Industries.
   3. Titus; brand of Johnson Controls International plc, Global Products.

B. Devices shall be specifically designed for variable-air-volume flows.
C. Material: Aluminum.
D. Finish: Baked enamel, color selected by Architect.
E. Face Size: as scheduled on the plan set.
F. Mounting: Surface.
G. Pattern: Adjustable.
H. Dampers: Radial opposed blade.

2.02 LOUVER FACE DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Anemostat Products; a Mestek company.
   2. Price Industries.
   3. Titus; brand of Johnson Controls International plc, Global Products.

B. Devices shall be specifically designed for variable-air-volume flows.
C. Material: Aluminum.
D. Finish: Baked enamel, color selected by Architect.
E. Face Size: As scheduled.
F. Mounting: Surface.
G. Pattern: Adjustable core style.
H. Dampers: Radial opposed blade.
I. Accessories:
   1. Square to round neck adaptor.

2.03 LINEAR SLOT DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Anemostat Products; a Mestek company.
   2. Price Industries.
   3. Titus: brand of Johnson Controls International plc, Global Products.

B. Devices shall be specifically designed for variable-air-volume flows.

C. Material - Shell: Steel, insulated.
D. Material - Pattern Controller and Tees: Aluminum.
E. Finish - Face and Shell: Baked enamel.
F. Finish - Pattern Controller: Baked enamel.
G. Finish – Tees: Baked enamel, color selected by Architect
H. Slot Width: As scheduled.
I. Number of Slots: As scheduled.
J. Length: As scheduled.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install diffusers level and plumb.
B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.02 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Adjustable blade face registers and grilles.
   2. Fixed face registers and grilles.

B. Related Requirements:
   1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
   2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 REGISTERS

A. Adjustable Blade Face Register
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anemostat Products; a Mestek company.
      b. Price Industries.
      c. Titus; brand of Johnson Controls International plc, Global Products.
   2. Material: Aluminum.
   3. Finish: Baked enamel, color selected by Architect.
   4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
   5. Core Construction: Removable.
   6. Rear-Blade Arrangement: Horizontal spaced 1/2 inch apart.
   7. Frame: 1 inch wide.
   8. Mounting: As required by specific application.
   9. Damper Type: Adjustable opposed blade.
   10. Accessories:
      a. -blade gang operator.

B. Fixed Face Register:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anemostat Products; a Mestek company.
      b. Price Industries.
      c. Titus; brand of Johnson Controls International plc, Global Products.
   2. Material: Aluminum.
   3. Finish: Baked enamel, color selected by Architect.
   4. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
   5. Core Construction: Removable.
   6. Frame: 1 inch wide.
   7. Mounting: As required by specific application.
   8. Damper Type: Adjustable opposed blade.

2.02 GRILLES

A. Fixed Face Grille:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Anemostat Products.
      b. Price Industries.
      c. Titus; brand of Johnson Controls International plc, Global Products.

2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal; spaced 1/2 inch apart.
5. Core Construction: Removable.
6. Frame: 1 inch wide.
7. Mounting: As required by specific application.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.02 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pleated panel filters.
   2. Filter gauges.

B. Related Requirements:
   1. Section 233119 "HVAC Casings" for customized housings used for particulate air filters.
   2. Section 233416 "Centrifugal HVAC Fans" for customized fan and filter units.
   3. Section 234133 "High-Efficiency Particulate Air Filtration" for HEPA filters used in combination with particulate air filters.
   4. Section 234300 "Electronic Air Cleaners" for electronic units combined with particulate filters as part of a system.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance:
   1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
   2. Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.

B. 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.

2.2 PLEATED PANEL FILTERS

A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AAF International.
      b. Camfil Farr.
      c. Flanders Corporation.

B. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive. Coat media with an antimicrobial agent.
   1. Separators shall be bonded to the media to maintain pleat configuration.
   2. Welded-wire grid shall be on downstream side to maintain pleat.
   3. Media shall be bonded to frame to prevent air bypass.
   4. Support members on upstream and downstream sides to maintain pleat spacing.

C. Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.

PART 3 EXECUTION

3.1 INSTALLATION OF FILTERS

A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
B. Install filters in position to prevent passage of unfiltered air.
C. Install filter gauge for each filter bank.
D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
E. Coordinate filter installations with duct and air-handling-unit installations.

3.2 INSTALLATION OF FILTER GAUGES

A. Install filter gauge for each filter bank.
B. Install filter-gauge, static-pressure tips upstream and downstream from filters. Install filter gauges on filter banks with separate static-pressure taps upstream and downstream from filters. Mount filter gauges on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gauges.

3.3 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.
B. Connect control wiring between pressure sensors and DDC system.
C. Connect control wiring between controlled devices.
D. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.4 CLEANING

A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fixed-plate, sensible/latent heat exchangers in packaged, outdoor, energy-recovery units.
   2. Natatorium dehumidifier

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 COORDINATION

A. Coordinate sizes and locations of building openings and duct connections with actual equipment provided.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of packaged, outdoor, fixed-plate, energy-recovery units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Packaged Energy-Recovery Units: One year from date of Substantial Completion.
   2. Warranty Period for Fixed-Plate Heat Exchangers: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
B. ASHRAE Compliance:
   1. Applicable requirements in ASHRAE 62.1.
   2. Capacity ratings for fixed-plate energy-recovery units shall comply with ASHRAE 84.
C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.

2.2 AIR HANDLING UNIT WITH DEHUMIDIFIER

A. Accepted manufacturer: Desert Aire, or Approved Equal.
B. Enclosure:
   1. 12-gauge galvanneal steel channels; corner posts and side posts shall be formed of 16-gauge galvanneal steel; top panels and removable side panels shall be 16-gauge galvanneal steel.
   2. Removable panels with insert nut screw sites shall be provided to allow easy access to all internal parts and components. The electrical control box and switch panel shall be enclosed in a separate compartment, complete with a hinged door.
C. Paint and Finish:
   1. Painting shall be by a powder coat technique to assure positive adherence with a high impact finish. All sides of panels shall be painted after manufacturing.
   2. The paint shall be High Yield Polyester. The paint shall be rated to meet a minimum of 1,000-hour salt spray test (ASTM B117), have a minimum Direct Impact Resistance of 160 in-lbs (ASTM D2794), have a minimum flexibility of ¼" Mandrel (ASTM D522, Method B) and a minimum 1000-hour Humidity Resistance (ASTM D2247).
   3. The unit color shall be light gray.
D. Refrigerant System:

1. Refrigerant: The system's operating refrigerant shall be R-410A.
2. Compressors: The compressors shall be a dual circuit, tandem pair, heavy-duty scroll-type. The circuits shall be staged. The compressor shall be equipped with high and low-pressure safety switches, with internal protection from overheating. The compressor shall be externally vibration isolated.
3. Receiver: The unit shall include a refrigerant receiver with rotolock service valves. The receiver shall be sized for full-system refrigerant capacity to allow system pump down, and for operating at the highest efficiency over a wide range of load conditions.
4. Evaporator Dehumidifier Coils:
   a. Fins: Fins shall be die-formed, aluminum and shall be damage resistant. Extruded fin collars provide maximum heat transfer. Fin spacing shall be 10 FPI (fins per inch) maximum. The coil shall be a maximum of 38" in height to avoid water carryover to the reheat coil and re-evaporation into the air stream.
   b. Tubes: Coils shall be fabricated from seamless drawn copper. The tubes shall be hydraulically expanded into the fins to form a permanent metal-to-metal bond for maximum heat transfer and stability. Each coil shall have its own drain pan.
   c. Testing: Coils shall be leak tested with 420 psig nitrogen.
5. Refrigerant Condenser Coils: Air-Cooled Condenser (Reheat Coil): The reheat coil shall be positioned with a minimum of 5" clearance from the DX coil to help prevent water re-evaporation.
   a. Fins: Fins shall be die–formed aluminum and shall be damage resistant. Fin spacing shall be 12 FPI (fins per inch) maximum.
   b. Tubes: Coils shall be fabricated from seamless drawn copper. The tubes shall be hydraulically expanded into the fins to form a permanent metal–to–metal bond for maximum heat transfer and stability. The coil shall be a minimum of two (2) rows deep.
   c. Testing: Coils shall be leak tested with 420 psig nitrogen.
6. Auxiliary Heater
   a. Hot Water Coil:
      1) The capacity shall be in accordance Desert Aire schedule. The coil shall be integral to the unit.
      2) Fins: Fins shall be die-formed, aluminum and shall be damage resistant. Fin spacing shall be 14 FPI.
      3) Tubes: Coil shall be fabricated from seamless drawn copper. The tubes shall be hydraulically expanded into the fins to form a permanent metal-to-metal bond for maximum heat transfer and stability.
      4) Coils shall be leak tested with 315 psig of nitrogen.
      5) Freeze protection: The system will include a temperature sensor that is located on the top third of the discharge side of the hot water coil. When this sensor reads a temperature of 35°F or below, the unit will de-energize the blower(s), close the outdoor air damper, open the return damper (if applicable) and force the heat output to maximum. The unit will go into alarm mode and will need to manually reset to restart the unit.
      6) The modulating or on/off control valve shall be provided and installed by the mechanical contractor to meet the required flow rate and pressure drop listed in the schedule.

E. Unit Location:
   1. Outdoor installation, west side of the natatorium.
F. Ventilation and Exhaust Air:
   1. Refer to Section 23 35 00 "Special Exhaust Systems"
G. Electrical Control Panel:
   1. Short Circuit Current Rating (SCCR):
      a. The complete unit shall be rated in compliance with NEC® 110.10 and UL 1995 at nameplate voltage maximum, when protected by Class J, Class T or Class RK1 fusing.

b. Electrical markings on the unit shall include, but not limited to the MCA (Minimum Circuit Ampacity), the MOPD (Maximum Over-Current Protection Device) and the SCCR.

2. The unit will be provided with single point power connection to serve controls, fans, electric auxiliary heater (if provided), and compressors, factory wired to the power connection lug set.
3. The electrical controls will include low-voltage transformers to supply 24 VAC control power, clearly labeled high and low-voltage terminal strips, high- and low-pressure control (with manual reset of the high-pressure cutout and automatic reset of low-pressure cutout), and an anti-short cycling timer to protect against compressor cycling.

H. Control System:
1. Digital control system using a modern microprocessor will be used to control the unit dehumidification system and the space environment accurately and precisely.
2. Temperature Sensor:
a. The unit shall include a return air temperature sensor.
3. Relative Humidity Sensor
a. The unit shall include a relative return air humidity sensor
4. BMS Compatibility:
a. BacNet MS/TP
5. Airflow Switch:
a. The dehumidifier shall be equipped with an airflow switch to prevent the compressors from starting or operating on loss of airflow.

I. Condensate Drain Pan:
1. The drain pan will meet all the requirements of ASHRAE Standard 62:
a. 20-gauge stainless steel, sloped, and positioned under the dehumidifier coil

J. Insulation:
1. The thermal and sound insulation shall be engineered polymer closed-cell foam insulation (EPFI). Indoor units shall have 3/8” thick insulation and outdoor units shall have 3/4" thick insulation. The insulation meets the following requirements:
a. NFPA 255 Flame Spread – 25
b. NFPA 255 Smoke Developed – 50
c. NFPA 255 Fuel Contributed – 0 NFPA 90A (2-2.4.2) and 90B
d. ASTM C5118 (Thermal Resistance)
e. ASTM C411 (Hot Surface Performance)
f. ASTM C423 (Sound Absorption)
g. ASTM C665 (Fungi Resistance)
h. ASTM E90 (Airborne Sound Transmission Loss)
i. ASTM E96 (Water Vapor Transmission)
j. UL 94HBF (Horizontal Burn)
k. UL 181 (Air Erosion, Mold Growth, and Humidity)
l. ASTM C1136 (Mold, Mildew, and Moisture Resistance)

K. Fans:
1. Main Supply and Return
a. Double Inlet Air Foil Fans: The fan housing shall be made of galvanized steel. The high performance impeller is manufactured in corrosion resistant steel, with backward curved, true airfoil shaped blades, welded into position.
b. Blower Discharge: The unit’s air discharge will be as shown on the drawing.
c. Blower Pulley Assembly: The driver pulley and the blower pulley will be made of cast iron. The motor sheave will be a variable pitch type to allow for field adjustment of CFM and external static.
2. Exhaust Fan:
a. The unit shall be provided with plenum fan(s) and motor(s) in direct drive arrangement on a frame independent of the unit base.

b. The exhaust fan motor shall be variable speed via electronically commutated (EC) design for highest overall system efficiency. Motor to be permanent magnet brushless DC design with integral rectifier and electronics. Integral under/over voltage protection, motor protection, and status indication is required. Motor electronics to be encapsulated for shock, moisture and corrosion resistance. Fixed speed motors or AC motors with variable speed drives are not acceptable. Motors shall utilize permanently lubricated ball bearings with L10 life of 40,000 hours minimum.

c. The venturi shall be constructed of heavy weight galvanized steel and have provisions for static pressure measurement via transducer at the inlet plenum and specific position at the venture throat. Qualified values of the venture static pressure coefficients to calculate airflow must be type tested in the application and programmed into the unit controller for display of flow rates.

d. The fan impeller is to be constructed of a high strength, low mass, corrosion-free composite material in a single shot injection molding process. The impeller blades are to be backwards-curved airflow type. Forward-curved or flat backwards-incline blades are not acceptable. The impeller shall be balanced with hub with admissible vibration severity less than 0.11 in/s.

e. The exhaust fan frame assembly shall be constructed of heavy gauge galvanized and shall support the fan and motor. When more than one fan is provided, each must be mounted on its own independent frame.

L. Filters:
   1. MERV 13 disposable filters consisting of 4” pleated filter.

M. Accepted Manufacturer:
   1. Desert Aire or Approved equal.

PART 3 EXECUTION

3.1 INSTALLATION OF PACKAGED, OUTDOOR, FIXED-PLATE, ENERGY-RECOVERY UNITS

A. Examine casing insulation materials and filter media before packaged, outdoor, fixed-plate, energy-recovery unit installation. Replace insulation materials and filter media that are wet, moisture damaged, or mold damaged.

B. Install packaged, outdoor, fixed-plate, energy-recovery units, so supply and exhaust airstreams flow in opposite directions.
   1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to interior components.
   2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
   3. Access doors and panels are specified in Section 233300 "Air Duct Accessories."

C. Equipment Mounting:
   1. Install packaged, outdoor, fixed-plate, energy-recovery units on structural support stand. Contractor shall provide design of steel stand sealed by a Structural Engineer licensed in the State of Washington.
   2. Comply with requirements for vibration-isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

D. Install units with clearances for service and maintenance.

E. Do not operate equipment fans until temporary or permanent filters are in place. Replace temporary filters used during construction and testing with new, clean filters prior to final inspection.

3.2 DUCTWORK CONNECTIONS

A. Comply with requirements for ductwork in accordance with Section 233113 "Metal Ducts."

B. Connect duct to units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."

3.3 ELECTRICAL CONNECTIONS

A. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
C. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
   1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
   2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections with assistance of factory-authorized service representative.
B. Tests and Inspections:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
C. Packaged, outdoor, fixed-plate, energy-recovery units will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air-to-air energy-recovery units.

END OF SECTION 237223.29

PART 1 GENERAL

1.01 SUMMARY OF WORK

A. The extent and location of "Air Handling Unit" Work is shown in the Contract Documents. Section includes all accessories.

1.02 GOVERNING CODES, STANDARDS AND REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. ARI (Air Conditioning and Refrigeration Institute)
    a. ARI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils.
2. AMCA (Air Movement and Control Association)
    a. AMCA 99 - Standards Handbook.
    b. AMCA 210 - Laboratory Methods of Testing Fans for Rating.
    c. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
    d. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
    e. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
3. ABMA (American Bearing Manufacturers Association)
    a. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings.
    b. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings.
4. ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers)
    a. ASHRAE 51 - Lab Methods of Testing Fans for Rating.
5. FM (Factory Mutual Standards)
6. NEMA (National Electrical Manufacturers Association)
    a. NEMA MG1 - Motors and Generators.
7. NFPA (National Fire Protection Association)
    a. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
8. SMACNA (Sheet Metal and Air Conditioning Contractors' National Association)
    a. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
9. UL (Underwriters Laboratories, Inc.)
    a. UL 900 - Standard for Air Filter Units.
    b. UL - Fire Resistance Directory.

1.03 SUBMITTALS

A. Submit materials data in accordance with Section 01 33 00 - Submittals. Furnish manufacturers' technical literature, standard details, product specifications, and installation instructions.

B. LBC Submittals: All materials to be used in the project are to be submitted in accordance with the requirements of specification section 01 81 13 - Sustainable Design Requirements (LBC).

C. Submittals shall include the following:

1. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
2. Product Data, Submit:
    a. Published Literature: Indicate capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
    b. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
    c. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
    d. Sound Power Level Data: Fan outlet (“supply” and “return” sides of fan) and casing radiation at rated capacity.
    e. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
3. Manufacturer's Installation Instructions: Submit.
4. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Provide materials in accordance with the specifications.

B. Maintain one copy of each document on site.

1.05 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 approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage

B. Protect units from weather and construction traffic by storing in a dry, roofed location.

1.07 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.08 EXTRA MATERIALS

A. Spare and extra parts shall be identified for all products, but not provided. Include spare parts information in Operation and Maintenance Manuals.

PART 2 PRODUCTS

2.01 DEDICATED OUTDOOR AIR HANDLERS (DOAS-1):

A. Accepted Manufacturers: Nortek, Oxygen8, Greenheck, York, Or Approved Equal.

B. Configuration: Fabricate as detailed on prints and drawings:
1. Return plenum
2. Filter sections
3. Fan sections

4. Heat Recovery Section

C. Each unit shall be specifically designed for outdoor air application and include a fully insulated cabinet. Each unit shall be completely factory assembled and shipped in one piece.

D. Performance: All scheduled capacities and face areas are minimum accepted values and must be met. All scheduled amps, kW, and HP are maximum accepted values. Consideration will be made for any unit that can be shown to use less energy on an annual basis.

E. Cabinet, Casing, Frame

1. Panel construction shall be double-wall construction for all panels including the floor panels. Equipment shall have an under floor liner. Insulation shall be a minimum of 1" thick with an R-value of 6.5. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.

2. Exterior surfaces shall be constructed of pre-painted galvanized steel, 22-gauge, for aesthetics and long term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat of a neutral beige color.

3. Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Door shall be of same construction as panels.

4. Provide factory mounted disconnect.

F. Exhaust Fan and Supply Fan

1. Exhaust fan and Supply fans shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan and supply fan shall be a direct drive fan mounted to the motor shaft

2. The fan motor shall be a totally enclosed EC motor that is speed controlled by the unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

3. Fan assembly shall be a slide out assembly for servicing and maintenance.

4. The unit controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure set point. The field shall mount the required sensing tubing from the building to the factory mounted building static pressure sensor.

G. Filters:

1. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2” prefilter and a 4” final filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2” construction filters. The contractor shall furnish and install, at building occupancy, the final set of filters per the contract documents.

2. Provide MERV 13 filters for all outside air.

3. Provide MERV 8 filters for all exhaust air.

4. Provide factory mounted pressure sensors to measure filter pressure drop across filters. Unit controller shall monitor filter pressure level and report when filter changes are required.

H. Heat Recovery Section

1. Cross flow style energy recovery system.
2. 0% leakage between airstreams.
3. Unit shall include bypass dampers with modulating actuators. Unit controller shall operate bypass dampers to maximize heat transfer without frosting and bypass heat exchanger during economizer mode. Energy recovery device shall be installed over a stainless-steel double sloped condensate pan.

I. Controls:

1. Refer to sequence of operations.
2. Provide all sensors, actuators, and relays to execute sequence of operations.
3. Provide with communications card compatible with BACnet. Communication shall include, at aminimum, status, enable, disable, alarms, faults, and maintenance alerts.

PART 3 **EXECUTION**

3.01 INSTALLATION

A. Install in accordance with ARI 430.

3.02 FIELD QUALITY CONTROL

A. Section 01 45 16.13 – Contractor's Quality Control Program.

B. Section 23 05 93 - Testing, Adjusting, and Balancing.

3.03 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit unit operation without air filters.

3.04 SCHEDULES

A. See Mechanical Drawings Schedule for capacities and electrical characteristics.

End of Section

PART 1 GENERAL

1.1 SUMMARY

A. Section includes complete VRF HVAC system(s) including, but not limited to the following components to make a complete operating system(s) according to requirements indicated:
   1. Indoor, concealed, ceiling-mounted units for ducting.
   2. Indoor, exposed, wall-mounted units.
   3. Outdoor, air-source heat recovery units.
   4. Heat recovery control units.
   5. System controls.
   6. System refrigerant and oil.
   7. System condensate drain piping.
   8. System refrigerant piping.
   9. Metal hangers and supports.
   10. Fastener systems.
   11. Equipment stands.
   12. Miscellaneous support materials.
   13. Piping and tubing insulation.
   14. System control cable and raceways.

1.2 DEFINITIONS

A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.

B. Heat-Pump System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.

C. Heat Recovery System Operation: System capable of operation with simultaneous heating and cooling zones that transfer heat between zones.

D. HRCU: Heat Recovery Control Unit. HRCUs are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and cooling zones. "Heat Recovery Control Unit" is the term used by ASHRAE for what different manufacturers term as branch circuit controller, branch selector box, changeover box, flow selector unit, mode change unit, and other such terms.

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

F. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

G. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One liquid line and refrigerant vapor line connect HRCUs to associated indoor units.

H. Two-Pipe System Design: One refrigerant vapor line and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One refrigerant liquid line and refrigerant vapor line connect HRCUs to associated indoor units. HRCUs used in two pipe systems act as an intermediate heat exchanger and include diverting valves and gas/liquid separators to move high and low pressure refrigerant between indoor units.

I. VRF: Variable refrigerant flow.

1.3 ACTION SUBMITTALS

A. Product data.

B. Sustainable Design Submittals:
   1. Product Data: For energy performance.
   2. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
   3. Air-Balance Report: Documentation indicating that Work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
   4. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
   5. Refrigerant: Product Data for refrigerants, indicating compliance with refrigerant management practices.
   6. Product Data for EA Credit "Optimize Energy Performance": Indicating that system meets efficiency requirements.
   7. Refrigerant: Product Data for refrigerants, indicating compliance with refrigerant management practices.
   8. Product Data for EA Credit "Advanced Energy Metering": For continuous metering equipment.
   9. Product Data for EQ Credit "Acoustic Performance": Documentation indicating that systems and equipment comply.
C. Shop Drawings: For VRF HVAC systems.
   1. Include plans, elevations, sections, and mounting/attachment 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
   5. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.
B. Software and Firmware Operational Documentation:
   1. Software operating and upgrade manuals.
   2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
   3. Device address list.
   4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.
   1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
   2. Installer certification shall be valid and current for duration of Project.
   3. Retain copies of Installer certificates on-site and make available on request.
   4. Each person assigned to Project shall have demonstrated past experience.
      a. Demonstrated past experience with products being installed for period within five consecutive years before time of bid.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.
   1. Warranty Period:
      a. For Compressor: ten year(s) from date of Substantial Completion.
      b. For Parts, Including Controls: ten year(s) from date of Substantial Completion.
      c. For Labor: five year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Daikin AC (Americas), Inc.
   2. Mitsubishi Electric & Electronics USA, Inc.

2.2 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, HRCUs, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.
   1. Two-pipe system design. Three-pipe is acceptable alternate at no additional cost.
   2. System(s) operation, heat recovery as indicated on Drawings.
   3. Each system with one refrigerant circuit shared by all indoor units connected to system.
B. 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.
C. AHRI Compliance: System and equipment performance certified according to AHRI 1230
D. ASHRAE Compliance:
   1. ASHRAE 15: For safety code for mechanical refrigeration.
   2. ASHRAE 62.1: For indoor air quality.
   3. ASHRAE 135: For control network protocol with remote communication.
   4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.
E. UL Compliance: Comply with UL 1995.

2.3 PERFORMANCE REQUIREMENTS

A. Service Access:
   1. Provide and document service access requirements.
   2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
   3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
   4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
   5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
   6. Comply with OSHA regulations.
B. System Design and Installation Requirements:
   1. Design and install systems indicated according to manufacturer's recommendations and written instructions.

2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.

C. System Adaptability to Future Changes: Arrange and size system refrigerant piping to accommodate future changes to system without having to resize and replace existing refrigerant piping.
1. Future changes to system(s) indicated on Drawings.
2. Each branch circuit shall accommodate addition of two indoor unit(s) with unit capacity equal to largest indoor unit connected to the branch circuit.

D. Isolation of Equipment: Provide isolation valves to isolate each HRCU, indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.

E. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:
1. Not less than 60 percent.
2. Not more than 120 percent.
3. Range acceptable to manufacturer.

F. System Turndown: Stable operation down to 20 percent of outdoor-unit capacity.

G. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.

H. Outdoor Conditions:
1. Suitable for outdoor ambient conditions encountered.
a. Design equipment and supports to withstand wind loads of governing code and ASCE/SEI 7 .
b. Design equipment and supports to withstand snow and ice loads of governing code and ASCE/SEI 7 .
c. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.
2. Maximum System Operating Outdoor Temperature: See Drawings.
3. Minimum System Operating Outdoor Temperature: See Drawings.

I. Seismic Performance: VRF HVAC system(s) shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified [and the system will be fully operational after the seismic event]."
2. Component Importance Factor: 1.0 .

J. Capacities and Characteristics: As indicated on Drawings.

2.4 INDOOR, CONCEALED, CEILING-MOUNTED UNITS FOR DUCTING

A. Description: Factory-assembled complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

B. Cabinet:
1. Material: Galvanized or painted steel.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:
1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:
1. Fan(s):
   a. Direct-drive arrangement.
   b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
   c. Fabricated from non-ferrous components or ferrous components with corrosion-resistant finish.
   d. Wheels statically and dynamically balanced.
2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:
1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
2. Efficiency: ASHRAE 52.2, MERV 13
3. Media:
   a. Replaceable: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.

G. Unit Accessories:
1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

H. Unit Controls:
1. Enclosure: Metal, suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:
4. Features and Functions:
   a. Self-diagnostics.
   b. Time delay.
   c. Auto-restart.
   d. External static pressure control.
   e. Auto operation mode.
   f. Manual operation mode.

g. Filter service notification.
h. Power consumption display.
i. Drain assembly high water level safety shutdown and notification.
j. Run test switch.

5. Communication: Network communication with other indoor and outdoor units.
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

I. Unit Electrical:
1. Enclosure: Metal, suitable for indoor locations.
2. Field Connection: Single point connection to power unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways.

2.5 INDOOR, EXPOSED, WALL-MOUNTED UNITS

A. Description: Factory-assembled complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

B. Cabinet:
1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:
1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

D. Drain Assembly:
1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Pumped unless specifically noted on plans otherwise.
a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.
3. Field Piping Connection: Non-ferrous material.

E. Fan and Motor Assembly:
1. Fan(s):
a. Direct-drive arrangement.

b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:
1. Access: Front, to accommodate filter replacement without the need for tools.
2. Washable Media: Manufacturer's standard filter with antimicrobial treatment.

G. Grille Assembly: Manufacturer's standard discharge grille with field-adjustable air pattern.

H. Unit Accessories:
1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power.

I. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Communication: Network communication with other indoor units and outdoor unit(s).
4. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
5. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

J. Unit Electrical:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

2.6 OUTDOOR, AIR-SOURCE HEAT RECOVERY UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
1. Specially designed for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
3. All units installed shall be from the same product development generation.

B. Cabinet:
1. Galvanized steel and coated with a corrosion-resistant finish.
2. Mounting: Manufacturer-designed provisions for field installation.

3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Compressor and Motor Assembly:
   1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to 15 percent of rated capacity.
   2. Protection: Integral protection against the following:
      a. High refrigerant pressure.
      b. Low oil level.
      c. High oil temperature.
      d. Thermal and overload.
      e. Voltage fluctuations.
      f. Phase failure and phase reversal.
      g. Short cycling.
   3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
   4. Vibration Control: Integral isolation to dampen vibration transmission.
   5. Oil management system to ensure safe and proper lubrication over entire operating range.
   6. Crankcase heaters with integral control to maintain safe operating temperature.
   7. Fusible plug.

D. Condenser Coil Assembly:
   1. Plate Fin Coils:
      a. Casing: Aluminum, galvanized, or stainless steel.
      b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
      c. Tubes: Copper, of diameter and thickness required by performance.
   2. Aluminum Microchannel Coils:
      a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
      b. Single- or multiple-pass arrangement.
      c. Construct fins, tubes, and header manifolds of aluminum alloy.
   3. Coating: Corrosion resistant.
   4. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

E. Condenser Fan and Motor Assembly:
   1. Fan(s): Propeller type.
      a. Direct-drive arrangement.
      b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
      c. Statically and dynamically balanced.
   2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
   3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
   4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
   5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
   6. Vibration Control: Integral isolation to dampen vibration transmission.

F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

G. Unit Controls:
   1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
   2. Factory-Installed Controller: Configurable digital control.
   3. Factory-Installed Sensors:
      a. Refrigerant suction temperature.
      b. Refrigerant discharge temperature.
      c. Outdoor air temperature.
      d. Refrigerant high pressure.
      e. Refrigerant low pressure.
      f. Oil level.
   4. Communication: Network communication with indoor units and other outdoor unit(s).
   5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
   6. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Electrical:
   1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
   2. Field Connection: Single point connection to power entire unit and integral controls.
   3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
   4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
   5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
   6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

I. Unit Hardware: Zinc-plated steel, or stainless steel.

J. Unit Piping:
   1. Unit Tubing: Copper tubing with brazed joints.
   2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
   3. Field Piping Connections: Manufacturer's standard.
   4. Factory Charge: Dehydrated air or nitrogen.
   5. Testing: Factory pressure tested and verified to be without leaks.

2.7 HEAT RECOVERY CONTROL UNITS (HRCUS)

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
   1. Specially designed for use in systems with simultaneous heating and cooling.
   2. Systems shall consist of one unit, or multiple unit that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.

B. Cabinet:
   1. Galvanized-steel construction.
   2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
   3. Mounting: Manufacturer-designed provisions for field installation.
   4. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

D. Refrigeration Assemblies and Specialties:

1. Specially designed by manufacturer for type of VRF HVAC system being installed, either two or three pipe.
2. Each refrigerant branch circuit shall have refrigerant control valve(s) to control refrigerant flow.
3. Spares: Each heat recovery control unit shall include at least two branch circuit port(s) for future use.
4. Each system piping connection upstream of heat recovery unit shall be fitted with an isolation valve to allow for service to any heat recovery control unit in the system without interrupting operation of the system.
5. Each branch circuit connection shall be fitted with an isolation valve and capped service port to allow for service to any individual branch circuit without interrupting operation of the system.
   a. If not available as an integral part of the heat recovery control unit, isolation valves shall be field installed adjacent to the unit pipe connection.

E. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Features and Functions: Self-diagnostics, fuse protection
4. Communication: Network communication with indoor units and outdoor unit(s).
5. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

F. Unit Electrical:
1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

G. Unit Piping:
1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.8 SYSTEM CONTROLS

A. General Requirements:
1. Network: Indoor units, HRCUs and outdoor units shall include integral controls and connect through manufacturer-selected control network.
2. Network Communication Protocol: Open control communication between interconnected units.
3. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:
   a. Ethernet connection via RJ-45 connectors and port with transmission at 100 Mbps or higher.

b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least 5 minutes > of battery backup operation after a power loss.
c. Integration shall include control, monitoring, scheduling, change of value notifications. Refer to points list/sequence of operations on plans for additional requirements.
d. Operator Interface:
e. Operators shall interface with system and unit controls through the following:
    1) Operator interfaces integral to controllers.
    2) Web interface through web browser software.
    3) Integration with Building Automation System.
f. Users shall be capable of interface with controllers for control of indoor units to extent privileges are enabled. Control features available to users shall include the following:
    1) On/off control.
    2) Temperature set-point adjustment.

B. Central Controllers:
1. Centralized control for all indoor and outdoor units from a single central controller location. Mitsubishi AE-200 or equal.
2. Include multiple interconnected controllers as required.
3. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
4. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
    a. Sets schedule for daily, weekly, and annual events.
    b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.
5. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
6. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
7. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
8. Service diagnostics tool.
9. Able to disable and enable operation of individual controllers for indoor units.
10. Information displayed on individual controllers shall also be available for display through central controller.
11. Information displayed for outdoor units, including refrigerant high and low pressures
12. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
13. Operator interface through a backlit, high-resolution color display touch panel

C. Wired Controllers for Indoor Units:
1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. On/Off: Turns indoor unit on or off.
4. Hold: Hold operation settings until hold is released.
5. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
6. Temperature Display: 1-degree increments.
7. Relative Humidity Display: 1 percent increments.
8. Relative Humidity Set-Point: Adjustable in 1 percent increments between
9. Fan Speed Setting: Select between available options furnished with the unit.
10. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.

11. Seven-day programmable operating schedule with up to five events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
12. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
13. Occupancy detection.
14. Service Notification Display: "Filter".
15. Service Run Tests: Limit use by service personnel to troubleshoot operation.
16. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
17. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
18. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
19. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

2.9 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:
   1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
   2. ASHRAE 34.
   3. R-410a.
B. Oil:
   1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.10 SYSTEM CONDENSATE DRAIN PIPING

A. If more than one material is listed, material selection is Contractor's option.
B. PVC plastic pipe according to ASTM D1785, Schedule 40, with socket-type pipe fittings according to ASTM D2466 and solvent cement according to ASTM D2564, primer according to ASTM F656.

2.11 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 232300 "Refrigerant Piping" for system piping requirements.
B. Refrigerant Piping:
   1. Copper Tube: ASTM B280, Type ACR Wrought-Copper Fittings: ASME B16.22.
   2. Brazing Filler Metals: AWS A5.8/A5.8M.
C. Refrigerant Tubing Kits:
   1. Furnished by VRF HVAC system manufacturer.
   2. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
   3. Standard one-piece length for connecting to indoor units.
   4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
   5. Factory Charge: nitrogen.
D. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.
E. Refrigerant Isolation Ball Valves:
   1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.

2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on size.

2.12 METAL HANGERS AND SUPPORTS

A. Copper Tube Hangers:
   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or copper-coated steel .

2.13 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Indoor Applications: Zinc-coated or stainless steel.
   2. Outdoor Applications: Stainless steel.

2.14 OUTDOOR EQUIPMENT STANDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eberl Iron Works, Inc.
   2. MIRO Industries.
   3. RectorSeal HVAC; a CSW Industrials Company.
B. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof-supported outdoor equipment components, without roof membrane penetration, in a prefabricated system that can be modularly assembled on-site.
C. Foot Material: Rubber or polypropylene.
D. Rails Material: Hot-dip galvanized carbon steel.

2.15 MISCELLANEOUS SUPPORT MATERIALS

A. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.
B. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.
C. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

2.16 PIPING AND TUBING INSULATION

A. Comply with requirements in Section 230719 "HVAC Piping Insulation" for system piping insulation requirements.
B. Condensate Drain Piping and Tubing Insulation and Jacket Requirements:
   1. Flexible Elastomeric Insulation:
      a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
   2. Field-Applied Jacket:
      a. Concealed: None required.

b. Indoors, Exposed to View: PVC, color selected by Architect, 20 mils thick.
c. Outdoors, Exposed to View: Aluminum, smooth, 0.020 inch thick.

C. Refrigerant Tubing Insulation and Jacket Requirements:
1. Flexible Elastomeric Insulation:
a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C534, Type I for tubular materials.
2. Field-Applied Jacket:
a. Concealed: None required.
b. Indoors, Exposed to View: PVC, color selected by Architect, 20 mils thick
c. Outdoors, Exposed to View: Aluminum, smooth, 0.020 inch thick

D. Flexible Elastomeric Insulation Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Verify adhesive complies 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."

E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Verify adhesive complies 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."

F. Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.
5. Verify sealant complies 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."

2.17 SYSTEM CONTROL CABLE AND RACEWAYS

A. Low-Voltage Control Cabling:
1. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

B. TIA-485A Network Cabling:
1. Standard Cable: NFPA 70, Type CMG.
2. Plenum-Rated Cable: NFPA 70, Type CMP.

C. Ethernet Network Cabling: TIA-568-C.2 Category 6RJ-45connectors.

D. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for control wiring and cable raceways.

2.18 MATERIALS

A. Steel:
1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:
1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

E. Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating.
F. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a 3000hour salt-spray test according to ASTM B117.
   1. Standards:
      a. ASTM B117 for salt spray.
      b. ASTM D2794 for minimum impact resistance of 100 in-lb.
      c. ASTM B3359 for cross-hatch adhesion of 5B.
   2. Gloss: Minimum gloss of 60 on a 60-degree meter.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Clearance:
   1. Maintain manufacturer's recommended clearances for service and maintenance.
   2. Maintain clearances required by governing code.
B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.
   1. Loose components shall be installed by [manufacturer's service representative] [or] [system Installer under supervision of manufacturer's service representative].
C. Equipment Restraint Installation: Install equipment with seismic-restraint device. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
D. Indoor Unit Installations:
   1. Install units to be level and plumb while providing a neat and finished appearance.
   2. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.
   3. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.
   4. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.
   5. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.
   6. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.
   7. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.
   8. Install floor-mounted units on support structure indicated on Drawings.
   9. Attachment: Install hardware for proper attachment to supported equipment.
E. Outdoor Unit Installations:
   1. Install units to be level and plumb while providing a neat and finished appearance.
   2. Install outdoor units on support structures indicated on Drawings.
   3. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
      a. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
      b. Grouting: Place grout under equipment supports and make bearing surface smooth.
   4. Roof-Mounted Installations: Install outdoor units on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, stainless-steel fasteners.

3.2 GENERAL REQUIREMENTS FOR PIPING AND TUBING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.
B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.
E. Install piping and tubing to permit valve servicing.
F. Install piping and tubing at indicated slopes.
G. Install piping and tubing free of sags.
H. Install fittings for changes in direction and branch connections.
I. Install piping and tubing to allow application of insulation.
J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.
K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 CONDENSATE DRAIN PIPE AND TUBING INSTALLATION

A. General Requirements for Drain Piping and Tubing:
   1. Install a union in piping at each threaded unit connection.
   2. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
   3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:
      a. Details indicated on Drawings.
      b. Manufacturer's requirements.
      c. Governing codes.
      d. In the absence of requirements, comply with requirements of ASHRAE handbooks.
   4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
   5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.
B. Gravity Drains:
   1. Slope piping from unit connection toward drain termination at a constant slope of not less than [**two** percent.
C. Pumped Drains:
   1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

3.4 REFRIGERANT PIPING AND TUBING INSTALLATION

A. Refrigerant Tubing Kits:

1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
2. Support tubing using hangers and supports indicated at intervals not to exceed 5 feet Minimum rod size, 1/4 inch.
3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

B. Install refrigerant piping according to ASHRAE 15 and governing codes.
C. Select system components with pressure rating equal to or greater than system operating pressure.
D. Install piping as short and direct as possible, with a minimum number of joints and fittings.
E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
F. Install refrigerant piping and tubing in protective conduit where installed belowground.
G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.
H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:
   1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor.
   3. Install traps to entrain oil in vertical runs.
   4. Liquid lines may be installed level.
I. When brazing, remove or protect components that could be damaged by heat.
J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.
K. Joint Construction:
   1. Ream ends of tubes and remove burrs.
   2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
   3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
      a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
      b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

3.5 PIPE AND TUBING INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Installation to maintain a continuous vapor barrier.
B. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
C. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are unavailable, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

E. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 DUCT, ACCESSORIES, AND AIR OUTLETS INSTALLATION

A. Where installing ductwork adjacent to equipment, allow space for service and maintenance.

B. Comply with requirements for metal ducts specified in Section 233113 "Metal Ducts."

C. Comply with requirements for air duct accessories specified in Section 233300 "Air Duct Accessories."

D. Comply with requirements for air diffusers specified in Section 233713.13 "Air Diffusers."

E. Comply with requirements for registers and grilles specified in Section 233713.23 "Registers and Grilles."

3.7 SOFTWARE

A. Cybersecurity:
   1. Software:
      a. Coordinate security requirements with IT department
      b. Ensure that latest stable software release is installed and properly operating.
      c. Disable or change default passwords to password using a combination of uppercase and lower letters, numbers, and symbols at least eight characters in length. Record passwords and turn over to party responsible for system operation and administration.
   2. Hardware:
      a. Coordinate location and access requirements with IT department
      b. Enable highest level of wireless encryption that is compatible with Owner's ICT network.
      c. Disable dual network connections.

3.8 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.9 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.
   1. Service representative shall be a factory-trained and -authorized service representative of VRF HVAC system manufacturer.
   2. Complete startup service of each separate system.
   3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:

1. Check control communications of equipment and each operating component in system(s).
2. Check each indoor unit's response to demand for cooling and heating.
3. Check each indoor unit's response to changes in airflow settings.
4. Check each indoor unit , HRCU and outdoor unit for proper condensate removal.
5. Check sound levels of each indoor and outdoor unit.

C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.
   1. Installer shall correct deficiencies found during startup service for reverification.

D. System Operation Report:
   1. After completion of startup service, manufacturer shall issue a report for each separate system.
   2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
   3. Manufacturer shall electronically record not less than twohours of continuous operation of each system and submit with report for historical reference.
      a. All available system operating parameters shall be included in the information submitted.

E. Witness:
   1. Invite Architect. Owner, Commissioning Agent and Engineer to witness startup service procedures.
   2. Provide written notice not less than 10 business days before start of startup service.

3.10 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.

C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.

D. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.11 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   1. Upgrade Notice: Provide notification at least 30 days in advance to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.12 DEMONSTRATION

A. Engage a VRF HVAC system manufacturer's or factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system.

END OF SECTION

DIVISION 26

Electrical

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes general electrical requirements for all Division 26 work and is supplemental and in addition to the requirements of Division 01.

B. Section Includes:
   1. Electrical equipment coordination and installation.
   2. Sleeves for raceways and cables.
   3. Sleeve seals.
   4. Grout.
   5. Common electrical 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. Workmanship shall be of the best quality and competent and experienced electricians shall be employed and shall be under the supervision of a competent and experienced foreman.

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.

1.02 DEFINITIONS

A. Definitions of all terms shall be in accordance with applicable definitions of:
   1. AIA - American Institute of Architects
   2. IEEE - Institute of Electrical and Electronic Engineers
   3. IES - Illuminating Engineering Society
   4. NEMA - National Electrical Manufacturers Association
   5. NEC - National Electrical Code
   6. IBC - International Building Code
   7. IFC - International Fire Code
   8. ADA - Americans with Disabilities Act
   9. NFPA - National Fire Protection Association

1.03 CODES

A. Codes for installation of electrical work shall be State of Washington Electrical Code, Electrical Safety Code, applicable rules and regulations and OSHA and Washington Industrial Safety and Health Act. Any violation of the above Safety Codes shall be cause for immediate termination of Contractor's authority to proceed with work, and recourse to surety for completion of the project.

1.04 PERMITS AND INSPECTIONS

A. Obtain permits and pay fees required by governmental agencies having jurisdiction over this work.

B. Arrange for inspections required during construction. On completion of work, furnish satisfactory evidence to show all work installed in accordance with codes.

1.05 CLEARANCES

A. Adequate working space shall be provided around electrical equipment for maintenance and operation. Minimum clearances shall conform to Art. 110-16 of N.E. Code.

1.06 TESTS

A. Test all wiring and connections for continuity and grounds before any fixtures or equipment are connected, and run a Megger test. Where such tests indicate faulty insulation or other defects, all such defects and faults shall be located, repaired and tested again.

B. Make check of proper load balance on 3-wire system and on phases of 3-phase system. Check direction of rotation and lubrication on all motors after final service connections have been made.

C. Make final tests in presence of Architect.

1.07 INDUSTRY STANDARDS, CODES AND SPECIFICATIONS

A. All materials, equipment, and systems shall conform to the following applicable Industry Standards, Codes and Specifications:
   1. ANSI - American National Standards Institute
   2. IEEE - Institute of Electrical and Electronic Engineers
   3. IES - Illuminating Engineering Society
   4. IPCEA - Insulated Power Cable Engineers Association
   5. NFPA - National Fire Protection Association
   6. NEMA - National Electrical Manufacturers Association
   7. UL - Underwriters Laboratory
   8. IBC - International Building Code
   9. IFC - International Fire Code
   10. IMC - International Mechanical Code
   11. ADA - Americans with Disabilities Act (Washington State ADA/WAC51-30)

12. WAC - Washington Administrative Code

B. Where differences occur between state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern.

1.08 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Nothing in the Drawings or Specifications shall be construed to permit Work not conforming to applicable laws, ordinances, rules or regulations.
   2. When Drawings or Specifications exceed requirements of applicable laws, ordinances, rules, or regulations, comply with documents establishing the more stringent requirements.

1.09 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.

1.10 PROJECT CONDITIONS

A. Equipment Rough-In:
   1. Rough-in locations for equipment furnished under other Divisions and for equipment furnished by Owner are approximate only. Obtain exact rough-in locations from the following sources:
      a) From Shop Drawings for Contractor provided equipment.
      b) From Architect for Owner furnished, Contractor installed equipment.

1.11 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

1.12 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.

1.13 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. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

E. 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.

F. 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.

G. 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.

1.14 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.

1.15 RUBBISH AND CLEAN-UP

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.

1.16 SCOPE OF WORK

A. Mention herein or indication on drawings of articles, materials, operations or methods, requires that Contractor provide each item mentioned or indicated, of quality, or subject to qualifications noted; perform according to conditions stated, each operation prescribed.

B. Work included under this contract provides for all labor, equipment, and materials to complete all electrical work as outlined in drawings and specifications for project.

C. The scope of this work is listed generally but is not limited to as follows:
   1. Lighting System and fixtures
   2. Branch wiring, power, lighting, and equipment
   3. Equipment connections
   4. Site electrical work
   5. Low Voltage Lighting Control

1.17 SUBMITTALS

A. General:
   1. Submittals shall be in accordance with requirements of Division 01 and as specified.
   2. Forward all submittals to the Architect, together, at one time. Individual or incomplete submittals are not acceptable.
   3. Organize submittals in same sequence as they appear in Specification Sections.
   4. Identify each submittal item by reference to Specification Section paragraph in which item is specified, or Drawing and Detail number.
   5. 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.

B. Shop Drawings:
   1. 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.
   2. Catalog cuts and published material may be included to supplement Shop Drawings.

C. Contract Closeout Submittals:
   1. Provide full size copies of ”Record” one-line diagrams, in metal frames with glass fronts. Locate diagrams as directed.
   2. Operation and Maintenance:
      a) Subsequent to final completion, and testing operations, instruct Owner’s authorized representatives in operation, adjustment, and maintenance of electrical plant.

b) Before Owner's personnel assume operation of systems, submit operating and maintenance instructions, manuals, parts lists on electrical plant, its component parts, including all equipment which requires, or for which the manufacturer recommends, maintenance in a specified manner. Data sheets shall show complete internal electrical wiring, ratings, and characteristics, catalog data on components parts whether furnished by equipment manufacturer or others, names, addresses, and telephone numbers of source of supply for parts subject to wear or electrical failure, and description of operating, test, adjustment, and maintenance procedures.

D. Submit the equipment for final review.

1.18 ELECTRICAL EQUIPMENT MAINTENANCE MANUALS

A. The Electrical Contractor shall prepare maintenance manuals for the servicing of all equipment installed as a part of the construction contract.

B. The information contained in the manuals shall be grouped in an orderly arrangement under basic categories, i.e., Secondary Systems Equipment, Special Raceways, Motors & Controls, Lighting Equipment, etc.

C. Bind in 3-ring binder with label clearly indicating project.

1.19 JOB RECORD INFORMATION

A. Record 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.

B. Drawings shall include dimensions on all underground conduit.

1.20 NAMEPLATES AND TAGS IN ADDITION TO 260553

A. The following items shall be equipped with tags or nameplates with etched letters:
   1. All motors, transformers, motor starters, pushbutton stations, control panels and time switches.
      a) Disconnect switches, fused or unfused; switchboards and panelboards; circuit breakers, contactors or relays in separate enclosures.
   2. Wall switches controlling outlets, or equipment where the outlets are not located within sight of the controlling switch. All low voltage lighting switches.
   3. Special electrical systems shall be properly identified at junction and pull boxes, terminal cabinets and equipment racks.
   4. Label all junction boxes with pen indicating type of system (i.e. Power, Data, etc.), circuit voltage, panel and circuit number and switch leg.
   5. Paint all junction boxes with the following color code.
      a) Security Yellow
      b) Normal 120/208 White
      c) Normal 277/480 Brown
      d) Low Voltage Black

6. Tags shall adequately describe the function of, or use of, the particular equipment involved. Tags for panelboards and switchboards shall include the panel designation, voltage and phase of the supply. For example, “Panel A, 240/120V.” The name of the machine shall be the same as the one used on all motor starter, disconnect and P.B. station tags for that machine.
7. Tags for 120/240 volts shall be laminated phenolic plastic with white engraved letters on black background. Lettering shall be 3/16” high at pushbutton stations, thermal overload switches, receptacles, wall switches and similar devices, where the tag is attached to the device plate. All other locations, lettering shall be 1/4” high, unless otherwise detailed on the drawings. Tags shall be securely fastened to the equipment with screws or brass bolts. Contact cement is approved in dry locations. All tags and their installation are a part of this work.

1.21 FINAL SUBMITTALS

A. After completion of all electrical work and prior to final inspection, submit the following:
   1. Letter addressed to Engineer, stating that Contractor, or superintendent in charge of job, has personally made a complete inspection of the job; that those items found to be defective in material or workmanship or not in conformance with drawings and specifications have been corrected; and that entire electrical job is ready for final observation by Engineer.
   2. One copy of the electrical equipment maintenance manual (see 1.15) to be sent direct to Engineer for review, containing the following:
      a) Letter of transmittal, addressed to Engineer, containing a list of suppliers of replacement parts for all electrical equipment used on job.
      b) Panel, switchboard, and control drawings corrected to agree with Engineer’s notations.
      c) Catalog cuts of all lighting fixtures, lamps, transformers, starters, special devices, door control system, and all other equipment used on job.
      d) All available maintenance data published.
      e) Wiring diagrams and operating instructions for all systems installed.
      f) Marked-up set of prints showing exact location of all conduits and outlets deviating from original plans. Purchase prints new for this purpose. Prints not required to be bound in maintenance manual.
      g) Signed receipts for all loose items i.e. keys, instructions and guarantee, etc.
   3. Refer to Division 01 for Operations and Maintenance Manuals.

1.22 WARRANTY

A. Warranties shall be provided per Division 01. Where not indicated provide minimum 1 year (or standard manufacturer’s warranty if longer) warranty for all equipment installed on this project. Warranty shall include all labor, site visit, installation costs.

1.23 COMMISSIONING

A. The lighting control systems (photocells, relay controls, occupancy sensors, dimmer boards) will be commissioned on this project by an owner directed Commissioning Agent. Contractor shall provide for 4 meetings with the commissioning agent and provide complete systems at time directed by commissioning agent. After commissioning report contractor shall provide all corrections noted in the Commissioning report.

PART 2 - PRODUCTS

2.01 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: Provide in accordance with Division 07.
   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.

2.02 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel or EMT, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a) For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
      b) 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.

2.03 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.

2. 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.
3. Pressure Plates: Plastic, Carbon steel. Include two for each sealing element.
4. 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.

2.04 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

3.01 INSTALLATION

A. Mounting Heights: To center of device unless noted:
   1. Convenience outlets ----------1'-6" above floors,
      (Wiremold 4000) 6" above counters,
      3" above back splashes
   2. Wall Switches ---------- ---------- 48" to top above floor
   3. Card Reader ---------- 48" to top above floor

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. Conduit System:
   1. Work into complete integrated arrangement with like elements. Make Work neat and finished appearing.
   2. Run concealed, except where shown otherwise. Where exposed run parallel with walls or structural elements with vertical runs plumb, horizontal runs level; groups racked together neatly with bends parallel and uniformly spaced.
   3. Flash and counterflash all penetrations through roof in accordance with requirements of Division 07 and as shown.

E. Provide hangers, supports, anchors and chases as required for installation of Electrical Work.

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.

3.02 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.

3.03 CLEANING

A. Properly prepare Work under this Division to be finish painted under Division 01.

3.04 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.

3.05 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. 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.

D. 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.

E. Right of Way: Give to piping systems installed at a required slope

3.06 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
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. 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.".

J. 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."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. 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.

3.07 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.

3.08 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."

3.09 DEMOLITION AND REMODEL

A. Demolition drawings do not show every removal of individual devices, concealed items or circuits and raceways. Contractor shall remove all devices and equipment, raceway, wire, etc no longer required.

B. Maintain existing fire alarm, telephone, intercom, clock, television, intrusion alarm, Data/voice, and Wide Area Network, at all times except as scheduled with the Architect.

C. Where remodeling work disrupts continuity of existing circuits or systems to remain, restore same at no additional cost to Owner.

3.10 COMMISSIONING SUPPORT

A. Selected Division 26 equipment and systems referenced are to be commissioned per Section 01 91 13 – General Commissioning Requirements and Section 26 08 00 – Commissioning of Electrical Systems. The contractor has specific responsibilities for scheduling, coordination, startup, test development, testing and documentation. Coordinate all commissioning activities with the Commissioning Authority.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Building wires and cables rated 600 V and less.
   2. Connectors, splices, and terminations rated 600 V and less.

1.02 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.

1.03 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.01 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. Copper Conductors: Comply with NEMA WC 70. Minimum size - No. 12 AWG. Stranded or solid

C. Aluminum: Stabloy type in sizes No. 2 and larger only. Burndy Hy-lug or Hy-plug terminations.

D. Conductor Insulation: Comply with NEMA WC 70. Drawings are based on using copper THHN-THWN cables. Contractor shall increase conduit size for any other insulation.

E. Ground Wire: Provide NEC sized equipment ground wire in all circuits, sized per code. Raceway shall not be used as ground.

F. Control and Low Voltage Cable: Cable shall be as recommended by manufacturer. Contractor shall coordinate location of plenums in building with all other trades. Provide plenum rated cable whenever cable passes through a plenum for the entire length.

2.02 CONNECTORS AND SPLICES

A. Splices and Terminations
   1. 600 Volt
      a. Splices: Solderless type only. Pre-insulated "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: Pre-insulated crimp pigtail or butt splice connectors.
      b. Terminations: Locking spade, insulated, compression lugs.

B. Splices and Terminations When Aluminum Wire Permitted
   1. Burndy Hy-Lug or Hy-Plug on both ends.

C. 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.

D. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

A. Submit schedule of proposed aluminum wire for review. Contractor to increase conduit size to accommodate aluminum wire.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

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.

3.03 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 neutral and hot 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 120/240V – Phase A, Black – Phase B, Blue – Neutral, White – Ground, Green. 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.

3.04 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.

3.05 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in raceway in finished walls, ceilings, and floors, unless otherwise indicated.

B. 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.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Exposed cables not permitted.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.06 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 and UL 486B.

B. Make splices 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 and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

3.07 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and branch conductors for compliance with requirements.
      a. Megger Test, #4 and bigger
   2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes methods and materials for grounding.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.
   1. Operation and Maintenance Data: For grounding include the following in emergency, operation, and maintenance manuals:
   2. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, grounding connections for separately derived systems, based on NFPA 70B.
      a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
      b. Include recommended testing intervals.

1.03 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B 3.
   2. Stranded Conductors: ASTM B 8.
   3. Tinned Conductors: ASTM B 33.
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.02 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
   1. Pipe Connectors: Clamp type, sized for pipe.

C. Insulated Ground Conductors: Per 260519.

D. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Equipment Ground Conductors: Green colored insulation. Provide in all raceways.

B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated. Size is 18” x 4” x ¼”
   1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
   2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

D. Conductor Terminations and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors or exothermic weld where required by code authority.
   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.

3.02 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. Flexible raceway runs.
6. Armored and metal-clad cable runs.
7. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

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 a 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 an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.03 INSTALLATION

A. Grounding Conductors: 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.

B. 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 any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

C. 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, using a bolted

clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a 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 a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

D. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 3/0 AWG.
   1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
   2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

E. Separately Derived Systems (Transformers): Bond to structural steel, main waterpipe within five feet of waterpipe entry to building, or building grounding electrode.

F. Consult with code authority and comply with all code authority requirements.

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
      a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
      b. Perform tests by fall-of-potential method according to IEEE 81.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.02 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

D. IBC: International Building Code

1.03 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

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, Building Use Group III.

1.04 SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.
   2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
   1. Trapeze hangers. Include Product Data for components.
   2. Steel slotted channel systems. Include Product Data for components.
   3. Nonmetallic slotted channel systems. Include Product Data for components.
   4. Equipment supports.

C. Welding certificates.

1.05 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.06 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

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
   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. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
   4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
   5. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Not permitted.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in

riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. 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.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Hilti Inc.
         2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         3) MKT Fastening, LLC.
         4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Cooper B-Line, Inc.; a division of Cooper Industries.
         2) Empire Tool and Manufacturing Co., Inc.
         3) Hilti Inc.
         4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
         5) MKT Fastening, LLC.
   3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
   4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
   5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
   6. Toggle Bolts: All-steel springhead type.
   7. Hanger Rods: Threaded steel.

H. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

I. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
   1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, as permitted in 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 shall be weight of supported components plus 200 lb.

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 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches 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 meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "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.

3.04 CONCRETE BASES (HOUSEKEEPING PADS)

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section.

C. Anchor equipment to concrete base.
   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.

3.05 PAINTING

A. Touchup: 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.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.02 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-diene terpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

J. RGS: Rigid galvanized steel

K. PVC: Polyvinyl Chloride

1.03 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
   1. Custom enclosures and cabinets.
   2. For handholes and boxes for underground wiring, including the following:
      a. Duct entry provisions, including locations and duct sizes.
      b. Frame and cover design.
      c. Grounding details.
      d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
      e. Joint details.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand

seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For professional engineer and testing agency.

E. Source quality-control test reports.

1.04 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.

PART 2 - PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AFC Cable Systems, Inc.
   2. Alflex Inc.
   3. Allied Tube & Conduit; a Tyco International Ltd. Co.
   4. Anamet Electrical, Inc.; Anaconda Metal Hose.
   5. Electri-Flex Co.
   6. Manhattan/CDT/Cole-Flex.
   7. Maverick Tube Corporation.
   8. O-Z Gedney; a unit of General Signal.
   9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. Aluminum Rigid Conduit: Not permitted.

D. IMC: ANSI C80.6.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch, minimum.

F. EMT: ANSI C80.3. Hot dipped galvanized inside and outside.

G. FMC: Aluminum.

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
   2. Fittings for EMT: Steel, compression or set screw type.
   3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

K. NMSC, NMC: Not permitted.

2.02 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AFC Cable Systems, Inc.
   2. Anamet Electrical, Inc.; Anaconda Metal Hose.
   3. Arnco Corporation.
   4. CANTEX Inc.
   5. CertainTeed Corp.; Pipe & Plastics Group.
   6. Condux International, Inc.
   7. ElecSYS, Inc.
   8. Electri-Flex Co.
   9. Lamson & Sessions; Carlon Electrical Products.
   10. Manhattan/CDT/Cole-Flex.
   11. RACO; a Hubbell Company.
   12. Thomas & Betts Corporation.

B. ENT: NEMA TC 13. Not permitted

C. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated as PVC 80.

D. LFNC: Not permitted.

E. Fittings for Elbows and Sweeps shall be plastic coated rigid galvanized steel or fiberglass

F. RNC: NEMA TC 3; match to conduit or tubing type and material.

G. Fittings for LFNC: Not permitted.

2.03 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper B-Line, Inc.
   2. Hoffman.
   3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R when outside, unless otherwise indicated.

C. Fittings and Accessories: Include 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.

D. Wireway Covers: Hinged type.

E. Finish: Manufacturer's standard enamel finish.

2.04 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
   2. EGS/Appleton Electric.
   3. Erickson Electrical Equipment Company.
   4. Hoffman.
   5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
   6. O-Z/Gedney; a unit of General Signal.
   7. RACO; a Hubbell Company.
   8. Robroy Industries, Inc.; Enclosure Division.
   9. Scott Fetzer Co.; Adalet Division.
   10. Spring City Electrical Manufacturing Company.
   11. Thomas & Betts Corporation.
   12. Walker Systems, Inc.; Wiremold Company (The).
   13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Minimum size: 4-inch by 4-inch by 1 ½-inch. Voice/data/AV boxes minimum 2 1/8-inch deep.
   1. Exception: AV boxes shall be deep, mnimum 3” for special applications shown on shop drawings

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: Not permitted.

E. Metal Floor Boxes: Wiremold Evolution 6 gang.

1. On Grade: Wiremold EFB6S-OG with die cast bronze cover and mounting brackets per drawings
2. Upper Floors: Wiremold EFB6S with die cast bronze cover and mounting brackets per drawings.

F. Metal Floor Boxes in Commons: Waterproof top. CW Cole#TLS351-W. This box has 4” x 7” mounting space available

G. Nonmetallic Floor Boxes: Not permitted.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

J. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

K. Cabinets:
1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.05 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.06 SLEEVE SEALS

A. Basis-of-Design Product:
1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. 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.
2. Pressure Plates: Carbon steel. Include two for each sealing element.
3. 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.

2.07 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

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.
   1. 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.
   2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. All conduit sizes on drawings are based on EMT. Any alternate raceway used shall have its size adjusted per the NEC

B. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
   1. Exposed Conduit: Rigid steel conduit.
   2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC, EMT.
   3. Underground Conduit: Rigid Steel Conduit or RNC, Type EPC-40-PVC, direct buried with plastic coated RGS bends and sweeps. See 260543.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

C. Comply with the following indoor applications, unless otherwise indicated:
   1. Open Ceiling Spaces: Exposed conduit is not permitted, conduit shall be run in the rigid insulation space in IMC or RGS.
   2. Exposed, Not Subject to Physical Damage: EMT. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
      a. Loading dock.
      b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   3. Concealed in Ceilings and Interior Walls and Partitions: EMT. Homeruns minimum 3/4”. MC Cable may be used for branch circuitry in rooms above ceilings and in walls. No MC for homeruns or between rooms.
   4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
   5. Damp or Wet Locations: Rigid steel conduit.
   6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
   1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
   2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Communications and Electronic Safety and Security: Shall be EMT overhead. Underground is not permitted except for connections between MDF and IDF's. See 260534.

3.02 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers, Supports and Fasteners."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed. Instances requiring more than 3 bends shall be submitted for approval to the engineer.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Change from RNC Type EPC-40-PVC to plastic coated rigid steel conduit or EMT before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a

blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
   d. Attics: 135 deg F temperature change.
2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

O. 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.

P. Set metal floor boxes level and flush with finished floor surface.

3.03 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

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. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. 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.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using 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 "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.04 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.05 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.06 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.07 ADDITIONAL MATERIALS

A. Provide 10 additional receptacles, each with 50 feet of ¾" EMT and 5#12. Include cost of installation. Locate at locations field directed by architect. Any items not used to be provided to the owner at project completion.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Identification for raceway and metal-clad cable.
   2. Identification for conductors and communication and control cable.
   3. Underground-line warning tape.
   4. Warning labels and signs.
   5. Instruction signs.
   6. Equipment identification labels.
   7. Miscellaneous identification products.

1.02 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.03 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.04 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

2.01 RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:
   1. Power: White letters on a black field.
   2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Labels: Preprinted, laminated hard label with a clear, weather- and chemical-resistant coating.

D. Snap-Around Labels for conduit: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.02 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
   1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.03 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
   1. Not less than 6 inches wide by 4 mils thick.

2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.04 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, Engraved, Laminated Acrylic or Melamine Label, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated. Minimum size = 1/4”.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.05 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with letters per above. Minimum letter height shall be 3/8 inch.

2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
1. Minimum Width: 3/16 inch.
2. Tensile Strength: 50 lb, minimum.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. Junction Boxes: All junction boxes shall be painted per the following color code and 260050:
1. 120/240 Volt Normal: Black

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.07 PANEL DIRECTORIES

A. 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.

B. Identification: Spare circuits will be identified as such in pencil. Permanent room numbers, as furnished by owner, shall be used for location identification.

PART 3 - EXECUTION

3.01 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label or snap-around label or self-adhesive vinyl tape applied in bands.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands or snap-around, color-coding bands:
   1. Fire-Suppression Supervisory and Control System: Red and yellow.
   2. Security System: Blue and yellow.
   3. Mechanical and Electrical Supervisory System: Green and blue.
   4. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 4 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use aluminum wraparound marker labels. Identify each ungrounded conductor according to source and circuit number.

E. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.

F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
   3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
   1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
      a. Power transfer switches.
      b. Controls with external control power connections.
   2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

I. Instruction Signs:
   1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
   2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer and load shedding.

J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
      b. Outdoor Equipment: Engraved, laminated acrylic or melamine label. Stenciled legend 4 inches high.
      c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   2. Equipment to Be Labeled:
      a. Panelboards, electrical cabinets, and enclosures.
      b. Access doors and panels for concealed electrical items.
      c. Motor-control
      d. Disconnect switches.
      e. Enclosed circuit breakers.
      f. Motor starters.
      g. Push-button stations.
      h. Power transfer equipment.
      i. Contactors.
      j. Remote-controlled switches, dimmer modules, and control devices.

k. Power-generating units.
l. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
m. Junction boxes: System, voltage and circuit with black pen.

3.02 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded conductors.
1. Color shall be factory applied.
2. Colors for 240/120-V Circuits:
a. Phase A: Black.
b. Phase B: Red.
c. Neutral: White
3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Integral Occupancy and Daylighting Sensor Control

B. Control Intent – Control Intent includes, but is not limited to:
   1. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
   2. Initial sensor and switching zone.
   3. Initial time switch settings
   4. Task lighting controls.

1.02 REFERENCES

A. Edit the following to include only those standards referenced elsewhere in this Section.

B. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) (www.ansi.org and www.ieee.org)

C. Underwriter Laboratories of Canada (ULC)

D. International Electrotechnical Commission (www.iec.ch)

E. International Organization for Standardization (ISO) (www.iso.ch):

F. National Electrical Manufacturers Association (NEMA)

G. WD1 (R2005) - General Color Requirements for Wiring Devices.

H. Underwriters Laboratories, Inc. (UL) (www.ul.com):
   1. 916 – Energy Management Equipment.
   2. 924 – Emergency Lighting

1.03 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control and Automation system as defined under this section covers the following equipment:
   1. Integral Motion Sensors – Motion sensor with microwave technology embedded into light fixture.
   2. Integral Photosensors – Single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications can provide switching or dimming control for daylight harvesting. Sensors shall be integral to light fixtures.
   3. Emergency Lighting is done via individual battery units. No generator provided.

1.04 SUBMITTALS

A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.

B. Shop Drawings:
   1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
   2. Scale drawings indicating exact location of switches.

C. Product Data: Catalog sheets, specifications and installation instructions.

1.05 QUALITY ASSURANCE

A. Manufacturer: Minimum [10] years experience in manufacture of lighting controls.

1.06 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 0° to 40° C (32° to 104° F).
   2. Relative humidity: Maximum 90 percent, non-condensing.

1.07 WARRANTY

A. Provide a five year complete manufacturer's warranty on all products to be free of manufacturers' defects.

1.08 MAINTENANCE

A. Spare Parts:
   1. Provide
      a. Wall Switches – 1
      b. Keyed Wall Switches - 2

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. WattStopper, Douglas Controls, Nlight

2.02 WALL SWITCHES

A. Switches, 120/277 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
      b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).

c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

2.03 INTEGRAL MOTION SENSORS

A. See Light Fixture Schedule

2.04 INTEGRAL PHOTO SENSORS

A. See Light Fixture Schedule

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.

B. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
1. Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.

C. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:
1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
3. Load Parameters (e.g. blink warning, etc.)

D. Re-calibration – After 30 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Architect / Owner of re-calibration activity.

3.02 FACTORY START-UP

A. Upon completion of the installation, the system shall be started by the manufacturer's factory authorized representative who will verify a complete fully functional system.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the desired system start-up and adjustment date.

C. Upon completion of the system start-up the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide switchboard as indicated on drawings.

B. Entire switchboard, all devices, panels, fuses, motor control shall be provided per the Coordination Study. All devices shall be fully coordinated. Provide electronic trip for all equipment required to selectively coordinate.

C. Coordination Study: Provide all devices to comply with the requirements of the coordination study. No equipment shall be ordered prior to this.

PART 2 - PRODUCTS

2.01 SWITCHBOARD

A. General
1. NEMA PB-2 and UL 891 design equipped with hinged front panel for breaker and metering compartments. Front access only.
2. Manufacturer: Cutler Hammer, General Electric, Square D, or Siemens (No Substitute).
3. The main bus shall run continuously through the switchgear and shall include a fully rated neutral conductor which shall be insulated from the switchgear frame and supported in the same manner as the phase conductors.
4. Copper or Aluminum bus only. Fully insulated on line side of main breaker. Brace in agreement with coordination study.
5. Provide copper ground through each vertical section.
6. The main breaker shall be provided in a compartmentalized circuit breaker with electronic trip unit.
7. Branch breakers may be grouped molded case. Breakers shall have electronic trip unit where required to meet coordination study.
8. Provide terminal strips for remote control and status features in an accessible cubicle. Neatly dress all control wire (horizontally and vertically) in enclosed channel (w/removable cover) or surface mounted raceway.
9. Main devices requiring energy for operation shall be supplied power from integral bus taps or stored mechanical energy devices. Provide automatic ‘source select’ scheme to ensure continuous control power to trip units and electronic meters. Provide terminals for access to the future secondary tie control power.
10. Provide Mimic labeling on the front surface of the switchboard showing the bussing arrangement. This labeling should reflect the equipment’s one line diagram. Include transformer and breaker representations.
11. U.L. service entrance label.
12. Manufacturer's standard finish.
13. Refer to drawings for clearances and access expectations.
14. Provide bolt on circuit breakers rated and coordinated per Coordination Study.

2.02 SWITCHBOARD - INCOMING MAIN SECTION DEVICES

A. Main Circuit Breaker(s)
   1. Electronic trip molded case full function 100% rated circuit breaker, draw out type.
      a. All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Long Time Delay, Short Time Pickup, Short Time Delay, Ground Fault Pickup, Ground Fault Delay and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.
      b. Circuit breaker trip system shall be a microprocessor-based true rms sensing designed with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedule / drawing.
      c. Local visual trip indication for overload, short circuit and ground fault trip occurrences.
      d. Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.
      e. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.
      f. Circuit breaker shall be provided with Zone selective Interlocking (ZSI) communications capabilities on the short-time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on schedules

2.03 SWITCHBOARD - DISTRIBUTION SECTION DEVICES

A. Group mounted circuit breakers through 1200A
   1. Circuit breaker(s) shall be group mounted plug-on with mechanical restraint on a common pan or rail assembly.
   2. 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.
   3. Circuit breaker(s) equipped with line terminal jaws shall not require additional external mounting hardware. Circuit breaker(s) shall be held in mounted position by a self-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.
   4. Line-side circuit breaker connections are to be jaw type.
   5. All unused spaces provided, unless otherwise specified, shall be fully equipped for future devices, including all appropriate connectors and mounting hardware.
   6. Electronic trip 100%
      a. Electronic trip molded case full function 100% rated circuit breakers through 2000A
      b. All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Long Time Delay, Short Time Pickup, Short Time Delay, Ground Fault Pickup, Ground Fault Delay and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.
      c. Circuit breaker trip system shall be a microprocessor-based true rms sensing designed with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedule / drawing.

d. Local visual trip indication for overload, short circuit and ground fault trip occurrences.
e. Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.
f. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.
g. Circuit breaker shall be provided with Zone selective Interlocking (ZSI) communications capabilities on the short-time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on schedules
h. Furnish thermal magnetic molded case circuit breakers for 250A frames and below.

B. Individually Mounted circuit breakers greater than 1200A
Electronic trip molded/insulated case full function 100% rated circuit breaker(s) through 2000A
1. All electronic circuit breakers shall have the following time/current response adjustments: Long Time Pickup, Long Time Delay, Short Time Pickup, Short Time Delay, Ground Fault Pickup, Ground Fault Delay and Instantaneous settings. Each adjustment shall have discrete settings (fully adjustable) and shall be independent of all other adjustments.
2. Circuit breaker trip system shall be a microprocessor-based true rms sensing designed with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedule / drawing.
3. Local visual trip indication for overload, short circuit and ground fault trip occurrences.
4. Long Time Pickup indication to signal when loading approaches or exceeds the adjustable ampere rating of the circuit breaker shall be provided.
5. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.
6. Circuit breaker shall be provided with Zone selective Interlocking (ZSI) communications capabilities on the short-time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on schedules

2.04 SHOP DRAWINGS

A. Submit for approval prior to manufacture; include front view, plan, section views, shipping splits, assembly data and wiring diagrams. Protective device study must be available to verify equipment sizing.

2.05 SWITCHBOARD DIMENSIONS

A. Overall height of the board shall be maximum 90 inches (not including two-inch base channels or breaker lifting device). Length and depth shall not exceed dimensions as detailed on drawings, or as approved.

2.06 SWITCHBOARD COMPONENTS

A. Includes, but not limited to:
1. Breakers, as noted on drawings.

2. Space for future breakers as noted.
3. Shall be full fault current rated.
4. Connections to transformers.
5. Miscellaneous devices as required for a complete installation.

2.07 NAMEPLATES

A. Provide for each and every instrument, protective device and disconnect device for the entire assembly.

2.08 CLEATS

A. Provide for securing all feeder cables within the switchgear.

2.09 SURGE PROTECTOR

A. Provide Innovative Technology #PTX-160 for switchboard. Provide 30/3 breaker for connecting to bus whether scheduled or not. Maximum length of leads on surge protector shall be 8 inches.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Floor mounted on housekeeping pad as indicated on plans (power riser diagram). Pad is to contain leveled railing. Anchor to building structure as required for seismic 3 conditions. Provide submittal for review.

B. Provide vibration isolators where dictated by 260548.

C. In accordance with manufacturer's installation instructions.

3.02 SETTINGS

A. Provide services of manufacturer's field representative for equipment start-up and check out.

B. Provide manufacturer's suggested settings for all breaker selectable positions at switchboard. Include fault current calculations and coordination curves based on project feeder lengths. Extend to panels subjected to more than 7,000 symmetrical amps.

3.03 FIELD START UP AND TESTING

A. Provide services of manufacturer’s field representative for equipment start-up and check out.

B. Third party representative is to perform inspection and testing as set forth in Division 26 Acceptance Testing criteria and Power System Studies.

3.04 HOUSEKEEPING PAD

A. Provide minimum 3-inch housekeeping pad under all switchboards. Extend 3-inches beyond footprint. Provide reinforcing bars, ASTM A 615A, Grade 60, deformed. Reinforcing shall not be welded or frame bent except by means of specific procedures.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Panelboard - Furnish and install lighting and appliance panelboard(s) as specified herein and where shown on the associated drawings.

B. Selective Coordination: Provide selective coordination study on both emergency and normal systems. Contractor shall provide correct breakers including electronic trip breakers as required to obtain selective coordination. None of the following equipment specifications alleviates the contractor from this requirement.

C. Contractor shall note that drawings allow and may 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.

1.02 REFERENCES

The panelboard(s) and circuit breaker(s) referenced herein are designed and manufactured according to the latest revision of the following specifications.

A. NEMA PB 1 – Panelboards

B. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

C. NEMA AB 1 - Molded Case Circuit Breakers

D. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)

E. UL 50 - Enclosures for Electrical Equipment

F. UL 67 – Panelboards

G. UL 98 - Enclosed and Dead-front Switches

H. UL 489 - Molded-Case Circuit Breakers and Circuit Breaker Enclosures

I. CSA Standard C22.2 No. 29-M1989 - Panelboards and Enclosed Panelboards

J. CSA Standard C22.2 No. 5-M91 - Molded Case Circuit Breakers

K. Federal Specification W-P-115C - Type I Class 1

L. Federal Specification W-C-375B/Gen - Circuit Breakers, Molded Case, Branch Circuit And Service.

M. NFPA 70 - National Electrical Code (NEC)

N. ASTM - American Society of Testing Materials

1.03 SUBMITTAL AND RECORD DOCUMENTATION

A. Approval documents shall include drawings. Drawings shall contain overall panelboard dimensions, interior mounting dimensions, and wiring gutter dimensions. The location of the main, branches, and solid neutral shall be clearly shown. In addition, the drawing shall illustrate one line diagrams with applicable voltage systems.

1.04 QUALIFICATIONS

A. Company specializing in manufacturing of panelboard products with a minimum of fifty (50) years documented experience.

B. Panelboards shall be manufactured in accordance with standards listed Article 1.2 - REFERENCES.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect and report concealed damage to carrier within their required time period.

B. Handle carefully to avoid damage to panelboard internal components, enclosure, and finish.

C. Store in a clean, dry environment. Maintain factory packaging and, if required, provide an additional heavy canvas or heavy plastic cover to protect enclosure(s) from dirt, water, construction debris, and traffic.

1.06 OPERATIONS AND MAINTENANCE MATERIALS

A. 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.

1.07 WARRANTY

A. Manufacturer shall warrant specified equipment free from defects in materials and workmanship for the lesser of one (1) year from the date of installation or eighteen (18) months from the date of purchase.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Shall be Square D Company, General Electric, Eaton/Westinghouse, or Siemens.

B. Substitutions must be submitted in writing three weeks prior to original bid date with supporting documentation demonstrating that the alternate manufacturer meets all aspects of the specification herein.

2.02 208/120 VOLT AND 240/120 VOLT PANELBOARD

A. NQOD
   1. Interior
   2. Shall be type NQ panelboard rated for 240 Vac/48 Vdc maximum. Continuous main current ratings, as indicated on associated drawings, not to exceed 600 amperes maximum.

a. Minimum short circuit current rating: as shown on drawings but minimum 10,000 in rms symmetrical amperes at 240 Vac.
b. Provide one (1) continuous bus bar per phase. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers. The bussing shall be fully rated. Panelboard bus current ratings shall be determined by heat-rise tests conducted in accordance with UL 67. Bussing rated 100-400 amperes shall be plated copper or aluminum. Bussing rated for 600 amperes shall be plated copper as standard construction. Bus bar plating shall run the entire length of the bus bar. Panelboards shall be suitable for use as Service Equipment when application requirements comply with UL 67 and NEC Articles 230-F and -G.
c. All current-carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
d. A solidly bonded copper equipment ground bar shall be provided.
e. Split solid neutral shall be plated and located in the mains compartment up to 225 amperes so all incoming neutral cable may be of the same length. 200% rated solid neutral shall be plated copper for non-linear load applications. Panelboards shall be marked for non-linear load applications.
f. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trim shall have pre-formed twistouts covering unused mounting space.
g. 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.
h. Interiors shall be field convertible for top or bottom incoming feed. Main circuit breakers in 100A interiors shall be vertically mounted. Main circuit breakers over 100A shall be vertically mounted. Sub-feed circuit breakers shall be vertically mounted. Main lug interiors up to 400 amperes shall be field convertible to main breaker. Interior leveling provisions shall be provided for flush mounted applications.

3. Main Circuit Breaker where indicated.
   a. Shall be Square D type circuit breakers.
   b. Main circuit breakers shall have an overcenter, trip-free, 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 be factory calibrated to operate in a 40° C ambient environment. Thermal elements shall be ambient compensating above 40° C.
   c. Two- and three-pole circuit breakers shall have common tripping of all poles. Circuit breakers frame sizes above 100 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. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
   d. 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.
   e. 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.
   f. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors.

Lugs shall be suitable for 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.

g. The circuit breakers shall be 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.

h. Provide electronic trip and I-Line type panel where required for coordination.

4. Branch Circuit Breakers
   a. Shall be Square D type circuit breakers. Circuit breakers shall be UL Listed with amperage ratings, interrupting ratings, and number of poles as indicated on the associated drawings.
   b. Molded case branch circuit breakers shall have bolt-on type bus connectors.
   c. Circuit breakers shall have an overcenter toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have thermal and magnetic trip elements in each pole. Two- and three-pole circuit breakers shall have common tripping of all poles.
   d. 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.
   e. The exposed faceplates of all branch circuit breakers shall be flush with one another.
   f. Lugs shall be UL Listed to accept solid or stranded copper and aluminum conductors. Lugs shall be suitable for 90° C rated wire, sized according to the 75° C temperature rating per NEC Table 310-16.
   g. Breakers shall be UL Listed for use with the following factory installed accessories: Shunt Trip, Auxiliary Switch, and Alarm Switch.
   h. Provide electronic trip and I-Line type panel where required for coordination.
5. Enclosures
   a. Type 1 Boxes
      1) Boxes shall be galvanized steel constructed in accordance with UL 50 requirements. Galvannealed steel will not be acceptable.
      2) Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
      3) Box width shall be 20” wide maximum unless approved.
   b. Type 1 Fronts
      1) Front shall meet strength and rigidity requirements per UL 50 standards. Front shall have ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
      2) Fronts shall be hinged 1-piece with door (door in door). Mounting shall be as indicated on associated drawings.
      3) Panelboards shall have MONO-FLAT fronts with concealed door hinges and mounted with trim screws. Front shall not be removable with the door locked. Doors on front shall have rounded corners and edges shall be free of burrs.
      4) Front shall have cylindrical tumbler type lock with catch and spring-loaded stainless steel door pull. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.

c. Type 3R, 5, and 12 where indicated.
   1) Enclosures shall be constructed in accordance with UL 50 requirements. Enclosures shall be painted with ANSI 49 gray enamel electrodeposited over cleaned phosphatized steel.
   2) All doors shall be gasketed and equipped with a tumbler type vault lock and two (2) additional quarter turn fasteners on enclosures 59 inches or more in height. All lock assemblies shall be keyed alike. One (1) key shall be provided with each lock. A clear plastic directory cardholder shall be mounted on the inside of door.
   3) Maximum enclosure dimensions shall not exceed 21" wide and 6.5" deep.

6. In Alternate bid provide Innovative Technology PTE-080 surge protector or TPS/CTE LP series, 30/3 breaker with maximum 8" lead length at all 120/208V panels.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install panelboards in accordance with manufacturer's written instructions, NEMA PB 1.1 and NEC standards.

3.02 FIELD QUALITY CONTROL

A. Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads within 20% of each other. Maintain proper phasing for multi-wire branch circuits.

C. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. All receptacles are tamperproof
   3. Twist-locking receptacles.
   4. Isolated-ground receptacles.
   5. Floorboxes and multioutlet assemblies.

1.02 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.04 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.

1.05 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

1.06 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Provide six (6) duplex receptacles, and two (2) GFCI receptacles each with fifty feet 3/4-inch EMT-5#12 and four (4) elbows each. All installed at location directed by owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   3. Leviton Mfg. Company Inc. (Leviton).
   4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

B. All wiring devices shall be white color.

2.02 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, tamper resistant, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

B. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face Configuration: NEMA WD 6, Configuration 5-20R.

C. Standards: Comply with UL 498.

D. Products: Subject to compliance with requirements, provide one of the following:
   1. Hubbell; HBL5362TR (duplex).
   2. Leviton; 5362SG (duplex).
   3. Pass & Seymour; TR5362 (duplex).

E. Controlled receptacles same as A above but green color with “controlled” label and symbol on them. Pass and Seymour# TR5362CDGN or alternate approve equal

F. Twistlock, to match above, Configuration: NEMA WD 6, Configuration L5-20R. Standards: Comply with UL 498.

G. Isolated-Ground, Duplex Convenience Receptacles, tamper resistant 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Pass & Seymour; TRIG5362.

2. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.03 GFCI RECEPTACLES

A. All exterior receptacles, receptacles within ten feet of sinks and mop sinks shall be GFCI type whether indicated on drawings or not.

B. General Description: Straight blade. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

C. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
2. Pass & Seymour; TR2097NA (No substitute).
3. Exterior GFCI receptacles shall bear the “WR” Weather resistant label. 2097TRWRNAW

2.04 RANGE RECEPTACLES: NEMA 14-50R, PASS AND SEYMOUR #3894NA WITH STAINLESS PLATE

2.05 DRYER RECEPTACLES: NEMA 14-30R, PASS AND SEYMOUR#3864NA WITH STAINLESS PLATE

2.06 SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A – see 260923

C. Key-Operated Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper; 2221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.
2. Description: Single pole, with factory-supplied key in lieu of switch handle.
3. Provide two keys with each switch.

2.07 OCCUPANCY SENSORS – SEE 260923

2.08 WALL PLATES

A. Single and combination types to match corresponding wiring devices, stainless steel.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum while in use with lockable cover.
   1. Hubbell #WP8M/WP26M

2.09 FLOORBOXES – SEE 260533

2.10 MULTIOUTLET ASSEMBLIES (WIREMOLD)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Wiremold Company (The) #V4000 with divider.

B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles. Include divider, entrance fittings, corners, etc. for complete system.

C. Raceway Material: Metal, with ivory finish.

D. Provide duplex receptacles as shown on drawings and communications outlets as shown on drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. 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:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.

c. 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. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. 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.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.02 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:
   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

PART 1 - GENERAL

1.01 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. Selective Coordination: see section 260573 for selective coordination study on both emergency and normal systems. Contractor shall provide correct breakers including electronic trip breakers as required to obtain selective coordination. None of the following equipment specifications alleviates the contractor from this requirement.

1.02 SUMMARY

A. Section Includes:
1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.03 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.04 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. 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."

1.05 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field quality-control reports.
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Manufacturer's field service report.

G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
   2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. 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.

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 NFPA 70.

1.07 COORDINATION

A. 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.

1.08 EXTRA 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
   2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.01 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. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
   5. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open where required.
   6. Hookstick Handle: Allows use of a hookstick to operate the handle.
   7. Service-Rated Switches: Labeled for use as service equipment.

2.02 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 600-V ac, 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, 600-V ac, 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, Double Throw, 600-V ac, 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. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   4. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open where required.
   5. Hookstick Handle: Allows use of a hookstick to operate the handle.

2.03 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products to match panelboard breakers.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current 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.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
   1. Instantaneous trip.
   2. Long- and short-time pickup levels.
   3. Long- and short-time time adjustments.
   4. Ground-fault pickup level, time delay, and I2t response.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Provide electronic trip where required for coordination.

2.04 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, 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.

PART 3 - EXECUTION

3.01 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.

3.02 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.03 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Solid-state luminaires that use LED technology.
   2. Lighting fixture supports.

1.02 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.

1.03 ACTION 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, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project, 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. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

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. Fixture requirements:
1. DLC – all fixtures shall have DLC or Energy Star label
a. Fixtures specified that do not have DLC label are exempt

D. Retain "Samples" Paragraph for custom luminaires and single-stage samples. Retain "Samples for Initial Selection" and "Samples for Verification" paragraphs for two-stage Samples.

E. Samples: For each luminaire and for each color and texture with standard factory-applied finish where requested.

F. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.
1. Include Samples of luminaires and accessories involving color and finish selection.

G. Samples for Verification: For each type of luminaire.
1. Include Samples of luminaires and accessories to verify finish selection.

H. Product Schedule: For luminaires and lamps. See Drawings for schedule

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Lighting luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:
a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Ceiling-mounted projectors.
7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of luminaire.

F. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

G. Sample warranty.

1.05 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.

1.06 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. LED Drivers/Power Supplies: Provide 1 for each fixture type.
2. LED Lamp Modules: Provide 1 for each fixture type

1.07 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: 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.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

E. Mockups: For interior lighting 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. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

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.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.09 TEST REPORTS

A. LED Luminaire IES LM-79: Test Report Submit test report on manufacturer's standard production model luminaire. Include all applicable and required data as outlined under "14.0 Test Report"

B. LED Light Source IES LM-80 Test Report: Submit report on manufacturer's standard production LED light source (package, array, or module). Include all applicable and required data as outlined under

C. LED Light Source IES TM21 Test Report: Submit test report on manufacturer's standard production LED light source (package, array or module). Include all applicable and required data, as well as required interpolation information as outlined in IES TM-21.

1.10 LUMINAIRE USEFUL LIFE CERTIFICATE

A. Submit certification from the manufacturer indicating the expected useful life of the luminaires provided. The useful life must be directly correlated from the IES LM-80 test data using procedures outlined in IES TM-21. Thermal properties of the specific luminaire and local ambient operating temperature and conditions must be taken into consideration

1.11 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. Verify available warranties and warranty periods.

C. Warranty Period: Minimum Five year(s) from date of Substantial Completion unless manufacturers standard warranty is longer

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.02 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 for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. Recessed Fixtures: Comply with NEMA LE 4.

D. Bulb shape complying with ANSI C79.1.

E. Lamp base complying with ANSI C81.61

F. CRI of minimum 80 unless noted. CCT of 3500 K unless noted

G. Minimum Rated lamp life of 50,000 hours.

H. Lamps dimmable from 100 percent to 0 percent of maximum light output.

I. Internal driver.

J. Nominal Operating Voltage: Per Drawings
   1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

K. Housings:
   1. Extruded-aluminum housing and heat sink.
   2. Custom color per architect from provided paint chip

2.03 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. 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.

C. Diffusers and Globes: Per drawings
   1. 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.
   2. Glass: Annealed crystal glass unless otherwise indicated.

3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. 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.
   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.

2.04 LED POWER SUPPLIES/DRIVERS

A. UL 8750 LED power supplies (drivers) must be electronic, UL Class 1 , constant-current type and comply with the following requirements:

B. Output power (watts) and ouput current (mA) as shown in luminaire schedule for each luminaire type to meet minimum luminaire efficacy (LE) value provided.

C. Power Factor (PF) greater than or equal to .90.

D. Total Harmonic Distortion (THD) of less than 20%.

E. Class A sound rating.

F. Operable at input voltage of 120-277 volts at 60 hertz.

G. Minimum 5 year manufacturer's warranty.

H. RoHS compliant.

I. Integral thermal protection that reduces output power if case temperature exceeds 185 degrees F 85 degrees C

2.05 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.

2.06 LUMINAIRE FIXTURE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" 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 A 641/A 641 M, 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.

PART 3 - EXECUTION

3.01 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 fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 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.

3.03 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 vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:
   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 Luminaire Support:
   1. Attached to structural members in walls or Attached to a minimum 20 gauge backing plate attached to wall structural members
   2. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:
1. Ceiling mount with two 5/32-inch- (4-mm-) diameter aircraft cable supports connected to structur above ceiling
2. Ceiling mount with pendant mount with minimum 5/32-inch- (4-mm-)]diameter aircraft cable supports.
3. Ceiling mount with hook mount.

H. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. 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.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod wire support for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
2. Retain first subparagraph below to require ceiling grid to be connected to building structure at four corners of luminaire opening.
3. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
4. Retain subparagraph below if ceiling grid is not connected to building structure at four corners of the luminaire opening.
5. 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.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.05 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.

3.06 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 260943.16 "Addressable-Fixture Lighting Controls."

B. Comply with requirements for startup specified in Section 260943.23 "Relay-Based Lighting Controls."

3.07 ADJUSTING

A. Occupancy Adjustments: When requested within 12 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

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
   2. Luminaire supports.

1.02 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.03 ACTION 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 Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project 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.
      b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
   6. Wiring diagrams for power, control, and signal wiring.
   7. Photoelectric relays.
   8. 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. Fixture Ratings
1. Bug Rating
2. USGBC Leed
3. DLC listing
4. Lighting Design Labs

D. Samples: For each luminaire and for each color and texture indicated with factory-applied finish.

E. Product Schedule: For luminaires and lamps. See Drawings.

F. Delegated-Design Submittal: For luminaire supports.
1. Include design calculations for luminaire supports and seismic restraints.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: 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. Luminaires.
2. Structural members to which equipment and luminaires will be attached.
3. Underground utilities and structures.
4. Existing underground utilities and structures.
5. Above-grade utilities and structures.
6. Existing above-grade utilities and structures.
7. Building features.
8. Vertical and horizontal information.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each type of the following:
1. Luminaire.

E. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

F. Source quality-control reports.

G. Sample warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires [and photoelectric relays] to include in operation and maintenance manuals.
   1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.

1.06 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. LED Drivers/Power Supplies: One for each type
   2. Glass, Acrylic, and Plastic Lenses, Covers, and Other Optical Parts: (1) for each type

1.07 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: 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.

C. Provide luminaires from a single manufacturer for each luminaire type.

D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

E. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

F. Mockups: For exterior luminaires, complete with power and control connections.
   1. Obtain Architect's approval of luminaires in mockups before starting installations.
   2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
   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.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.09 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.

1.10 TEST REPORTS

A. LED Luminaire IES LM-79: Test Report Submit test report on manufacturer's standard production model luminaire. Include all applicable and required data as outlined under "14.0 Test Report"

B. LED Light Source IES LM-80 Test Report: Submit report on manufacturer's standard production LED light source (package, array, or module). Include all applicable and required data as outlined under

C. LED Light Source IES TM21 Test Report: Submit test report on manufacturer's standard production LED light source (package, array or module). Include all applicable and required data, as well as required interpolation information as outlined in IES TM-21.

1.11 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: Minimum 5 year(s) from date of Substantial Completion unless manufacturers standard warranty is longer.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7
   1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.02 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.

E. Lamp base complying with ANSI C81.61

F. Bulb shape complying with ANSI C79.1.

G. CRI of minimum 70 unless noted and CCT of 4100 K unless noted

H. L70 lamp life of 100,000 hours.

I. Lamps dimmable from 100 percent to 0 percent of maximum light output when noted

J. Internal driver.

K. Nominal Operating Voltage: Per Drawings

L. In-line Fusing: On the primary for each luminaire

M. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.

N. Source Limitations: Obtain luminaires from single source from a single manufacturer.

O. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.03 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Per Schedule. 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, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

E. 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.

F. 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.

G. 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.

2.04 LED POWER SUPPLIES/DRIVERS

A. UL 8750 LED power supplies (drivers) must be electronic, UL Class 1 , constant-current type and comply with the following requirements:

B. Output power (watts) and output current (mA) as shown in luminaire schedule for each luminaire type to meet minimum luminaire efficacy (LE) value provided.

C. Power Factor (PF) greater than or equal to .90.

D. Total Harmonic Distortion (THD) of less than 20%.

E. Class A sound rating.

F. Operable at input voltage of 120-277 volts at 60 hertz.

G. Minimum 5 year manufacturer's warranty.

H. RoHS compliant.

I. Integral thermal protection that reduces output power if case temperature exceeds 185 degrees F 85 degrees C

2.05 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.
      a. Color: Custom

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.
      a. Color: Custom

2.06 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, poles, canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

2.07 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Retain first paragraph below if seismic restraint is required by local code or authorities having jurisdiction. See the Evaluations.

C. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

D. Install lamps in each luminaire.

E. Fasten luminaire to structural support.

F. 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.

G. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls or Attached to a minimum 1/8 inch (3 mm) backing plate attached to wall structural members

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. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

L. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

2.08 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

C. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

D. Examine roughing-in for foundation and conduit to verify actual locations of installation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

2.09 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections
   1. Coordinate "Operational Test" Subparagraph below with requirements in Section 260923 "Lighting Control Devices."
   2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   3. Retain "Photoelectric Control Operation" Subparagraph below for luminaires controlled by photoelectric controls.
   4. Verify operation of photoelectric controls.

C. Luminaire will be considered defective if it does not pass tests and inspections.

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

DIVISION 27

Communications

PART 1 - GENERAL

1.01 SCOPE

A. Provide complete and comprehensive cabling and termination for local area networks.

1.02 WORK INCLUDED

A. The work includes all necessary labor, installation, preparation, materials, equipment, services, and other items required, whether specified or not, to provide a complete and fully operational local area network cabling and jack system conforming to EIA/TIA 568.

B. The work requires installation of cabling, station jacks, patch cables, and patch panels.

C. The work includes performance of diagnostic tests on all cables, connectors and components. A signed written report of all diagnostic findings shall be provided to the Owner. Using the results of the diagnostic report, the contractor is responsible for repairing all cable, connector and component problems.

1.03 OWNER FURNISHED EQUIPMENT

A. All wiring hubs, modules, computer equipment, file servers, workstations, network interface cards, and related hardware and software will be provided by the Owner.

B. No other equipment furnished.

1.04 DRAWINGS AND PLANS

A. All indicated data drop locations are to be cabled, including RJ45 jack at workstation end and termination at appropriate punch-down blocks in head-end rack.

1.05 PHYSICAL LAYER COMPONENTS

A. All components shall be new and shall comply with IEEE 802.3i standards for 100-Base-T Ethernet over twisted pair media and EIA/TIA Standard 568. All components shall be housed in appropriate equipment racks so as to assure a solid, permanent installation. Bidder shall identify each proposed data system component by manufacturer and part number including data cabling, fiber optic cabling, data and data/phone jacks, UTP and fiber optic station and headend patch cables, patch panels, mounting devices for termination blocks, and equipment racks.

PART 2 - PRODUCTS

2.01 ALL MATERIAL, COMPONENTS, AND EQUIPMENT SHALL BE NEW AND OF HIGH QUALITY. THE COMPONENTS AND EQUIPMENT FURNISHED MUST HAVE A PROVEN TRACK RECORD, AND IF REQUIRED, THE CONTRACTOR MUST FURNISH SATISFACTORY EVIDENCE AS TO THE KIND AND QUALITY OF MATERIALS AND EQUIPMENT. ALL WORK TO COMPLY WITH EIA/TIA CATEGORY 6

REQUIREMENTS. SPECIFICATION IS BASED ON SYSTIMAX PRODUCTS TO ESTABLISH A BASIS OF PERFORMANCE. EQUAL PRODUCTS BY OTHER MANUFACTURERS ARE ACCEPTABLE.

2.02 WARRANTY

A. Installer shall be certified by the manufacturer to provide the Systimax SCS Applications Assurance Program to provide 20 year extended product warranty. Equal warranty shall be provided if a manufacturer other than Systimax is used.

B. Approved installers: EZ Interface or Evergreen Technologies. No other installers allowed.

2.03 DATA AND TELEPHONE OUTLETS

A. EIA/TIA 568 Category 6 modular. Provide inserts for number of data and telephone outlets shown on drawings. Stainless steel faceplate. White color outlets. Provide Systimax #MGS 400BH insert, icon, and label. Provide white blanks in unused outlets.

2.04 DATA (D) CABLE AND TELEPHONE (T) CABLE

A. EIA/TIA 568, Category 6, 4 pair 24 gage. Systimax #2071 plenum rated. Data is blue, telephone is yellow.

2.05 PATCH PANEL/110 BLOCKS

A. Patch Panel: EIA/TIA 568 Category 6, number of total ports/patch panels as required to terminate all data cables shown on drawings with 25% spare capacity, 110 on back, RJ45 on front, 48 port maximum. Systimax #1100GS3.

B. 110 Blocks: EIA/TIA 568 Category 5, quantity as required to terminate all voice cables plus 25% spare capacity. Systimax.

C. Wire Management Blocks. Systimax#1100D1. Provide one per patch panel.

2.06 TELEPHONE BACKBONE CABLE

A. 24 gage, plenum rated in building, PE-89 gel filled on exterior. Pair count as shown on drawings.

B. Provide protections blocks at each end of cable. Terminated all pairs at protection blocks and extend from protections blocks to terminations at 110 blocks.

2.07 WRAPS AND SUPPORTS

A. Provide J-hooks, bridle rings, D-rings as required.

B. Tye wraps shall not be used. Provide Leviton #45224-RCS, 46700-SLG, 41141-SPS to wrap cables.

PART 3 - EXECUTION

3.01 EQUIPMENT MOUNTING

A. All equipment shall be suitable mounted on fire rated terminal backboards, in equipment racks, or otherwise suitably solidly supported. Equipment suspended by it's cable or connector is unacceptable. Placing of equipment shall be done to insure that it is readily accessible.

3.02 CABLE INSTALLATION

A. 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 in cable trays, raceways, and above ceiling spaces as shown on drawings.

B. All cable runs shall have a minimum 8 times the outside diameter bending radius.

3.03 CABLE SUPPORTS

A. Cable shall be in raceway, either surface raceway, conduit, or cable tray or supported at 5'O.C. by bridle rings or j-hooks where open above ceilings. Wrap cable to perform a neat and professional installation. Cable wraps shall be loose to provide no strain on cables.

3.04 CABLE LABELS

A. All cables shall be permanently labeled at workstation jack, termination block and host module port to identify terminal location and on both ends of cable. Label designation shall be a continuation of the existing labeling scheme.

3.05 DATA CABLE ROUTING

A. All shall be routed to prevent interference with any systems such as access boxed, ventilation mixing boxes, access hatches to air filters, switch panels, fire alarm equipment, clock systems, lighting fixtures, etc. The routing must not interfere with any other service or system, operation or maintenance. Raceway shall not be placed in close contact with other devices, electrical or otherwise, that will interfere with it's proper operation as a transmitter of data signal. The contractor will be responsible for rerouting any raceway that is not acceptable to the Architect at no cost. Where surface raceways are used, care shall be taken to route around existing obstacles. Ceilings, wall trim shall be neatly cut to allow installation of surface raceways only as required at permission of the Owner.

3.06 DATA STATION DROPS

A. All drop cables shall be installed at locations as indicated on drawings. Exact outlet location within each room will be as indicated on the drawings and will deviate from the drawing only by minimal shifting the outlet laterally along the indicated wall. The drop cabling shall be installed without splices from the outlets to the appropriate terminal block.

3.07 TESTING

A. The contractor shall test all installed unshielded twisted-pair cables, termination to termination to meet EIA/TIA Category 6 standards and Avaya warranty requirements including pair continuity, shorts, grounds, crosses, near end cross talk, resistance, noise, and measure dB loss.

B. Print out and deliver test report on each cable.

3.08 COMPANY QUALIFICATIONS

A. The bidder shall be regularly engaged in the type of work specified herein. Award will be made only to a bidder who furnished satisfactory evidence that he has the technical ability, experience, equipment, personnel, and financial resources to enable him to successfully and promptly fulfill the requirements and conditions of these specifications.

B. Bidder must have an installation base of at least 150 workstation drops using proposed products.

END OF SECTION

DIVISION 28

Electronic Safety and Security

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The provisions of the Owner-Contractor Agreement, the General and Supplementary Conditions and Modifications to General Conditions apply to the work specified in this section.

1.02 DESCRIPTION

A. Provide fire alarm system devices where indicated on plans. Connect to existing fire alarm system.

B. Contractor shall design and install a complete and fully functional fire alarm system in compliance with applicable codes and requirements of authority having jurisdiction.

C. System shall include fire alarm control panel, LCD annunciator, smoke detectors, horns, strobes, raceways, wiring, and all other devices and accessories required for a complete and fully functional fire alarm system.

1.03 CODES

A. System shall comply with 2018 International Fire Code, 2018 International Building Code, 2018 International Mechanical Code, Bainbridge Island Municipal Code/Washington State Amendments, Local Fire Marshal requirements, and appropriate NFPA regulations.

B. Submit shop drawings to the Local Fire Marshal and obtain approval. Comply with all Local Fire Marshal shop drawing comments.

C. Obtain and pay for permit as required for work.

PART 2 - PRODUCTS

2.01 SYSTEM COMPONENTS

A. System components shall be equal to the following Silent Knight Company catalog numbers. Installer shall be a factory authorized installer.

Control Panel	Existing fire alarm control panel. Provide all power supplies, addressable modules, zone modules, batteries, and so forth as required to provide a complete system and support added devices.
Manual Stations	SK-PULL-SA, single action
Smoke Detectors	SD505 series, addressable

Duct Smoke Detectors	SD505-DUCT series, addressable Provide remote indicator light.
Horns	SpectrAlert series. Combined horn/strobe units. Low frequency where required by code.
Strobes	SpectrAlert series. Synchronized per ADA requirements. Candela rating as required by code for area coverage.
Heat Detectors	SD505-HEAT series, addressable. Fixed temperature or rate of rise as required.

Wire shall be rated 105 degree C, fire alarm type per NEC ratings.

Gel Cell Batteries.

Provide panel contacts for delivering alarm and trouble signal to Central Station service system. Owner will contract with monitoring service.

PART 3 - EXECUTION

3.01 GENERAL

A. Training: Include 4 hours of training on system functions for Owner’s personnel.

3.02 TESTING

A. Install system complete for operation and test in presence of Fire Marshal.

B. Obtain Fire Marshal approval via testing process.

3.03 MANUFACTURER'S ACCEPTANCE

A. Manufacturer's representative to submit letter stating that he has tested the system and found it acceptable in all respects.

3.04 FIRE ALARM REVIEW

A. Submit complete fire alarm system shop drawings to Fire Marshal for review before proceeding with installation. Obtain Fire Marshal's approval after installation.

3.05 FAN SHUTDOWN

A. Coordinate control relay provisions (contacts rated for 120 Volt AC) with Mechanical at starters for fire alarm shutdown. Provide circuit to connect to fire alarm system.

3.06 DUCT DETECTORS

A. Install all detectors at locations coordinated with Mechanical Contractor.

3.07 BATTERY BACK-UPS

A. System shall be sized at 200% required to power all devices connected to the fire alarm system.

B. Time period for back-up will be as required by the Fire Marshal. Minimum time 24 hours.

C. Submit battery calculations to Fire Marshal.

3.08 SMOKE/FIRE DAMPERS

A. Provide relay connected to output on FACP. Local 120 volt power connection to damper. All dampers drop close on alarm by dropping power to damper.

END OF SECTION