

P R O J E C T M A N U A L

Including Specifications

for

PORTLAND INTERNATIONAL AIRPORT CONCOURSE D ALL-USER RESTROOM REMODEL

Solicitation No. 2026-14124

EAN 2026D012

July 2026

DOCUMENT 000107
APPROVALS

PORTLAND INTERNATIONAL AIRPORT
CONCOURSE D
ALL-USER RESTROOM REMODEL

Project Manager: Janelle Brannan

Digitally signed by Janelle Brannan
DN: c=US,
E=janelle.brannan@portofportland.com,
CN=Janelle Brannan
Date: 2026.07.17 12:33:10-07'00'

Project Engineer: Brian Francis

Digitally signed by Brian Francis
DN: c=US, E=brian.francis@portofportland.com,
O=Port of Portland, OU=Engineering, CN=Brian Francis
Date: 2026.07.17 11:59:57-07'00'

Architectural Consultant:

MWA Architects
501 S.E. 14th Avenue, Suite 103
Portland, OR 97214
(503) 973-5151



Stamp

Structural Consultant:

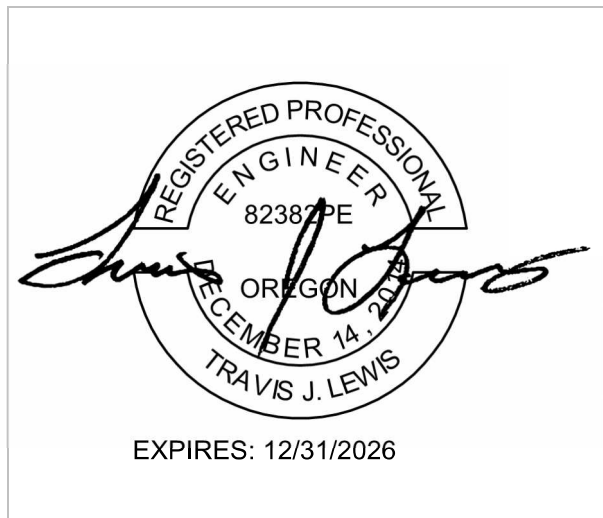
ABHT Structural Engineers
1640 N.W. Johnson Street
Portland, OR 97209
(503) 243-6682



Stamp

Plumbing Consultant:

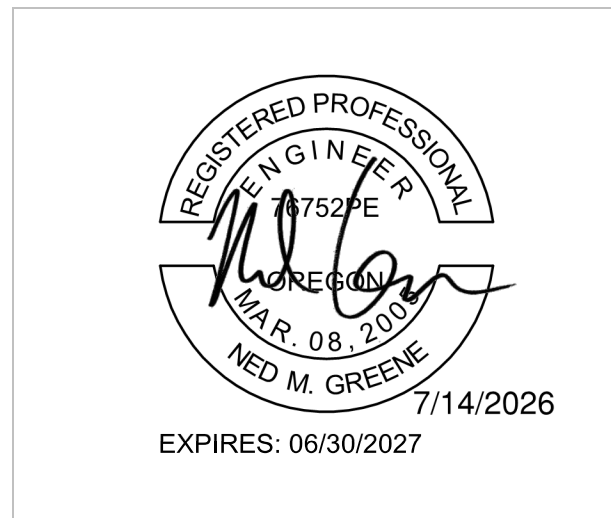
PAE
151 S.W. 1st Avenue, Ste 300
Portland, OR 97204
(503) 226-2921



Stamp

HVAC Consultant:

PAE
151 S.W. 1st Avenue, Ste 300
Portland, OR 97204
(503) 226-2921



Stamp

Electrical and Technology Consultant:

PAE
151 S.W. 1st Avenue, Ste 300
Portland, OR 97204
(503) 226-2921



Stamp

DOCUMENT 000110
TABLE OF CONTENTS

PORTLAND INTERNATIONAL AIRPORT
CONCOURSE D
ALL-USER RESTROOM REMODEL

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP

Document 000107 Approvals	000107-1
Document 001100 Invitation to Bid	001100-1
Document 002100 Instructions to Bidders	002100-1
Document 004100 Bid Form	004100-1
Document 004335 First-Tier Subcontractor Disclosure Form	004335-1
Document 005200 Agreement.....	005200-1
Document 006100 Performance Bond.....	006100-1
Document 006101 Labor and Material Payment Bond	006101-1
Document 007200 General Conditions	007200-1
Document 007300 Supplementary Conditions	007300-1
Document 007346 Wage Rates.....	007346-1

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

DIVISION 1 – GENERAL REQUIREMENTS

Section	011100	Summary of Work
	013100	Project Management and Coordination
	013200	Construction Progress Documentation
	013300	Submittal Procedures
	013513	Airport Security, Safety, and Operating Regulations
	014500	Quality Control
	015000	Temporary Facilities and Controls
	015719	Environmental Construction Controls
	016116	Volatile Organic Compound (VOC) Content Restrictions
	017000	Execution Requirements
	017329	Cutting and Patching
	017419	Construction Waste Recycling
	017700	Closeout Procedures

FACILITY CONSTRUCTION SUBGROUP

DIVISION 2 – EXISTING CONDITIONS

Section	024119	Selective Interior Demolition

DIVISION 5 – METALS

Section	054000	Cold-Formed Metal Framing
	055000	Metal Fabrications
	057000	Decorative Metal

DIVISION 6 – WOOD, PLASTICS, AND COMPOSITES

Section	061053	Miscellaneous Rough Carpentry
	066116	Solid Surfacing Fabrications

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

Section	078100	Applied Fireproofing
	078400	Firestopping
	079200	Joint Sealants

DIVISION 8 – OPENINGS

Section	081100	Metal Doors and Frames
	083100	Access Doors and Panels
	084326	All-Glass Storefronts
	087100	Door Hardware
	088000	Glazing
	088300	Mirrors

DIVISION 9 – FINISHES

Section	090561	Common Work Results for Flooring Preparation
	092216	Non-Structural Metal Framing
	092613	Gypsum Veneer Plastering
	092713	Glass-Fiber-Reinforced Gypsum Fabrications
	092900	Gypsum Board
	093000	Tiling
	095100	Acoustical Ceilings
	096623	Resinous Matrix Terrazzo Flooring
	096800	Broadloom Carpet
	099100	Painting

DIVISION 10 – SPECIALTIES

Section	101400	Identifying Devices
	102113	Toilet Compartments
	102600	Wall and Door Protection
	102800	Toilet Accessories

FACILITY SERVICES SUBGROUP

DIVISION 21 – FIRE SUPPRESSION

Section	210500	Common Work Results for Fire Suppression
	210523	General Duty Valves for Water-Based Fire Suppression Piping
	210529	Hangers and Supports for Fire Suppression Piping and Equipment
	210548	Vibration and Seismic Controls for Fire Suppression Piping and Equipment
	210553	Identification for Fire Suppression Piping and Equipment
	210590	Pressure Testing of Fire Suppression Systems
	211100	Fire Suppression Piping
	212000	Fire Suppression Systems

DIVISION 22 – PLUMBING

Section	220500	Common Work Results for Plumbing
	220519	Meters and Gauges for Plumbing Piping
	220523	General Duty Valves for Plumbing Piping
	220529	Hangers and Supports for Plumbing Piping and Equipment
	220545	Seismic Restraints for Plumbing Piping and Equipment
	220548	Vibration and Seismic Control for Plumbing Piping and Equipment
	220553	Identification for Plumbing Piping and Equipment
	220590	Pressure Testing of Plumbing Systems
	220719	Plumbing Insulation
	221100	Plumbing Piping
	221120	Plumbing Pumps
	223000	Plumbing Equipment
	224000	Plumbing Fixtures

DIVISION 23 – HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

Section	230500	Common Work Results for HVAC
	230519	Meters and Gauges for HVAC Piping
	230520	Piping Specialties for HVAC Piping
	230523	General Duty Valves and Specialties for HVAC Piping
	230529	Hangers and Supports for HVAC Piping and Equipment
	230545	Seismic Restraints for HVAC Piping and Equipment
	230548	Vibration and Seismic Controls for HVAC Piping and Equipment
	230553	Identification for HVAC Piping and Equipment
	230590	Pressure Testing of HVAC Systems
	230593	Testing, Adjusting, and Balancing
	230719	HVAC Insulation
	230900	Instrumentation and Controls for HVAC
	232000	HVAC Piping
	233113	Low Pressure Ductwork
	233114	Medium Pressure Ductwork
	233300	Air Duct Accessories
	233600	Air Terminal Units
	233700	Air Outlets and Inlets

DIVISION 26 – ELECTRICAL

Section	260500	Common Work Results for Electrical
	260505	Selective Demolition for Electrical
	260519	Low-Voltage Electrical Power Conductors and Cables
	260526	Grounding and Bonding for Electrical Systems
	260529	Hangers and Supports for Electrical Systems
	260533	Raceway and Boxes for Electrical Systems
	260545	Seismic Restraints for Electrical Systems
	260553	Identification for Electrical Systems
	260923	Lighting Control Devices
	260993	Sequence of Operations for Lighting Controls
	262726	Wiring Devices
	262816	Enclosed Switches and Circuit Breakers
	265000	Lighting

DIVISION 27 – COMMUNICATIONS

Section	270553	Identification for Telecommunication Systems

271000	Structured Cabling
275116	Public Address Systems
275129	Emergency Telephone Systems

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY

Section	280513	Conductors and Cables for Electronic Safety and Security
	280553	Identification for Fire Alarm Systems
	284600	Fire Detection and Alarm

DRAWINGS

PDX 2026-516

DOCUMENT 001100
INVITATION TO BID

THE PORT OF PORTLAND

PORTLAND INTERNATIONAL AIRPORT
CONCOURSE D
ALL-USER RESTROOM REMODEL

Solicitation No. 2026-14124

Bids for the Portland International Airport Concourse D All-User Restroom Remodel project will be received electronically through the Port's online bidding system until, but not after, 2 p.m. on August 13, 2026. Bid results will be publicly available in the Port's online bidding system immediately after the scheduled time for receipt of bids. See the Instructions to Bidders for more information on electronic submission.

The work includes but is not limited to:

Rehabilitation and conversion of one set of men's/women's restrooms into one all-user restroom.

Prequalification is not required for this work.

The contractor or a subcontractor need not be licensed for asbestos work under ORS 468A.720.

A pre-bid meeting will be held via Microsoft Teams at 10:30 a.m. on July 29, 2026, to discuss all phases of the work. To attend, bidders must RSVP through the Port's online bidding system no later than 24 hours before the pre-bid meeting. A Microsoft Teams meeting invite will be sent to all bidders who RSVP, with instructions on attending the meeting remotely.

Contractors, subcontractors, consultants, and suppliers are strongly encouraged to register through the Port's online bidding system, which can be accessed at <https://www.planetbids.com/portal/portal.cfm?CompanyID=15598>. All firms can view current business opportunities. Registered firms may receive electronic notification of Port solicitations, and have access to view or download solicitations, addenda, and solicitation-holders lists.

Questions must be submitted electronically using the "Q&A" feature in the Port's online bidding system.

Hard copies of drawings and specifications are not available directly from the Port. Registered firms may download the project manual and drawings through the Port's online bidding system.

The Port may reject bids that do not comply with applicable public contracting procedures and requirements. The Port may reject for good cause any or all bids if the Port finds that doing so is in the public interest. Bidder compliance for this project includes the following:

- A. Bids must be on the Port's bid form and must be accompanied by bid security made payable to The Port of Portland in an amount equal to at least 10 percent of the total amount bid.
- B. In accordance with ORS 279C.370, bidders must submit the enclosed First-Tier Subcontractor Disclosure Form within two working hours after bid opening.
- C. The Port will not receive or consider a bid unless the bid contains a statement by the bidder that the bidder will comply with the provisions of ORS 279C.800 to 279C.870 (regarding payment of

prevailing wage rates on public works projects over \$50,000). Current wage rates determined by the Oregon Bureau of Labor and Industries (BOLI) may be obtained from BOLI's web site at www.boli.state.or.us.

- D. Bidders are hereby alerted that public works contractors generally must file a public works bond with the Construction Contractors Board, as provided in ORS 279C.836.
- E. No bid will be considered unless the bidder is registered with the State of Oregon Construction Contractors Board to the extent required by ORS Chapter 701, prior to submitting a bid.
- F. Bids must identify whether the bidder is a resident bidder, as defined in ORS 279A.120.

Apprentice Opportunities on Port Projects over \$500,000: The Port is committed to advancing access to quality jobs through investments in workforce development. This includes encouraging efforts that improve workplaces, create job opportunities, support skill-building, and build career pathways. The Port's overall target for registered apprentice participation is 20 percent of total labor hours.

THE PORT OF PORTLAND

Contracts and Procurement
July 20, 2026

CPD/CON

DOCUMENT 002100
INSTRUCTIONS TO BIDDERS

TABLE OF CONTENTS

ARTICLE 1 – DESCRIPTION	1
ARTICLE 2 – PRE-BID INTERPRETATION OF CONTRACT DOCUMENTS	1
ARTICLE 3 – RESIDENT BIDDER PREFERENCE	1
ARTICLE 4 – EQUIVALENT MATERIALS, PRODUCTS, OR SERVICES	1
ARTICLE 5 – ESTIMATED QUANTITIES	2
ARTICLE 6 – EXAMINATION OF SITE.....	2
ARTICLE 7 – OFFICIAL BID DOCUMENTS.....	2
ARTICLE 8 – BID SECURITY	2
ARTICLE 9 – EXECUTION OF BID.....	3
ARTICLE 10 – DISCLOSURE OF FIRST-TIER SUBCONTRACTORS	3
ARTICLE 11 – SUBMISSION OF BID	3
ARTICLE 12 – WITHDRAWAL OF BID.....	4
ARTICLE 13 – OPENING OF BIDS.....	4
ARTICLE 14 – ACCEPTANCE OR REJECTION OF BIDS.....	4
ARTICLE 15 – EXECUTION OF AGREEMENT AND BONDS	5
ARTICLE 16 – NOTICE TO PROCEED	6
ARTICLE 17 – PROTESTS	6

ARTICLE 1 – DESCRIPTION

- 1.1 Provide labor, materials, and other means required by the contract documents to complete the work.

ARTICLE 2 – PRE-BID INTERPRETATION OF CONTRACT DOCUMENTS

- 2.1 If the bidder finds discrepancies, omissions, or is in doubt as to the true meaning of any part of the contract documents, submit a request for a clarification or interpretation using the “Q&A” feature in the Port’s online bidding system no less than five business days prior to the bid submission deadline. The Port may not consider requests submitted outside of the Port’s online bidding system.
- 2.2 The Port will respond to bidder requests for clarification or interpretation using the “Q&A” feature in the Port’s online bidding system. Actual changes to the contract documents will be issued by addendum. Consider addenda in the bid.

ARTICLE 3 – RESIDENT BIDDER PREFERENCE

- 3.1 Each bid shall contain a statement as to whether the bidder is a resident bidder, as defined in ORS 279A.120.
- 3.2 Under ORS 279A.120(1), a “resident bidder” is a bidder that has paid unemployment taxes or income taxes in this state during the 12 calendar months immediately preceding submission of the bid, has a business address in Oregon, and has stated in the bid whether the bidder is a “resident bidder” pursuant to ORS 279A.120(1).
- 3.3 Under ORS 279A.120(1), a “non-resident bidder” is a bidder who is not a “resident bidder” as defined in Item 3.2 above.
- 3.4 Failure to complete the “resident bidder” certification statement of residency or nonresidency contained in the bid form may result in rejection of the bid.
- 3.5 In determining the lowest responsive bidder, the Port will, for the purpose of awarding the contract, add a percent increase on the bid of a nonresident bidder equal to the percent, if any, of the preference given to that bidder in the state in which the bidder resides.

ARTICLE 4 – EQUIVALENT MATERIALS, PRODUCTS, OR SERVICES

- 4.1 Specified materials, products, or services are named for the purpose of establishing a standard of quality and characteristics desired. Unless the specification or description indicates that no substitution is permitted, other materials, products, or services of equal quality and characteristics for the purposes intended may be submitted at the appropriate time for approval. The Substitution Request Form is enclosed at the end of these Instructions to Bidders. Substitution requests must be submitted by a prospective bidder; substitution requests received from manufacturers, distributors, or companies that are not bidding the project will not be considered. The Port will be the judge of the equality and suitability of the proposed substitution.
- 4.2 The following definitions of the phrases stated after materials, products, or services in the Specifications determine the extent to which substitutions may be proposed.
 - A. “PRE-BID APPROVED EQUAL” materials, products, or services require approval by addendum prior to the bid submission deadline. Materials, products, or services which the bidder proposes to substitute, and which he/she considers equal to those specified, must be submitted by attaching the completed Substitution Request Form to the Q&A submission feature in the Port’s online bidding system no less than five business days prior to the bid submission deadline. Requests shall be accompanied by complete technical data and such pertinent

information and/or samples as necessary, or as specified, to fully identify and appraise the material, product, or service. Approval of materials, products, or services deemed equivalent will be issued by addendum prior to the bid submission deadline.

- B. "EQUAL" materials, products, or services require approval after contract award. See the General Conditions for requirements.
- C. "NO SUBSTITUTION" materials, products, or services are not eligible for substitution requests. See the General Conditions for requirements.

ARTICLE 5 – ESTIMATED QUANTITIES

- 5.1 Estimated quantities shown in the bid form provide a basis for comparison of bids only. The bidder shall verify the quantity of each bid item prior to submission of its bid. Reference is made to Change of Contract Price in the General Conditions.

ARTICLE 6 – EXAMINATION OF SITE

- 6.1 Examine the site and conditions thereon. Bids shall take into consideration conditions which may affect the work. No additional compensation or extension of time will be allowed because of any condition of which the bidder could have informed itself either by examination, testing, sampling, review of records, or otherwise. The Port's site study information, if any, will be made available to prospective bidders for review; however, the Port disclaims liability and responsibility for the completeness or accuracy thereof.

ARTICLE 7 – OFFICIAL BID DOCUMENTS

- 7.1 Bidders may view and download construction design and related documents electronically through the Port's online bidding system. Bidders may only rely on the final construction design documents that the Port makes available through its online bidding system. Bidders are responsible for adjusting hardware and software settings as needed to view and print all bid document content. Guidance for optimal viewing and printing may be provided on the drawings. For the bidders' convenience, the Port may occasionally post copies of studies, reports, permits, assessments, miscellaneous CAD files, reference drawings, manufacturer data, etc., as additional information that may pertain to this solicitation. However, the Port makes no warranties or representations regarding the integrity or completeness of such documents and bidders should use them only at their own risk.
- 7.2 Those using electronic documents provided by the Port do so at their own risk. The Port makes no warranties or representations regarding the ability to permanently access, or the presence or absence of computer viruses within, the electronic documents the Port provides. All or parts of electronic documents provided by the Port may be copyrighted, and those using them are responsible for determining the existence of copyrights and for obtaining permission to copy copyrighted material.

ARTICLE 8 – BID SECURITY

- 8.1 The bid shall be accompanied by bid security. The security shall be a certified or cashier's check, an irrevocable letter of credit, or a bid bond made payable to the Port of Portland. Checks shall be drawn on a United States bank. Irrevocable letters of credit shall be issued by a bank as defined in ORS 706.008. Bid bonds shall be executed by a surety company licensed to do business in the State of Oregon. The amount of the check, letter of credit, or bond shall be equal to at least 10 percent of the total amount bid. The check, letter of credit, or bond will be held by the Port as security and a guaranty that the bidder will execute the Agreement, give satisfactory evidence of insurance, and furnish a 100 percent performance bond and a 100 percent labor and material payment bond. A scanned copy of the bid security shall be submitted electronically through the Port's online bidding system along with the bid. The

bidder shall also provide hard copies of the original bid security documentation to the Port immediately if requested.

8.2 The Port may retain the bid security of the three lowest responsive bidders until:

- A. all bids are rejected,
- B. the fully executed Agreement is delivered to the successful bidder, or
- C. expiration of the bids,

at which time the bid security of all bidders will be returned in accordance with Item 8.3 below.

8.3 Bid security in the form of a surety bond or letter of credit will be returned via an email to the bidder confirming release. All forms of bid security will only be physically returned upon request.

ARTICLE 9 – EXECUTION OF BID

9.1 Bids shall be on the bid form provided to prospective bidders.

9.2 When the bid form provides for writing the bid price in words and numerals, the price as written in words governs over the price written in numerals.

9.3 In the case of conflict between the amount bid and the product of the estimated quantity and the unit bid price, the unit bid price prevails and the corrected product will be used in computing the total amount bid. All arithmetic errors apparent on the face of a bid will be corrected in determining the total bid price.

9.4 Complete the bid form requirements, including acknowledgement of receipt of addenda, if applicable; statement of resident status; and any other requirements specifically called for in the bid.

9.5 Execute the bid in the name of the firm followed by the signature of the officer authorized to sign for the firm and the printed or typewritten designation of the officer's name and office held.

9.6 Type or print the address and telephone number of the bidder on the bid form.

ARTICLE 10 – DISCLOSURE OF FIRST-TIER SUBCONTRACTORS

10.1 Within two working hours after the date and time of the bid submission deadline, the bidder shall disclose first-tier subcontractors on Document 004335, First-Tier Subcontractor Disclosure Form.

10.2 Disclosures of first-tier subcontractors shall be submitted by email (popcontracting@portofportland.com), and shall include one file with all the necessary attachments and be named "Bid XXXX-XXXX_Bidder Name_FT." Hard copies will not be accepted.

ARTICLE 11 – SUBMISSION OF BID

11.1 Bids shall be submitted electronically through the Port's online bidding system. Hard copies will not be accepted.

11.2 Bids will be received until the submission deadline stated in the Invitation to Bid.

ARTICLE 12 – WITHDRAWAL OF BID

- 12.1 Prior to the bid submission deadline, a bidder may withdraw its bid. This will not preclude submission of another bid by such bidder prior to the bid submission deadline. Withdrawal of the bid is the sole responsibility of the bidder through the Port's online bidding system. Contact the service provider (PlanetBids) directly for any technical issues.

ARTICLE 13 – OPENING OF BIDS

- 13.1 The Port reserves the right to postpone the bid submission deadline.
- 13.2 At the time and place set for the opening and reading of bids, bids received prior to the bid submission deadline will be publicly opened and read aloud. When opening bids electronically, bids are deemed to be opened publicly when bidder and bid information is made available to the public in the Port's online bidding system.

ARTICLE 14 – ACCEPTANCE OR REJECTION OF BIDS

- 14.1 The Port may reject any bid not in compliance with all prescribed public bidding procedures and requirements, and may, for good cause, reject any or all bids upon a finding it is in the public interest to do so. In any case where competitive bids are required and all bids are rejected, and the proposed contract is not abandoned, new bids may be called for as in the first instance. The Port may cancel a solicitation at any time before a contract is signed, if the Port determines cancellation is in the Port's best interests. If a solicitation is canceled, the Port will not be liable for any costs incurred by prospective bidders or bidders. If a solicitation is canceled before the bid submission deadline, bids will not be returned electronically. If a solicitation is canceled after the bid submission deadline, the Port will retain the bids.
- 14.2 The Port may disqualify any bidder if, at any time, it finds:
- A. The bidder has been convicted for the commission of a criminal offense as an incident in obtaining or attempting to obtain a public or private contract or subcontract, or in the performance of such contract or subcontract;
 - B. The bidder has been convicted under state or federal statutes of embezzlement, theft, forgery, bribery, falsification or destruction of records, receiving stolen property, or any other offense indicating a lack of business integrity or business honesty that currently, seriously, and directly affects the bidder's responsibility as a contractor;
 - C. The bidder has been convicted under state or federal antitrust statutes; or
 - D. The bidder has violated a contract provision that is regarded by the Port to be so serious as to justify disqualification. A violation may include, but is not limited to, a failure to perform the terms of a contract or an unsatisfactory performance in accordance with the terms of the contract. However, a failure to perform or an unsatisfactory performance caused by acts beyond the control of the contractor may not be considered to be a basis for disqualification.
- 14.3 The Port may disqualify an apparent low bidder if, at any time, it finds that the bidder:
- A. Does not have available the appropriate financial, material, equipment, facility and personnel resources and expertise, or the ability to obtain the resources and expertise, necessary to meet all contractual responsibilities;
 - B. Does not hold current licenses that businesses or service professionals operating in Oregon must hold in order to undertake or perform the work specified in the contract;
 - C. Is not covered by liability insurance and other insurance in amounts the Port requires in the solicitation documents;

- D. Does not qualify as a carrier-insured employer or a self-insured employer under ORS 656.407 or, if applicable, has not elected coverage under ORS 656.128;
 - E. Has not made the first-tier subcontractor disclosure required under ORS 279C.370;
 - F. Has not completed previous contracts of a similar nature with a satisfactory record of performance;
 - G. Does not have a satisfactory record of integrity;
 - H. Is not legally qualified to contract with the Port; or
 - I. Is otherwise not responsible pursuant to ORS 279C.375 and, if applicable, ORS 200.045, or fails to supply all necessary information in connection with demonstrating such responsibility.
- 14.4 In determining the low responsive bid, the Port will not consider alternates called for in the bid form.
- 14.5 The Port reserves the right to reject any irregular bid if rejection is in the best interest of the Port. Irregular bids include, but are not limited to:
- A. Bids that are incomplete or conditioned in any way;
 - B. Bids that contain erasures or alterations;
 - C. Bids that contain unit prices that are obviously unbalanced;
 - D. Bids that do not acknowledge receipt of previously issued addenda.
- 14.6 The Port may waive minor irregularities or technicalities in a bid if such waiver is in the best interest of the Port.
- 14.7 Acceptance of a bid by the Port and award of the Contract will be made by delivery of the fully executed Agreement to the successful bidder within 50 days after the bid submission deadline (or as modified by Document 004100, Bid Form). The bid may not be revoked by the bidder within this period. Failure by the Port to deliver the fully executed Agreement to the successful bidder within the 50-day period will permit the bidder to withdraw its bid. If withdrawn, the Port will return the bid security in accordance with Item 8.3 above. A bid remains effective until it is withdrawn by an affirmative act of the bidder or until the Port rejects the bid, either expressly or impliedly, by awarding the contract to another bidder.

ARTICLE 15 – EXECUTION OF AGREEMENT AND BONDS

- 15.1 Within 10 days after issuance of the Port’s written notice (or as otherwise requested), the apparent low bidder (Contractor) shall execute and deliver the Agreement, the Performance Bond, and the Labor and Material Payment Bond to the Port. The bonds shall each be for the total amount of the Contract. The company providing the bonds shall be authorized to do business in the State of Oregon. The Agreement and the bonds shall be on the forms provided by the Port.
- 15.2 The apparent low bidder, if a joint venture/partnership, shall provide a copy of the joint venture agreement or partnership agreement evidencing authority to offer and to enter into the resulting contract that may be awarded, together with corporate resolutions (if applicable) evidencing corporate authority to participate as a joint venture or partner. A contact person must also be designated for purposes of receiving all notices and communications under the contract. All partners and joint venturers will be required to sign the Agreement.

- 15.3 If the bidder fails to execute the Agreement, give satisfactory evidence of insurance, and furnish the bonds within 10 days after the Port's written notice, the bid security shall be forfeited in accordance with the applicable statute. The Port may extend the time for delivery of the executed contract documents. If the Port extends the time for delivery of the executed contract documents at the successful bidder's request, the Port may:
- A. Extend the time (see NOTICE TO PROCEED below) within which to issue a Notice to Proceed by an equivalent number of days, or
 - B. Reduce the contract duration period (see the Bid and the Agreement) by an equivalent number of days.

ARTICLE 16 – NOTICE TO PROCEED

- 16.1 Within 45 days after delivery of the fully executed Agreement to the successful bidder, the Port will issue Notice to Proceed. The Notice to Proceed will state the dates: (1) on which the Contractor may begin the work, (2) by which the Contractor is required to attain substantial completion of the work, and (3) by which the Contractor is required to attain final acceptance of the work.

ARTICLE 17 – PROTESTS

- 17.1 A bidder or prospective bidder who wishes to object to any aspect of this solicitation must deliver a written protest to the Port's Manager of Contracts and Procurement, 7200 N.E. Airport Way, 8th Floor, Portland, Oregon 97218; or P.O. Box 3529, Portland, Oregon 97208; or fax to (503) 548-5812.
- 17.2 If the protest relates to matters that are apparent on the face of the solicitation documents or that otherwise are known or reasonably ought to be known to the protestor, the protest must be delivered no less than five business days before the deadline for the Port's receipt of offers.
- 17.3 If the protest relates to other matters, including but not limited to the award of the Contract, it must be delivered as soon as possible, and in no event more than five business days after the protestor knows or reasonably ought to know of the award of the contract, the Port's intent to award the Contract, or the other matters to which the protest is addressed.
- 17.4 A protest is delivered for the purposes of this article when it actually is received by the Port's Contracts and Procurement staff.
- 17.5 The Port may decline to review a late protest.
- 17.6 The protest shall be deemed to include only the documents timely delivered pursuant to this article. It must clearly state all of the grounds for the protest and must include all arguments and evidence in support of the protest. Testimonial evidence may be submitted by affidavit. The Port may investigate as it deems appropriate in reviewing the protest, and will issue a written response to the protest. The Port may proceed with contract award, execution, and performance while a protest is pending.

END OF DOCUMENT



SUBSTITUTION REQUEST

Project: _____ From: _____

To: Port of Portland Date: _____

Specification Title: _____ Specification Section No.: _____
Section Page: _____ Article/ Paragraph: _____

Proposed Substitution: _____

Trade Name: _____ Model No.: _____

Manufacturer: _____ Address: _____ Phone: _____

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

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

The Undersigned certifies:

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

Submitted By: _____

Signature: _____

Address: _____

Telephone: _____

PORT REVIEW AND ACTION

- ☐ Substitution approved – Make submittals in accordance with the General Conditions and Specification Section 013300.
- ☐ Substitution approved as noted – Make submittals in accordance with the General Conditions and Specification Section 013300.
- ☐ Substitution rejected – Use specified materials.
- ☐ Substitution request received too late – Use specified materials.

Signed by: _____ Date: _____

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

Bidder: _____

DOCUMENT 004100
BID FORM

To The Port of Portland
P.O. Box 3529
Portland, Oregon 97208
Solicitation No. 2026-14124

The bidder warrants that it has carefully examined the contract documents for the Contract described as follows:

PORTLAND INTERNATIONAL AIRPORT
CONCOURSE D
ALL-USER RESTROOM REMODEL

The bidder further warrants that it has examined, or did not avail itself of the opportunity to examine, the proposed work area independently of the indications in the contract documents and has made, or did not avail itself of the opportunity to make, such investigations as are necessary to determine: (1) the character of the materials to be handled, (2) the probable interferences due to Port operations, and (3) other conditions to be encountered.

The bidder further warrants that if this Bid is accepted, it will contract with The Port of Portland in the form of Agreement hereto annexed and will to the extent of its bid provide all things necessary for the performance of the Contract, including, but not limited to, bonds, labor, material, transportation, and equipment.

The bidder promises that all work under this Contract shall be substantially complete within 348 days from the date specified in the written Notice to Proceed. The bidder agrees to pay, as liquidated damages to the Port for any delay, the sum of \$500 per day for each day of delay beyond the substantial completion date so promised.

The bidder further promises that all work under this Contract shall be complete, having gained a successful final inspection and received final acceptance from the Port, within 85 days after substantial completion. Final payment will not be made until the work is judged complete by the Port.

The bidder also agrees to pay Other Damages described in the General Conditions.

The bidder submits and proposes the following lump sum price, to wit:

	(\$ _____)
Written in Words	Numerals

Bidder: _____

The bidder hereby acknowledges receipt of Addendum Nos. ____, ____, ____, ____, ____, ____, to these contract documents.

This bid may not be revoked by the bidder for a period of 50 days after the date bids are opened.

Accompanying this bid is an electronic copy of the bid security. The amount is 10 percent of the total amount bid. By submitting a bid under this solicitation the bidder certifies that the electronic copy of the bid security is genuine, and that the bidder will provide hard copies of the original bid security documentation to the Port immediately upon request. It is agreed that if this bid is accepted by the Port's written notice within 50 days after bid opening, and the Contractor executes and delivers the Agreement, including a satisfactory performance bond, and labor and material payment bond, each for the full amount of the Contract, within 10 days after the Port's written notice, said bid security will be returned to the undersigned in accordance with Document 002100, Instructions to Bidders. Otherwise, said bid security may be collected as liquidated damages at the option of the Port.

After the Contractor has delivered the executed Agreement (including a satisfactory performance bond, and labor and material payment bond, each for the full amount of the Contract) and evidence of insurance, the Port will issue Notice to Proceed which will establish the dates by which the Contractor is required to attain substantial completion and final acceptance of the work. If all of the documents are not provided within 10 days, the Port may extend the Notice to Proceed date or reduce the contract duration period, as described in the Instructions to Bidders.

The surety company requested to issue the performance bond, and labor and material payment bond will be _____. The bidder hereby authorizes said surety to disclose to the Port any information concerning the bidder's ability to supply the required bonds.

The bidder agrees to comply with the requirements of ORS 279C.800 to 279C.870 governing the prevailing wage rates.

The bidder acknowledges that this bid takes into account the public works bond that the successful bidder generally must file with the Construction Contractors Board and that the bidder will be entitled to no compensation in addition to the bid price on account of that bond.

The bidder certifies that the bidder has not discriminated and will not discriminate, in violation of ORS 279A.110(1).

The bidder certifies that, under ORS 279A.120, it is a (check one):

☐ Resident Bidder ☐ Nonresident Bidder.

If a nonresident bidder, the bidder certifies residency of (insert name of state where the bidder is a resident):

_____.

Failure to complete the foregoing certification of residency or nonresidency may render the bid nonresponsive. Failure of a nonresident bidder to certify its state of residency also may render the bid nonresponsive.

Bidder: _____

The bidder acknowledges that the Port has the right to reject any or all bids.

Legal Name of Company (Bidder): _____

Business Address of Bidder: _____

Business Phone Number: _____ Fax Number: _____

E-Mail Address: _____

Signature of Authorized Person: _____

Printed Name of Authorized Person: _____

Title: _____

Date: _____

Name of Primary Contact: _____

Phone Number: _____

E-Mail Address: _____

State of Oregon Construction Contractors Board Registration No. _____
(Required for Bidding).

Bidder's Federal Tax I.D. No. _____ (Required for Bidding).

Include with this bid:

- Bid security

Submit within two working hours of bid opening:

- Document 004335, First-Tier Subcontractor Disclosure Form

DOCUMENT 004335
FIRST-TIER SUBCONTRACTOR DISCLOSURE FORM

PROJECT NAME: _____

SOLICITATION NO. _____ BIDS DUE: Date: _____ Time: _____

This form must be submitted at the location specified in the Invitation to Bid on the bid due date and within two working hours after the time of the deadline when bids are due.

List below: 1) the name of each subcontractor who will be furnishing labor or will be furnishing labor and materials, and who will have a contract value that is equal to or greater than five percent of the total project bid or \$15,000, whichever is greater, or \$350,000 regardless of the percentage of the total project bid; 2) the dollar value of the subcontract; and 3) the category of work that the subcontractor will be performing. Enter "NONE" if there are no subcontractors. (ATTACH ADDITIONAL SHEETS IF NEEDED.)

Name, Address, Telephone	Dollar Value	Category of Work

Failure to submit this form by the disclosure deadline will result in a nonresponsive bid. A nonresponsive bid will not be considered for award.

FORM SUBMITTED BY (BIDDER NAME): _____ CONTACT NAME: _____ PHONE: _____
Print or Type

Signature certifies as to the accuracy of the foregoing information: _____
Authorized Signature Date

DOCUMENT 005200
AGREEMENT

THE PORT OF PORTLAND
P.O. BOX 3529
PORTLAND, OREGON 97208

PORTLAND INTERNATIONAL AIRPORT
CONCOURSE D
ALL-USER RESTROOM REMODEL

THIS AGREEMENT made and entered into on the date of full execution of this Contract by and between
The Port of Portland, a port district organized under ORS Chapter 778, hereinafter called "the Port," and
_____ of
_____,
hereinafter called "the Contractor."

W I T N E S S E T H:

That the Contractor in consideration of the covenants, agreements and payments to be performed and made by the Port, hereby covenants and agrees to provide all things necessary for the performance of the Contract, including, but not limited to, bonds, labor, material, transportation, and equipment required to execute, construct and furnish in full compliance with the Contract Documents, in an expeditious, substantial and workmanlike manner, the work and material hereinafter particularly described:

PORTLAND INTERNATIONAL AIRPORT
CONCOURSE D
ALL-USER RESTROOM REMODEL

The Contractor agrees that the following are hereby made a part of this Contract and are mutually cooperative therewith: (1) a copy of the Contractor's Bid signed on _____, 20____, including any documentation accompanying the Bid; (2) this Agreement, including any post-Bid documentation attached as an exhibit to this Contract; (3) Performance Bond; (4) Labor and Material Payment Bond; (5) General Conditions; (6) Supplementary Conditions; (7) Wage Rates; (8) Drawings; (9) Specifications; (10) Exhibits; and (11) Addenda.

For satisfactorily completed work under this Contract, the Port will pay the Contractor as provided by the Contract, but in no event more than \$_____ without an amendment or change order.

The Contractor promises that all work under this Contract shall be substantially complete within 348 days from the date specified in the written Notice to Proceed. The Contractor agrees to pay, as liquidated damages to the Port for any delay, the sum of \$500 per day for each day of delay beyond the substantial completion date so promised.

The Contractor further promises that all work under this Contract shall be complete, having gained a successful final inspection and received final acceptance from the Port, within 85 days after substantial completion. Final payment will not be made until the work is judged complete by the Port.

The Contractor also agrees to pay Other Damages described in the General Conditions.

The Contractor shall obtain the prior written consent of the Port to any proposed assignment of any interest in or part of this Contract. Such consent shall be at the sole discretion of the Port.

Under the same date as this Agreement, the Contractor is furnishing the Port with a performance bond, and a labor and material payment bond with _____ as surety, each in the amount of the full Contract value. These bonds shall ensure complete performance by the Contractor of this Contract in accordance with all of its terms and provisions and payment of all amounts owed by the Contractor to others for work performed or materials provided under this Contract.

The Contractor agrees to diligently prosecute the work to final acceptance and to accept as full payment hereunder the amounts specified in this Contract; and the Port agrees to make payments at the time, in the amount, and upon the terms and conditions specified herein.

The Contractor agrees to comply with all federal and state laws and regulations regarding nondiscrimination in employment, employee benefits, and facilities.

IN WITNESS WHEREOF, the parties hereto have caused these presents to be duly executed:

(FULL NAME OF COMPANY)

THE PORT OF PORTLAND

BY: _____
(Signature)

BY: _____
(Signature)

NAME: _____
(Print)

NAME: _____
(Print)

TITLE: _____

TITLE: _____

DATE: _____

DATE: _____

Approved as to Legal Sufficiency for the Port of
Portland:

Counsel for The Port of Portland

Approved by Commission on

DOCUMENT 007200
GENERAL CONDITIONS

TABLE OF CONTENTS

<u>Title</u>	<u>Page Number</u>
DEFINITIONS	1
ARTICLE 1 - TERMINOLOGY	3
ARTICLE 2 - PRELIMINARY MATTERS	3
Port Representative.....	3
Contractor's Representative	3
Online Construction Management System	3
Informal Communications	4
Reporting Information	4
Copies of Project Manual and Drawings	4
Commencement of Contract Time	4
Starting the Work	4
Before Starting Construction	4
ARTICLE 3 - CONTRACT DOCUMENTS	6
Intent.....	6
Reference Standards	6
Reporting Ambiguities	7
Reuse	7
Use of Electronic Documents	7
ARTICLE 4 - AVAILABILITY OF LANDS; PHYSICAL CONDITIONS; SURVEY CONTROL	7
Availability of Lands	7
Physical Conditions – Investigations, Reports, and Tests	7
Differing Site Conditions	7
Survey Control.....	8
ARTICLE 5 - BONDS AND INSURANCE	8
Bonds.....	8
Workers' Compensation.....	8
Liability Insurance.....	8
Builder's Risk Insurance	9
ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES.....	10
Administration and Supervision	10
Labor and Material	10
"Pre-Bid Approved Equals," "Equals," and Substitutes.....	11
Concerning Subcontractors	13
Patent Fees and Royalties.....	13
Computer Software and Code Use Rights	13
Permits.....	13
Laws and Regulations.....	14
Environmental Responsibilities.....	19
Taxes	20
Use of Premises	20
Safety and Protection.....	20
Emergencies	21
Submittals (Shop Drawings, Product Data, Maintenance Data, Samples, Warranty Data, and Other Information).....	21
Access to the Work.....	22
Prosecution of the Work.....	22
Port's Right to Do the Work.....	23
Indemnification.....	23

Prevailing Wage Rates	23
Labor Relations	24
Records and Audits.....	24
ARTICLE 7 - WORK BY OTHERS	25
ARTICLE 8 - PORT'S STATUS DURING CONSTRUCTION	25
Construction Contract Manager.....	25
Clarifications and Interpretations	26
Rejection of Defective Work.....	26
Port Inspectors	26
Limitations on the Port's Responsibilities.....	26
ARTICLE 9 - CHANGE IN THE WORK	27
ARTICLE 10 - CHANGE OF CONTRACT PRICE.....	28
Contract Price Adjustment Methods.....	28
Fixed Price Method	28
Unit Price Method	30
Force Account Method	30
Cost Changes to Bonds and Insurance	33
Rental Rate Blue Book	33
Lump-Sum Breakdown	33
Deleted Work.....	34
ARTICLE 11 - CHANGE OF CONTRACT TIME	34
ARTICLE 12 - WARRANTY; TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK	35
Tests and Inspections.....	35
Uncovering Work	35
Warranty	36
Correction or Removal of Defective Work	36
Port May Correct Defective Work.....	36
ARTICLE 13 - PAYMENTS TO THE CONTRACTOR AND COMPLETION.....	37
Before Request for Progress Payment	37
Request for Progress Payment.....	37
Retainage	38
Review of Request for Progress Payment	38
Substantial Completion	38
Partial Utilization.....	39
Final Inspection and Final Acceptance.....	39
Final Payment.....	39
Contractor's Continuing Obligation	40
Contractor's Warranty of Title	40
Waiver of Claims.....	40
Liquidated Damages	40
Other Damages	41
ARTICLE 14 - SUSPENSION OR TERMINATION OF THE WORK	41
Port May Suspend the Work.....	41
Port May Terminate the Work.....	42
Port May Terminate the Work for Convenience	43
ARTICLE 15 - DISPUTE RESOLUTION.....	43
ARTICLE 16 - MISCELLANEOUS	44
Giving Notice	44
Computation of Time	45
Liability Claims	45
Rights and Remedies	45
Commencement of Limitations Period.....	45
PROJECT-RELATED FORMS AND APPLICATIONS.....	Following General Conditions

DEFINITIONS

For the purposes of this Contract, terms are defined in the Agreement and in this article, and may be defined in the Specifications or Drawings. Terms used in a defined sense normally are capitalized; terms used in a general or undefined sense normally are not capitalized. Unless the context clearly requires otherwise, or the term is expressly defined otherwise for a particular purpose, the following definitions apply throughout this Contract.

Act of God - Any misadventure or casualty caused by the direct, immediate, and exclusive operation of the forces of nature, uncontrolled and uninfluenced by the power of man and without human intervention, which could not have been prevented or escaped by any amount of foresight or prudence, by any reasonable degree of care, or by the aid of any appliances reasonably required under the circumstances. A meteorological event, including but not limited to, cold, heat, rain, snow, wind, flood, or lightning, shall be rebuttably presumed not to be an Act of God if it falls within two standard deviations of the mean of records for that event maintained by the U.S. Weather Bureau for the Portland International Airport at Portland, Oregon.

Addenda - Written or graphic instruments issued prior to bid opening which clarify, correct, or change the bidding documents or this Contract.

Agreement - The written document signed by the parties and incorporating other documents.

Ambiguities - Ambiguities, conflicts, errors, discrepancies, or inconsistencies.

Bid - The offer or proposal of the bidder submitted on the prescribed form setting forth the price(s) for the Work to be performed.

Change Directive - A written order prepared by the Port directing a change in the Work prior to agreement on adjustment, if any, in the Contract Price or Contract Time.

Change Order - A written amendment to this Contract which authorizes an addition, deletion, or revision to the Work described in this Contract, and which may authorize an adjustment in the Contract Price, the Contract Time, or both.

Construction Contract Manager - An individual authorized in writing by the Port to represent the Port with respect to this Contract within the scope of the authority conferred by the written authorization.

Contract - The entire written agreement between the Port and the Contractor establishing their respective rights and obligations concerning the Work.

Contract Documents - The Contract Documents include all documents that make up this Contract, including but not limited to the Contractor's signed Bid; the Agreement; bonds; these General Conditions; the Supplementary Conditions; wage rates; the Specifications; the Drawings; the Notice to Proceed; Addenda; and Change Orders.

Contract Price - The total compensation payable to the Contractor for performing the Work as stated in this Contract and as modified by Change Order.

Contract Time - The number of days between the Work Start Date established by the Notice to Proceed and the date by which Substantial Completion of all work must be achieved under this Contract.

Contractor's Representative - An individual authorized in writing by the Contractor to represent the Contractor with respect to this Contract.

Day or Calendar Day - Any 24-hour period beginning at midnight.

Day, Business - Any Calendar Day other than Saturday, Sunday, or a holiday on which the Port's administrative offices are closed.

Defective - (1) Unsatisfactory, faulty, or deficient, (2) not conforming to this Contract, or (3) not meeting the requirements of any inspection, test, or approval required by this Contract or federal, state, or local law.

Drawings or Plans - The graphic representations which show the character and scope of the Work to be performed, which have been prepared or approved by the Port, and which are expressly incorporated into this Contract.

Final Acceptance - The Port's written acknowledgment that the Work has been fully completed and all Contract-required documentation has been received and accepted.

Law - Any statute, rule, regulation, ordinance, or order of any federal, state, or local government including, but not limited to, ordinances and resolutions adopted by the Board of Commissioners of the Port of Portland, and rules and regulations adopted in accordance with those ordinances and resolutions.

Maintenance Data - Manufacturer's catalog information, Shop Drawings, installation, operation, and maintenance manuals, and other information needed for operating, troubleshooting, preventive maintenance, repair, restoration, or overhaul of materials, products, systems, and equipment furnished or provided by the Contractor.

Notice to Proceed - A written notice given by the Port to the Contractor fixing the Contract Time and designating a date on which the Contractor is authorized to begin the Work.

Owner - The Port of Portland.

Product Data - Pictures, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product, or system for some portion of the Work.

Samples - Physical examples of material, equipment, or workmanship which demonstrate and establish standards by which the Work will be judged.

Shop Drawings - Diagrams, drawings, illustrations, instructions, and other data submitted by the Contractor to illustrate some portion of the Work.

Specifications - Those portions of this Contract consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

Subcontractor - An individual or firm having a direct contract with the Contractor or with any other Subcontractor at any tier for the performance of a part of the Work.

Substantial Completion - Completion of the Work, or a part of the Work designated by the Port, in accordance with this Contract, to the point where it may be utilized for the purpose for which it was intended.

Work - The labor, material, equipment, and services required by this Contract.

Work Start Date - The day stated in the Notice to Proceed when the Contract Time will begin to run in accordance with this Contract.

ARTICLE 1 - TERMINOLOGY

- 1.1 Unless stated otherwise in this Contract, words or phrases which have a well-known technical, construction industry, or trade meaning are used in accordance with such recognized meaning.
- 1.2 Unless stated otherwise in this Contract, all Specifications are directed to the Contractor. This includes statements which have no grammatical subject, as in "Install equipment plumb and level."
- 1.3 In the interest of brevity, this Contract frequently omits modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.
- 1.4 The following terms are used in this Contract: as allowed, as directed, as ordered, as required, acceptable, proper, reasonable, satisfactory, suitable. These items and any others of like effect or import describe direction, judgment, requirement, or review of the Port. Such use is solely to evaluate the Work for compliance with this Contract unless there is a specific statement otherwise. The use of such terms never indicates the Port has authority to supervise or direct performance of the Work.
- 1.5 The words, "Furnish," "Install," "Perform," and "Provide" shall have the following meanings for the purposes of this Contract. When such verbs are not used in connection with services, materials, or equipment in a context clearly requiring an obligation on the part of the Contractor, "provide" is implied.
 - A. Furnish shall mean to supply and deliver services, materials, or equipment to the Work site (or other specified location) ready for use or installation and in usable or operable condition.
 - B. Install shall mean to put into use or place in final position services, materials, or equipment complete and ready for intended use.
 - C. Perform or provide shall mean to furnish and install services, materials, or equipment complete and ready for intended use.

ARTICLE 2 - PRELIMINARY MATTERS

Port Representative

- 2.1 The Port's Engineering Director is authorized to represent the Port with respect to this Contract, provided that their authority to amend this Contract is limited to the amount set by Port policy. The Engineering Director will appoint a Construction Contract Manager in writing to exercise all or part of their authority.

Contractor's Representative

- 2.2 The Contractor shall authorize the Contractor's Representative to receive communications from the Port and to sign the Contractor's communications to the Port. The Contractor's Representative shall not be replaced without written notice to the Port except under extraordinary circumstances.

Online Construction Management System

- 2.3 All written forms of communication, including but not limited to submittals, invoices, notices, reports, requests, clarifications, approvals, transmittals, and letters, shall be conducted exclusively through the Port's online construction management system unless otherwise specified or approved by the Port. Email shall not be considered an official repository for these items unless explicitly permitted by the Port.

- 2.4 The Contractor will receive an invitation to the Port's online construction management system to set up an account with a user name (e-mail address) and password. One login account will initially be granted to the Contractor, but the Port will allow up to two additional login accounts (for a total of three) upon request. The Contractor shall protect credentials, data, and system access consistent with industry best practices.
- 2.5 The Contractor shall ensure all assigned users complete Port-required training prior to accessing the system.
- 2.6 Email notifications generated from the system will be considered in effect as of the time the email is sent. The Contractor shall ensure timely entry, response, and status updates in the system in accordance with the Port's schedules and procedures.
- 2.7 Documents maintained within the system constitute the official project record. Electronic approvals and e-signatures executed therein carry the same force and effect as wet signatures to the extent allowed by law.

Informal Communications

- 2.8 In addition to the communication between the Port's Representative and the Contractor's Representative noted above, frequent informal communication will take place between Port and Contractor employees to facilitate the Work. These communications may include Contract enforcement and interpretation. If any communication from the Port appears that it will result in a change in Contract Time or Contract Price, the Contractor shall request that the issue be presented in writing.

Reporting Information

- 2.9 The Port uses an electronic reporting system to collect subcontractor payment utilization reports, workforce utilization reports, and certified payroll reports. This system can be accessed online at www.portofportland.dbesystem.com. The Contractor shall ensure that reports for the Contractor and its subcontractors at all levels are reported in the system at the frequency required per report type. The Contractor shall fill out and submit an "Assignment of Roles" form (provided by the Port) upon Contract execution indicating who will be responsible for these reports on behalf of the Contractor.

Copies of Project Manual and Drawings

- 2.10 The Port will furnish to the Contractor up to two copies of the project manual and Drawings for execution of the Work. Additional copies may be furnished, upon request, at the cost of reproduction.

Commencement of Contract Time

- 2.11 The Contract Time will commence to run on the Work Start Date stated in the Notice to Proceed. Unless provided otherwise by the Agreement, the Work Start Date may be any date within 45 days after the Port delivers the executed Contract to the Contractor.

Starting the Work

- 2.12 The Contractor may start to perform the Work on the Work Start Date stated in the Notice to Proceed.

Before Starting Construction

- 2.13 Generally, a preconstruction meeting to establish a working understanding among the parties will be held before the Contractor begins the Work. Procedures will be established for operations

coordination and administrative communication for matters such as submittals, clarifications and interpretations, and Change Orders; and for processing applications for payment. At least one week prior to this meeting or as otherwise specified below, the Contractor shall submit to the Port for review a complete list of material suppliers and subcontractors, a preliminary work progress schedule, a preliminary submittal schedule, a preliminary cash flow schedule, and the contractor safety information form.

- A. The preliminary work progress schedule shall be finalized and submitted to the Port one week after the preconstruction meeting. Unless specified otherwise, the work progress schedule shall indicate the Contractor's planned progress in increments of not more than 7-day periods. The schedule will be subject to review and comment by the Port. The Contractor shall prepare and submit revisions to match actual and projected progress as requested by the Port, before and during the course of the work, at no added cost to the Port. The Contractor shall adhere to the most recent version of the schedule.
 - B. The Port will prepopulate the Submittal Register in the Port's online construction management system. The Contractor shall verify that the Submittal Register includes all submittals required by the Contract Documents and then develop a preliminary submittal schedule with target submittal dates that align with the Contractor's approved work progress schedule. The target submittal dates shall factor in time for the Port's review and the Contractor's submission of revised submittals. The submittal schedule shall be in PDF or other format approved by the Port and be submitted at least 10 days prior to the first scheduled submittal date. Once the preliminary submittal schedule is approved by the Port, the Contractor shall enter the target dates in the Submittal Register and be responsible for updating it during the course of the Work.
 - C. The preliminary cash flow schedule shall be finalized and submitted to the Port one week after the preconstruction meeting. The schedule shall show the estimated dollar amount of each of the Contractor's monthly requests for progress payment and will be used by the Port for financial planning purposes. Payments to the Contractor are not restricted by the amounts given in the cash flow schedule. However, revised work progress and cash flow schedules will be required if amounts paid as monthly progress payments differ greatly from the amounts estimated.
 - D. Prior to commencement of work, the Contractor shall submit a site-specific safety and health plan in compliance with 29 CFR 1926, and the contractor safety information form for safety planning purposes (form follows these General Conditions). The Port expects that the Contractor will abide by all current federal and state OSHA requirements and the Contract Documents to provide for the safety of the Contractor's employees, Port employees, tenants, and the general public. Work performed by Subcontractors shall be on the form. The Contractor shall also include applicable company policies, procedures, or plans. Safety data sheets (SDS) for chemical products introduced to Port premises shall not be submitted with this information, but shall accompany the Contractor on site and be available to the Port upon request.
- 2.14 In the case of a lump-sum agreement or lump-sum bid items, the Contractor shall, no later than one week after the date indicated in the Notice to Proceed for commencement of preliminary Work prior to construction, submit to the Port a detailed breakdown of the amount of each item used in the compilation of the Bid. The breakdown format shall be sufficiently detailed to meet the approval of the Port, and to serve as the basis for progress payment requests. The detailed breakdown may be used in the compilation of Change Order prices when such breakdown is determined by the Port to be applicable and consistent with accepted construction practice.

- 2.15 The Contractor shall, no later than one week after receipt of the Notice to Proceed, submit to the Port a breakdown of the payroll rates for each trade. The Port may use this breakdown when evaluating Contract Price adjustments. The breakdown shall include the base rate, benefits, payroll taxes, and insurance.
- 2.16 Before undertaking each part of the Work, the Contractor shall carefully study and compare this Contract and check and verify pertinent figures shown therein and all applicable field measurements. The Contractor shall promptly report in writing to the Port any Ambiguities that the Contractor may discover.

ARTICLE 3 - CONTRACT DOCUMENTS

Intent

- 3.1 This Contract is complementary; what is called for by one element is as binding as if called for by all.
- 3.2 It is the intent of this Contract to describe the complete Work. Any labor, material, equipment, or service that may be reasonably inferred from this Contract as being required to produce the intended result shall be supplied whether or not it is expressly specified.
- 3.3 The Contractor is expected to read the entirety of the Contract Documents and to seek clarification from the Port of any Ambiguities found between, among or within the Contract Documents. Absent written clarification from the Port to the contrary, the Contractor shall, in resolving Ambiguities discovered either before or after original procurement and/or installation, provide the better quality of, and the greater quantity of, the Work. The Contractor shall specifically notify all Subcontractors and suppliers of this requirement.
- 3.4 Clarifications and interpretations of this Contract will be issued by the Port. They will be consistent with or reasonably inferable from the overall scope of this Contract.
- 3.5 This Contract is unique. Labor, material, equipment, or services approved for other Port work may not necessarily be approved for this Contract.
- 3.6 Pursuant to ORS 15.320, Oregon law applies to this Contract. In the event ORS 15.320 is deemed invalid or inapplicable, the parties agree that Oregon law applies to this Contract.
- 3.7 If the Contractor's Bid or Proposal is incorporated into this Contract, any Ambiguities between the bid or proposal and this Contract will be resolved in favor of this Contract. Any limitations of liability, waivers of damages, or disclaimers of warranty or liability contained in the Contractor's Bid or Proposal will not apply to the Work or this Contract.
- 3.8 If any provision of this Contract is held to be illegal, invalid, or unenforceable under present or future laws effective during the terms of this Contract or in subsequent dispute resolution proceedings, the legality, validity, and enforceability of the remaining provisions of this Contract will not be affected thereby. As to the illegal, invalid or unenforceable clauses, they shall be rendered void only to the extent of such illegal, invalid and unenforceable portions, with the remainder of such clauses given full force and effect.

Reference Standards

- 3.9 Unless expressly provided otherwise, references to standard specifications, manuals, or codes of any technical society, organization, or association, or to the codes of any governmental authorities, shall mean the latest version or edition in effect on the effective date of this Contract. Such reference may be specific or implied. No provision of any referenced standard specification,

manual, or code shall change the duties and responsibilities of the Port, the Contractor, or any of their employees, contractors, Subcontractors, or agents from those set forth in this Contract.

Reporting Ambiguities

- 3.10 If, during the performance of the Work, the Contractor discovers any Ambiguities within this Contract, the Contractor shall report it to the Port, in writing, at once. The Contractor shall proceed with the affected Work after receiving clarification or interpretation from the Port. The Contractor shall not be liable to the Port for failure to report any Ambiguities in this Contract unless the Contractor factually knew or reasonably should have known of the Ambiguities.

Reuse

- 3.11 Neither the Contractor nor any Subcontractor, manufacturer, fabricator, supplier, or distributor shall have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents, or copies thereof, prepared by or for the Port. They shall not reuse any of them for any purpose unrelated to this Contract without the prior written consent of the Port and of any other person with an intellectual property interest in the documents.

Use of Electronic Documents

- 3.12 Those using electronic documents provided by the Port do so at their own risk. Electronic documents are subject to data erosion, erasure, and alteration. Because computer software may become obsolete with time, the Port makes no warranties or representations regarding the ability to permanently access electronic documents it provides. The Port makes no warranties or representations regarding the presence or absence of computer viruses in electronic documents it provides; any person using an electronic document provided by the Port should check the document for computer viruses before using it in a manner that might allow the spread of a computer virus. All or parts of electronic documents provided by the Port may be copyrighted, and those using them are responsible for determining the existence of copyrights and for obtaining permission to copy copyrighted material.

ARTICLE 4 - AVAILABILITY OF LANDS; PHYSICAL CONDITIONS; SURVEY CONTROL

Availability of Lands

- 4.1 The Port will provide access to: (1) lands upon which the Work shall be performed, (2) rights-of-way for access thereto, and (3) such other lands designated in this Contract for the use of the Contractor. Any easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by the Port, unless otherwise provided in this Contract. The Contractor shall provide, at no additional cost to the Port, additional lands and access that the Contractor may require for temporary construction facilities or storage of material and equipment.

Physical Conditions – Investigations, Reports, and Tests

- 4.2 The Port may make investigations, reports, or tests available to the Contractor. However, the Port makes no warranty or representation regarding the accuracy or completeness of any such investigations, reports, or tests unless they have expressly been made a part of this Contract.

Differing Site Conditions

- 4.3 The Contractor shall promptly notify the Port in writing of any conditions at the site (1) differing materially from those shown in this Contract or (2) that are of an unusual nature, differing materially from conditions ordinarily encountered and generally recognized as inherent in the Work. The Contractor shall, to the extent reasonably possible, provide prompt written notice of such conditions before they are substantially disturbed or altered. The Port will promptly review

those differing conditions and advise the Contractor in writing if further investigation or tests are necessary. The Port will obtain any necessary additional investigations and tests. If the conditions differ materially from those shown in this Contract or from what reasonably could have been anticipated by the Contractor, this Contract may be amended to allow additional compensation, time, or both as reasonably necessary to accommodate the differing conditions.

Survey Control

- 4.4 Unless otherwise provided in the Contract, the Port will provide engineering surveys and establish those survey control points necessary for the Contractor to lay out the Work. The Contractor shall: (1) lay out the Work, unless otherwise specified in this Contract, (2) protect and preserve the established survey control points, and (3) make no change or relocation of the survey control points without the prior written approval of the Port. The Contractor shall report to the Port whenever any survey control point is lost, destroyed, or requires relocation. At no additional cost to the Port, the Contractor shall be responsible for the accurate replacement or relocation of survey control points lost or destroyed without Port approval. Such replacement shall be by a professional land surveyor licensed by the State of Oregon.

ARTICLE 5 - BONDS AND INSURANCE

Bonds

- 5.1 The Contractor shall furnish a performance bond, and a labor and material payment bond, each in an amount equal to the Contract Price, as security for the faithful performance of, and payment of, all the Contractor's obligations, responsibilities, and liabilities under this Contract. The bonds shall remain in effect until at least one year after the date of Final Acceptance, except as otherwise provided by Law. The performance bond, and labor and material payment bond shall be on the forms prescribed by the bidding and contract requirements and executed by sureties: (1) licensed to conduct business in the State of Oregon, and (2) named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All bonds signed by an agent shall be accompanied by a power of attorney or other evidence of the agent's authority to act on behalf of the surety.
- 5.2 The Contractor shall substitute another bond and surety meeting the requirements of Item 5.1 within 5 days after the surety on any bond furnished by the Contractor: (1) is declared bankrupt, (2) becomes insolvent, (3) has its right to do business terminated in any state where any part of the Work is located, or (4) ceases to meet the requirements of Item 5.1.

Workers' Compensation

- 5.3 The Contractor shall maintain workers' compensation and employer's liability insurance for all employees subject to the workers' compensation laws of the State of Oregon, unless exempt, and any other appropriate jurisdiction. The amount of employer's liability insurance shall not be less than \$1,000,000 per accident, and \$1,000,000 per employee for disease. In lieu of such insurance, the Contractor may maintain a self-insurance program approved by the State of Oregon and a policy of excess workers' compensation insurance in the amount required by the State, which policy includes coverage for employer's liability. The Contractor shall provide evidence of such insurance and self-insurance to the Port before commencing Work and throughout the term of this Contract.

Liability Insurance

- 5.4 The Contractor shall maintain the following liability coverages in an amount not less than \$1,000,000 per occurrence. The Port shall be given not less than 30 days' written notice prior to

cancellation, non-renewal, or material change of the policy. This insurance shall provide primary coverage and shall not seek any contribution from any insurance or self-insurance carried by the Port. One copy of each policy and a certificate(s) of such insurance, including an additional insured endorsement, shall be delivered to the Port before commencing Work and shall be subject to review and approval by the Port. The Port may defer delivery of the copy of the policy, but such deferral shall not be a waiver of the Port's right to a copy of the policy. In the event the Contractor fails to maintain such insurance, the Port may, without incurring liability to the Contractor for any related costs: (1) immediately suspend the Work until the required insurance is obtained, without any increase in the Contract Price or any extension of the Contract Time, directly or indirectly attributable to the suspension; and/or (2) terminate this Contract as provided for in Item 14.4.

- A. The Contractor shall maintain commercial general liability insurance to protect against liability for bodily injury and property damage which may arise out of the Contractor's operations under this Contract. Such insurance shall include coverage for products-completed operations liability, independent contractors, contractual liability (including the tort liability of another assumed under a business contract), and all other standard coverages usually afforded by a commercial general liability policy. Such insurance shall name the Port and its commissioners, employees, and agents as additional insureds, and shall insure the Contractor's obligations under this Contract to indemnify and hold harmless the Port, its commissioners, employees, and agents, provided that the Contractor's insurer shall not be required to indemnify the Port for damages arising out of the death or bodily injury to persons or damage to property caused in whole or in part by the negligence of the Port.
- B. The Contractor shall maintain business automobile liability insurance to protect against liability arising from the use, loading, and unloading of all of the Contractor's owned, hired, and non-owned automobiles in connection with this Contract. Such insurance shall cover the Port as an additional insured, provided that the Contractor's insurer shall not be required to indemnify the Port for damages arising out of the death or bodily injury to persons or damage to property caused in whole or in part by the negligence of the Port.

Builder's Risk Insurance

- 5.5 The Contractor shall obtain and maintain for the benefit of the parties to this Contract, as their interest may appear, all risk builder's risk insurance to the extent of 100 percent of the value of the Work. Coverage shall also include: (1) formwork in place, (2) form lumber and form components on site, (3) temporary structures, (4) equipment, and (5) supplies related to the Work. Such insurance shall be endorsed to allow partial occupancy and/or utilization of the Work by the Port prior to Substantial Completion of all the Work. Coverage shall continue until the Port's Final Acceptance of the Work. The Port shall be named as additional insured and loss payee as its interests may appear. The Port shall be given not less than 30 days' written notice prior to cancellation, non-renewal, or material change of the policy. One copy of the policy and one certificate of such insurance shall be delivered to the Port before commencing Work and shall be subject to review and approval by the Port. The Port may defer delivery of the copy of the policy, but such deferral shall not be a waiver of the Port's right to a copy of the policy. In the event the Contractor fails to maintain such insurance, the Port may, at the Port's sole option, arrange therefor; and any administrative costs and premium incurred shall be reimbursed by the Contractor.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

Administration and Supervision

- 6.1 The Contractor shall supervise and direct the Work competently and efficiently, applying the skills and expertise as may be necessary to perform the Work in accordance with this Contract. The Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. The Contractor shall be responsible for seeing that the finished Work complies accurately with this Contract.
- 6.2 The Contractor shall provide a competent project superintendent at the site at all times during work progress. The superintendent shall be responsible for oversight of the work being performed by the Contractor and its Subcontractors. The project superintendent shall not be replaced without written notice to the Port.
- 6.3 If the Contractor's Representative is not available for project administration, the superintendent shall have the authority to receive direction from the Port on behalf of the Contractor. All communications given to the superintendent shall be as binding as if given to the Contractor. This authority shall include, but not be limited to, receipt of Port-issued documentation, taking action on Port direction not involving changes to this Contract, taking direct action in emergency situations, and implementing stop work orders issued by the Port.

Labor and Material

- 6.4 The Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work, and to perform construction as required by this Contract. The Contractor shall at all times maintain good discipline and order at the site.
- 6.5 The Contractor shall give not less than 24 hours' notice to the Port if work is to be performed outside normal day-shift hours or on Saturday, Sunday or any legal holiday. Emergency conditions relating to safety or protection of persons or property are valid exceptions to such notice. Specific work hour restrictions may be described in the Supplementary Conditions or Division 1.
- 6.6 Unless otherwise specified, the Contractor shall furnish for the execution, required testing, initial operation, and completion of the Work all necessary material, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, and all other facilities and incidentals.
- 6.7 All material incorporated into the Work shall be new, except as otherwise provided in this Contract. Products containing asbestos or other hazardous material, as defined by ORS 466.605, shall be used only with the Port's prior written approval. If required by the Port, the Contractor shall furnish satisfactory evidence that the kind and quality of material and equipment provided meet Contract requirements. Satisfactory evidence may include test reports.
- 6.8 The Contractor shall obtain documentation from distributors, fabricators, manufacturers, and suppliers that provide instructions for the application, cleaning, connection, erection, installation, and use of their products. The Contractor shall follow these instructions unless more stringent requirements are provided in this Contract.
- 6.9 All material provided and normally tested and labeled by an approved testing laboratory, such as Underwriters Laboratories (UL), Canadian Standards Association (CSA), or by a similarly recognized third-party approval authority, shall be so labeled.

“Pre-Bid Approved Equals,” “Equals,” and Substitutes

6.10 Whenever an item of material or equipment is specified or described in this Contract by using the name of a proprietary item or the name of a particular supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description indicates that no substitution is permitted, other items of material or equipment, or material or equipment of other suppliers, may be submitted to the Port for evaluation under the circumstances described below:

- A. “Pre-Bid Approved Equal” Items: Requests for evaluation of “pre-bid approved equal” material, products, or services shall be made prior to submittal of the Bid, in accordance with the Instructions to Bidders.
- B. “Equal” Items: If in the Port’s sole discretion an item of material or equipment proposed by the Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by the Port as an “equal” item, in which case evaluation and approval of the proposed item may, in the Port’s sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. Proprietary materials, products, or services that are specified but not followed by the words “or pre-bid approved equal,” “or equal,” or “no substitution” will be evaluated as if they were followed by the words “or equal.” For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - 1. It is at least equal in quality, durability, maintainability, appearance, strength, and design characteristics;
 - 2. It will reliably perform at least equally well the function imposed by the design concept of the completed Work as a functioning whole, and;
 - 3. The Contractor certifies that there is no increase in cost to the Port; and that it will conform substantially, even with deviations, to the detailed requirements of the item named in this Contract.
- C. Substitute Items:
 - 1. If an item of material or equipment proposed by the Contractor does not qualify as an “equal” item as defined above, it will be considered a proposed substitute item. This determination will be at the Port’s sole discretion.
 - 2. The Contractor shall submit sufficient information, as provided below, to allow the Port to determine that the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. The Port will not accept requests for evaluation of proposed substitute items of material or equipment from anyone other than the Contractor. The Contractor shall make the request as a submittal.
 - 3. The application shall certify that the proposed substitute item will adequately perform the functions and achieve the results called for by the general design, be similar in substance to that specified, and be suited to the same use as that specified.
 - 4. The application shall state the extent, if any, to which the use of the proposed substitute item will prejudice the Contractor’s achievement of Substantial Completion on time, whether or not use of the proposed substitute item in the Work will require a change in this Contract (or in the provisions of any other affected contract with the Port for work) to adapt the design to the proposed substitute item, and whether or not incorporation or

use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

5. The application shall identify any variations of the proposed substitute item from that specified, and shall identify available engineering, sales, maintenance, repair, and replacement services.
6. The application shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change, all of which will be considered by the Port in evaluating the proposed substitute item.
7. The Port may require the Contractor to furnish additional data beyond that listed above about the proposed substitute item.
8. The Port may require the Contractor to furnish, at the Contractor's expense, a special performance guarantee or other surety with respect to any substitute.
9. No increase in the Contract Price or extension of the Contract Time will be considered when a substitution is not accepted.

D. No Substitution:

1. Materials, products, or services marked "no substitution" have been determined to be 1) manufactured from a single source only or 2) required for the efficient utilization of existing equipment or systems. Requests for substitution will not be considered for these items. Justifications for classifying these products as "no substitution" are on file as brand name exemption items in the Port's Contracts and Procurement Office.
- 6.11 Contractor Application for Evaluation: The application for evaluation of "equal" or substitute items shall be made using the forms provided by the Port. These forms may be copied.
- 6.12 Port's Evaluation: Within 10 days, the Port will evaluate each application for "equal" and substitute items. The Port will be the sole judge of acceptability. No "equal" or substitute item shall be ordered, installed, or utilized until the Port's evaluation is complete, which will be evidenced by either a Change Order for a substitute or an approved submittal for an "equal." The Port will advise the Contractor in writing of any negative determination.
- 6.13 Substitute Construction Methods or Procedures (Value Engineering): If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in, and expressly required by, this Contract, the Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by the Port. The Contractor shall submit sufficient information to allow the Port, in the Port's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by this Contract. The procedure for evaluation by the Port will be similar to that provided for substitute items. The Port will record time required by the Port and the Port's consultants in evaluating the substitute proposed by the Contractor and in making changes to this Contract (or in the provisions of any other affected contract with the Port for work). If the cost of the Work is reduced by the acceptance of any substitute item, after subtracting the reimbursement cost for Port evaluation, the Port agrees to pay 50 percent of the savings to the Contractor via a Change Order. The Port is not obligated to review proposals for substitute construction methods or procedures if the evaluation of such substitution appears more costly than the savings, or if such substitution otherwise appears not to be in the Port's best interests.

Concerning Subcontractors

- 6.14 All subcontracts shall be subject to the provisions of this Contract insofar as applicable.
- 6.15 Subcontractors and suppliers shall be subject to disapproval of the Port. If the Port has reasonable objection to any of these, the Contractor shall submit an acceptable substitute. The Contractor will not be required to employ anyone against whom the Contractor has reasonable objection. No subcontract may be awarded at any tier to a Subcontractor determined by the Commissioner of the Bureau of Labor and Industries to be ineligible to receive a contract or subcontract for public works pursuant to ORS 279C.860.
- 6.16 The Contractor is responsible for: (1) all acts and omissions of its Subcontractors, (2) persons and organizations directly or indirectly employed by its Subcontractors, (3) persons and organizations for whose acts any of its Subcontractors may be liable, and (4) scheduling and coordinating the work of Subcontractors, suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with the Contractor. Nothing in this Contract shall create any contractual relationship between the Port and any Subcontractor or other person or organization having a direct contract with the Contractor. Nothing in this Contract shall create any obligation on the part of the Port to pay or to see to the payment of any moneys due any Subcontractor or other person or organization, except as may otherwise be required by Law. The Port may furnish to any Subcontractor or other person or organization, to the extent practicable, evidence of amounts paid to the Contractor on account of specific Work completed.
- 6.17 The divisions and sections of the Specifications and the identifications of any Drawings shall not control the Contractor in dividing the Work among Subcontractors or delineating the work to be performed by any specific trade.

Patent Fees and Royalties

- 6.18 If any design, device, material, or process covered by letters patent or copyright is used by the Contractor or is provided for the Port's use, the Contractor shall: (1) provide for such use by agreement with the owner of the patent or copyright or a duly authorized licensee of such owner, and (2) defend, indemnify, and hold the Port harmless from all losses and expenses, including, without limitation, legal fees arising from the use of the patented or copyrighted design, device, material, or process.

Computer Software and Code Use Rights

- 6.19 If the Contract Documents require the Contractor to provide the Port with computer software programs or code as part of the Work, the Contractor shall provide the Port with all documentation and instruments necessary to evidence the Port's right to use such software or code, including but not limited to ownership transfer documentation, software license agreements, subscription agreements, or assignments of intellectual property interests, as applicable.

Permits

- 6.20 Port-Designed Work
- A. The Port will submit to federal, state, and local units of government all calculations and other documentation required for review and checking for purposes of obtaining permits.
 - B. The Port will obtain, and pay the costs and charges of, general project permits such as building, fill, environmental, and land use.
 - C. The Contractor shall obtain and pay all costs and charges imposed for permits customarily issued only to a contractor, such as electrical, mechanical, and plumbing.

- D. The Contractor shall give all notices necessary for permit-related inspections by third parties.
- E. The Contractor shall submit to the Port a legible copy of permits, certificates of approval, and certificates of occupancy issued by the responsible unit of government.

6.21 Contractor-Designed Work

- A. The Contractor shall submit to the Port, for review, all calculations and other documentation required for purposes of obtaining permits for Contractor-designed work.
- B. After Port review, the Contractor shall submit to federal, state, and local units of government all calculations and other documentation required for obtaining permits. During review by units of government, the Contractor shall notify the Port of proposed deviations from the original permit documentation.
- C. The Contractor shall submit to the Port all calculations and other documentation approved by units of government.
- D. The Contractor shall pay costs and charges imposed by local units of government for permits issued to the Contractor.
- E. The Contractor shall give all notices necessary for permit-related inspections by third parties.
- F. The Contractor shall submit to the Port a legible copy of permits, certificates of approval, and certificates of occupancy issued by the responsible unit of government.

Laws and Regulations

- 6.22 The Contractor shall comply, and shall ensure that its employees and those of its Subcontractors and suppliers at every tier comply, with the most current versions of applicable Laws, rules, regulations, and practices.
- 6.23 If the Contractor performs any Work knowing or having reason to know that it is contrary to any Law, the Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to the Contractor's performance or the resulting Work. The Contractor shall immediately report to the Port if performance under this Contract would violate any Law in any respect.
- 6.24 The Contractor shall adhere to the following specific provisions of the Public Contracting Code.
 - A. The Contractor shall:
 - 1. Make payment promptly, as due, to all persons supplying the Contractor labor or material for the performance of the work provided for in this Contract.
 - 2. Pay all contributions or amounts due the Industrial Accident Fund from the Contractor or any Subcontractor incurred in the performance of this Contract.
 - 3. Not permit any lien or claim to be filed or prosecuted against the Port on account of any labor or material furnished.
 - 4. Pay to the Department of Revenue all sums withheld from employees pursuant to ORS 316.167.
 - 5. Demonstrate that an employee drug testing program is in place.
 - B. If this is a public contract for demolition, the Contractor shall salvage or recycle construction and demolition debris, if feasible and cost-effective.

- C. If this is a public contract for lawn and landscape maintenance, the Contractor shall compost or mulch yard waste material at an approved site, if feasible and cost-effective.
- D. If the Contractor fails, neglects, or refuses to pay promptly a person's claim for labor or services that the person provides to the Contractor or a Subcontractor in connection with this Contract as such claim becomes due, the proper officer that represents the Port may pay the amount of the claim to the person that provides the labor or services and charge the amount of the payment against funds due or to become due the Contractor by reason of this Contract.
- E. If the Contractor or a first-tier Subcontractor fails, neglects, or refuses to pay a person that provides labor or material in connection with this Contract within 30 days after receiving payment from the Port or the Contractor, the Contractor or first-tier Subcontractor owes the person the amount due plus interest charges that begin at the end of the 10-day period within which payment is due under ORS 279C.580(3) or (4) and that end upon final payment, unless payment is subject to a good faith dispute as defined in ORS 279C.580(5). The rate of interest on the amount due is 9 percent per annum. The amount of interest may not be waived.
- F. If the Contractor or a Subcontractor fails, neglects, or refuses to pay a person that provides labor or material in connection with this Contract, the person may file a complaint with the Construction Contractors Board, unless payment is subject to a good faith dispute as defined in ORS 279C.580(5).
- G. Hours of Labor, Pay Equity, and Employee Discussions of Rate of Pay or Benefits:
 - 1. The Contractor and all Subcontractors shall not employ an employee for more than ten hours in any one day, or 40 hours in any one week, except in cases of necessity, emergency, or where the public policy absolutely requires otherwise, and in such cases the Contractor or Subcontractor shall pay the employee at least time and a half pay for:
 - a. All overtime in excess of eight hours in any one day or 40 hours in any one week if the work week is five consecutive days, Monday through Friday; or
 - b. All overtime in excess of ten hours in any one day or 40 hours in any one week if the work week is four consecutive days, Monday through Friday; and
 - c. All work the employee performs on Saturday, Sunday, New Year's Day on January 1, Memorial Day on the last Monday in May, Independence Day on July 4, Labor Day on the first Monday in September, Thanksgiving Day on the fourth Thursday in November, or Christmas Day on December 25, or, if one of those named holidays falls on a Sunday, on the following Monday or, if it falls on a Saturday, on the preceding Friday.
 - 2. The Contractor shall comply with the prohibition set forth in ORS 652.220. Such compliance is a material element of the Contract and a failure to comply is a breach that entitles the Port to terminate the Contract for cause.
 - 3. The Contractor shall not prohibit any of the Contractor's employees from discussing the employee's rate of wage, salary, benefits, or other compensation with another employee or another person and shall not retaliate against an employee who discusses the employee's rate of wage, salary, benefits, or other compensation with another employee or another person.
 - 4. The Contractor and all Subcontractors shall give notice in writing to employees working on this Contract as required by ORS 279C.520(2) and 279C.520(5)(b), either at the time of hire or before work begins on this Contract, or by posting a notice in a location

frequented by employees, of the number of hours per day and days per week that the Contractor or Subcontractor may require the employees to work.

5. The Contractor shall pay employees at least time and a half pay for work the employees perform under this Contract on the legal holidays specified in a collective bargaining agreement or in ORS 279C.540 (1)(b)(B) to (G) and for all time the employees work in excess of 10 hours in any one day or in excess of 40 hours in any one week, whichever is greater.
- H. The Contractor shall promptly, as due, make payment to any person, copartnership, association, or corporation furnishing medical, surgical and hospital care or other needed care and attention, incident to sickness or injury, to the employees of the Contractor, of all sums which the Contractor agrees to pay for such services and all moneys and sums which the Contractor collected or deducted from the wages of employees pursuant to any law, contract, or agreement for the purpose of providing or paying for such service.
- I. The Contractor shall comply with the terms of the workers' compensation laws of the State of Oregon, unless exempt, and any other applicable jurisdiction. All subject employers performing work under this Contract are either employers that will comply with ORS 656.017 or employers that are exempt under ORS 656.126.
- J. The Contractor shall comply with the following requirements (and, if applicable, prompt payment provisions stated in Document 007301, Supplementary Conditions for Federally Assisted Contracts):
 1. The Contractor shall include in each subcontract for property or services the Contractor enters into with a first-tier Subcontractor, including a material supplier, for the purpose of performing this Contract:
 - a. A payment clause that obligates the Contractor to pay the first-tier Subcontractor for satisfactory performance under the subcontract within 10 days out of amounts the Port pays to the Contractor under this Contract;
 - b. A clause that requires the Contractor to provide a first-tier Subcontractor with a standard form that the first-tier Subcontractor may use as an application for payment or as another method by which the Subcontractor may claim a payment due from the Contractor;
 - c. A clause that requires the Contractor, except as otherwise provided in this paragraph, to use the same form and regular administrative procedures for processing payments during the entire term of the subcontract. A Contractor may change the form or the regular administrative procedures the Contractor uses for processing payments if the Contractor:
 - 1) Notifies the Subcontractor in writing at least 45 days before the date on which the Contractor makes the change; and
 - 2) Includes with the written notice a copy of the new or changed form or a description of the new or changed procedure.
 - d. An interest penalty clause that obligates the Contractor, if the Contractor does not pay the first-tier Subcontractor within 30 days after receiving payment from the Port, to pay the first-tier Subcontractor an interest penalty on amounts due in each payment the Contractor does not make in accordance with the payment clause included in the subcontract pursuant to this subsection. The Contractor or first-tier Subcontractor is not obligated to pay an interest penalty if the only reason that the

Contractor or first-tier Subcontractor did not make payment when payment was due is that the Contractor or first-tier Subcontractor had not received payment from the Port or the Contractor when payment was due. The interest penalty:

- 1) Applies to the period that begins on the day after the required payment date and that ends on the date on which the amount due is paid; and
 - 2) Is computed at the rate specified in ORS 279C.515(2).
2. The Contractor shall include in each of its subcontracts a provision requiring the first-tier Subcontractor to include a payment clause and an interest penalty clause that conforms to the standards of this section in each of its subcontracts and to require each of its Subcontractors to include such clauses in their subcontracts with each lower-tier Subcontractor or supplier.
3. The clauses required by this section do not impair the right of the Contractor or a Subcontractor at any tier to negotiate, and to include in the subcontract, provisions that:
- a. Permit the Contractor or a Subcontractor to retain, in the event of a good faith dispute, an amount not to exceed 150 percent of the amount in dispute from the amount due a Subcontractor under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions the parties to the subcontract agree upon, giving such recognition as the parties consider appropriate to the ability of a Subcontractor to furnish a performance bond and a payment bond;
 - b. Permit the Contractor or a Subcontractor to make a determination that part or all of the Subcontractor's request for payment may be withheld in accordance with the subcontract; and
 - c. Permit such withholdings without incurring any obligation to pay a late payment interest penalty if:
 - 1) A notice that conforms to the standards of ORS 279C.580(8) has been previously furnished to the Subcontractor; and
 - 2) A copy of any notice the Contractor issues pursuant to the foregoing subsection has been furnished to the Port.
 - d. As used in this subsection, "good faith dispute" means a documented dispute concerning:
 - 1) Unsatisfactory job progress.
 - 2) Defective work not remedied.
 - 3) Third party claims filed or reasonable evidence that claims will be filed.
 - 4) Failure to make timely payments for labor, equipment, and materials.
 - 5) Damage to the Contractor or a Subcontractor.
 - 6) Reasonable evidence that the subcontract cannot be completed for the unpaid balance of the subcontract sum.

6.25 Civil Rights:

A. General Civil Rights Provisions:

1. The Contractor shall comply with pertinent statutes, Executive Orders, and such rules as identified in the Title VI List of Pertinent Nondiscrimination Acts and Authorities (see FAA Order 1400.11A; the “Nondiscrimination Acts and Authorities”), to ensure that no person shall, on the grounds of race, color, national origin, creed, sex, age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance. This provision binds the Contractor and its Subcontractors from the solicitation period through the completion of the Contract.

B. Compliance with Title VI Nondiscrimination Requirements:

1. During the performance of this Contract, the Contractor agrees as follows: (a) the Contractor will comply with the Title VI List of Pertinent Nondiscrimination Acts and Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract; (b) the Contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, national origin, creed, sex, age, or disability in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The Contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 21 including amendments thereto; (c) in all solicitations, either by competitive bidding or negotiation made by the Contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the Contractor of the contractor’s obligations under this contract and the Nondiscrimination Acts and Authorities on the grounds of race, color, or national origin; (d) The Contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Port or the FAA to be pertinent to ascertain compliance with such Nondiscrimination Acts and Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the Contractor will so certify to the Port or the FAA, as appropriate, and will set forth what efforts it has made to obtain the information; (e) in the event of a Contractor’s noncompliance with the non-discrimination provisions of this contract, the Port will impose such contract sanctions as it or the FAA may determine to be appropriate, including, but not limited to: (i) withholding payments to the Contractor under the contract until the Contractor complies; and/or (ii) cancelling, terminating, or suspending a contract, in whole or in part; and (f) the Contractor will include the provisions of paragraphs (a) through (e) in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations, and directives issued pursuant thereto. The Contractor will take action with respect to any subcontract or procurement as the Port or the FAA may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the Contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the Contractor may request the Port to enter into any litigation to protect the interests of the Port. In addition, the Contractor may request the United States to enter into the litigation to protect the interests of the United States.

Environmental Responsibilities

- 6.26 The following federal, state, and local agencies have enacted ordinances or regulations dealing with the prevention of environmental pollution and the preservation of natural resources that affect the performance of this Contract:
- A. City and county where the work is to be performed
 - B. Metro
 - C. Oregon Environmental Quality Commission
 - D. Oregon Fish and Wildlife Commission
 - E. U.S. Environmental Protection Agency
 - F. U.S. Fish and Wildlife Service
 - G. National Marine Fisheries Service
- 6.27 Known conditions at the construction site that may require the Contractor to comply with statutes or with ordinances or regulations enacted by the agencies listed above are specifically referred to at various places in this Contract, including but not necessarily limited to Division 1 of the Specifications.
- 6.28 The Contractor is solely responsible for (1) considering applicable statutes and the ordinances and regulations enacted by the agencies listed above, (2) considering the known conditions specifically referred to in this Contract, and (3) ensuring that the activities of the Contractor and the Contractor's employees, Subcontractors (including suppliers), agents, and invitees with respect to those conditions do not violate any of those statutes, ordinances, or regulations. Without limiting the foregoing, the Contractor is solely responsible for the following environmental and natural resource risks associated with the performance of this Contract:
- A. Air pollution;
 - B. Water pollution;
 - C. Contamination of soil, groundwater, or sediment;
 - D. Filling or destruction of wetlands;
 - E. Taking of a federally listed threatened or endangered species through habitat destruction, habitat degradation, or otherwise; and
 - F. Introduction of an invasive species.
- 6.29 In addition to the foregoing requirements, the Contractor shall manage and conduct all activities related to the performance of this Contract in accordance with all environmental Laws and regulations, and with the requirements of all permits issued under those Laws and regulations of which the Contractor has been given notice or has actual knowledge. "Environmental laws and regulations" means all federal and state statutes, all local ordinances, and all regulations adopted pursuant to those statutes and ordinances, as any of them may be amended from time to time, dealing with the prevention of environmental pollution or the preservation of natural resources, including but not limited to: the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation and Liability Act, the Toxic Substances Control Act, the Clean Air Act, the Clean Water Act, and Oregon Revised Statutes Chapters 465, 466, 467, 468, 468A, 468B, and 496. If the Contractor believes compliance with a requirement under this

Contract or a direction given by the Port will result in violation of any environmental laws or regulations, the Contractor shall so notify the Port in writing immediately and shall not proceed pursuant to that requirement or direction until the Port directs the Contractor to proceed.

- 6.30 In the event of a sudden spill or discharge of hazardous material as a result of actions related to this Contract by the Contractor or the Contractor's Subcontractor or agent, the Port may take action, including contracting for control or cleanup of the spill or discharge, unless the Contractor takes immediate appropriate action. If the Port takes action pursuant to this paragraph, the Port may recover from the Contractor all reasonable cost necessarily incurred in effecting the control and cleanup of the spill or discharge. Regardless of who undertakes the cleanup or control of the spill or discharge, the methods used shall be subject to the approval of the Port.

Taxes

- 6.31 The Contractor shall pay or ensure payment of sales, consumer, use, and other similar taxes required of the Contractor or any Subcontractor under any Law with respect to performance under this Contract. The Contractor shall comply with all Oregon tax Laws and shall submit a certification of such compliance in accordance with ORS 305.385(6).

Use of Premises

- 6.32 The Contractor shall confine equipment, the storage of material, and the operations of workers to areas permitted by this Contract. The Contractor shall not unreasonably encumber the premises with equipment or material.
- 6.33 During the progress of the Work, the Contractor shall keep the premises free from accumulations of waste material, rubbish and other debris resulting from the Work. At the completion of the Work, the Contractor shall leave the site clean and ready for occupancy. The Contractor shall restore to their original condition those portions of the site not designated for alteration by this Contract.
- 6.34 The Contractor shall not permit any part of any structure to be subjected to loads that may endanger its structural stability. The Contractor shall not subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

Safety and Protection

- 6.35 The Contractor shall comply with all Laws applicable to the safety of persons or property. Damage, injury, or loss to property caused by the Contractor, Subcontractor, or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, shall be remedied by the Contractor.
- 6.36 The Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work.
- 6.37 The Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities shall be the prevention of accidents and the maintenance and supervision of safety precautions and programs. This person shall be the Contractor's project superintendent unless otherwise designated in writing by the Contractor to the Port.
- 6.38 The Contractor shall report promptly in writing to the Port all recordable accidents and injuries occurring at the site. When the Contractor is required to file an accident report with a public authority, the Contractor shall submit a copy of the report to the Port.
- 6.39 The Contractor shall inform the Port of the specific requirements of the Contractor's safety program with which the Port's employees and representatives must comply while at the site.

- 6.40 If the Port deems any part of the Work unsafe, the Port, without assuming responsibility for the Contractor's safety program, may require the Contractor to stop performance of the Work or take corrective measures satisfactory to the Port, or both. If the Contractor does not adopt corrective measures, the Port may perform them and deduct their cost from the Contract Price. The Contractor agrees to make no claim for damages, for an increase in the Contract Price, or for a change in the Contract Time based on the Contractor's compliance with the Port's reasonable request.
- 6.41 The Contractor shall erect and maintain necessary safeguards for the safety and protection of:
- A. Employees on the Work and other persons whose safety may be adversely affected by performance of the Work.
 - B. The Work and material to be incorporated into the Work, whether in storage on or off the site. If the Contractor fails to protect the Work, the Port may, after giving notice to the Contractor, protect the Work and deduct the resulting cost from payment due the Contractor. The Port's determination of when and to what degree such protection is necessary shall be final.
 - C. Other property at the site including trees, shrubs, lawn, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement.
 - D. Adjacent property and utilities when prosecution of the Work may affect them.
- 6.42 The Contractor's duties and responsibilities for the safety and protection of the Work shall continue until the Contractor has completed all obligations under this Contract.

Emergencies

- 6.43 In the event of an emergency affecting the safety or protection of persons or the Work or property at, adjacent to, or near the site, the Contractor shall act to prevent threatened damage, injury, or loss. The Contractor may act without special instruction or authorization from the Port. The Contractor shall give the Port written notice within 24 hours of any significant change in the Work or deviation from this Contract caused by the Contractor's acts or omissions.

Submittals (Shop Drawings, Product Data, Maintenance Data, Samples, Warranty Data, and Other Information)

- 6.44 The Contractor shall check and verify all field measurements associated with the fit and function of supplied equipment, products, and material. The Contractor shall then submit Shop Drawings, Product Data, Maintenance Data, Samples, a warranty outline, and other information required by the Contract or necessary for performance of the Work to the Port for review in accordance with the accepted submittal schedule and with such promptness as to cause no delay in the Work. All submittals shall be identified in the manner required by the Port. All submittals shall be reviewed and stamped with the approval of the Contractor prior to submittal to the Port.
- 6.45 Shop Drawings, Maintenance Data, Product Data, a warranty outline, and other information required by the Contract or necessary for performance of the Work, including but not limited to substitution requests, certificates, reports, test data, and mix designs, shall be submitted electronically unless otherwise specified by the Port. Data shown in submittal information shall be sufficiently complete with respect to quantities, dimensions, material, and specified performance and design criteria so as to allow the Port to verify conformance with this Contract.
- 6.46 The Contractor shall submit to the Port for review the specified number of Samples required by this Contract. Samples shall be clearly identified as to material, manufacturer, pertinent catalog numbers, and intended use, and shall include any other information necessary for the Port to complete its review.

- 6.47 The Contractor shall identify in writing as part of its submittal to the Port any deviations from the requirements of the Contract contained in the Shop Drawings, Product Data, Maintenance Data, Samples, warranty outline, or other information.
- 6.48 Within 10 business days of actual receipt, the Port will stamp, date, and return each submittal to the Contractor indicating the action to be taken or will notify the Contractor that the Port's review will require more than 10 business days. The Port's review will be only for conformance with the design concept of the Work and for general compliance with this Contract. It will not extend to any other purpose, including but not limited to the means, methods, sequences, techniques, or procedures of construction, safety precautions or programs related thereto, or to the assembly in which an item functions. Under no circumstances will the Port's review of the Contractor's submittals relieve the Contractor of its sole responsibility for performing the Work in accordance with the Contract.
- 6.49 The Contractor shall make any corrections to its submittals required by the Port and shall proceed according to the Port's stamp and directions. When the Port requires corrections of the Contractor's submittals, the Contractor shall include with its resubmission the number of corrected copies required by the Port and shall resubmit new Samples for review. The Contractor shall direct specific attention in writing to revisions other than the corrections called for by the Port on previous submittals.
- 6.50 The Contractor's stamp of approval on any submittal shall constitute a representation to the Port that the Contractor has: (1) determined and verified all quantities, dimensions, field construction criteria, material, catalog numbers, and similar data or assumes full responsibility for doing so, and (2) reviewed and coordinated each submittal with the requirements of this Contract.
- 6.51 When a submittal is required by this Contract, no Work related to the submittal (other than preparation of the submittal) shall be commenced or costs incurred in the performance of the Work until the submittal is approved by the Port. If the Contractor proceeds with performance of the Work related to a submittal before receiving the Port's approval, such Work shall be at the Contractor's sole risk and expense and the Port will have no liability for such unauthorized Work.
- 6.52 The Port's review of a submittal shall not relieve the Contractor from responsibility for any deviations from this Contract except those called to the Port's attention in writing at the time of submission and accepted in writing by the Port. Changes in the Work shall follow procedures outlined for a Change Order and approval of a submittal shall not constitute approval for a Change Order. Review by the Port shall not relieve the Contractor from responsibility for errors or omissions in the submittal.
- 6.53 Submittals approved by the Port are binding upon the Contractor upon such approval. The Contractor shall be obligated to perform in accordance with the approved submittal.

Access to the Work

- 6.54 The Contractor shall provide reasonable and safe access to the Port and inspection authorities for observation, testing, and inspection of the Work including, but not limited to, ladders, lifts, equipment, and tie-off apparatus.

Prosecution of the Work

- 6.55 The Contractor shall continue performance of the Work in accordance with the work progress schedule during all claims or disputes with the Port. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as the Contractor and the Port may otherwise agree in writing.

Port's Right to Do the Work

- 6.56 If the Contractor fails to prosecute the Work properly or fails to perform any provision of this Contract, the Port, after a 3-day written notice to the Contractor, may without prejudice to any other remedy it may have, make good such failures. The Port may deduct the cost thereof from any payment due the Contractor. In cases of emergency, the Port may prosecute such Work without notice or delay and may deduct the cost thereof from any payment due the Contractor.

Indemnification

- 6.57 To the fullest extent allowed by law, the Contractor shall defend (using legal counsel acceptable to the Port), indemnify, reimburse, and hold harmless the Port and the Port's commissioners, employees, contractors, and agents for, from and against any and all actual or alleged claims, damages, losses, expenses, costs, fees (including, but not limited to, attorney, accountant, paralegal, expert, and escrow fees), fines, and/or penalties (collectively "Damages") which may be imposed upon, claimed against or incurred by the Port, to the extent such Damages are caused by any of the following: (a) any act, omission or negligence of the Contractor or the Contractor's partners, officers, directors, agents, employees, invitees or Subcontractors; (b) any use, occupation, management or control of Port property by the Contractor or the Contractor's employees, agents, Subcontractors, or suppliers, whether or not due to the Contractor's own act or omission and whether or not occurring on Port property; (c) any condition created on Port property by the Contractor or the Contractor's employees, agents, Subcontractors, or suppliers, and any accident, injury or damage arising from the condition; (d) any breach, violation or nonperformance of any of the Contractor's obligations under this Contract; (e) any damage caused by the Contractor or the Contractor's employees, agents, Subcontractors, or suppliers on or to Port property. Nothing in the foregoing shall be deemed to require any indemnity made void by ORS 30.140.

Prevailing Wage Rates

- 6.58 The Contractor shall comply with the prevailing wage rate requirements of ORS 279C.800 to 279C.870.
- A. The existing prevailing rates of wage which may be paid to workers in each trade or occupation required for this Work and employed in the performance of this Work by the Contractor, a Subcontractor, or any other person doing or contracting to do all or any part of the Work, may be obtained from BOLI's web site at www.boli.state.or.us. The wage rates and amendments in effect at the time this project is advertised are the rates that shall apply for the duration of the Work.
 - B. Workers in each trade or occupation required for this Work and employed in the performance of this Work by the Contractor, a Subcontractor, or any other person doing or contracting to do all or any part of the Work, shall be paid not less than the minimum hourly rate of wage specified in the foregoing paragraph. The Contractor shall ensure that each subcontract includes a provision that workers shall be paid not less than the minimum hourly rate of wage specified in the foregoing paragraph. For projects subject to both state and federal (Davis-Bacon) prevailing wage requirements, the Contractor shall ensure that each subcontract includes a provision that workers shall be paid not less than the higher of the applicable state or federal prevailing wage rates.
 - C. The Contractor shall have a public works bond filed with the Construction Contractors Board, as provided by ORS 279C.836. In every subcontract, the Contractor shall include a provision requiring the Subcontractor to have a public works bond filed with the Construction Contractors Board, unless exempt, as provided by ORS 279C.836.

- D. The fee that is required to be paid to the commissioner of the Bureau of Labor and Industries under ORS 279C.825(1) shall be paid under the administrative rule of the commissioner.

Labor Relations

- 6.59 The Contractor shall be responsible for labor relations and shall seek to resolve disputes between the Contractor and its employees. Any labor dispute arising from this Contract that causes a disruption of the Port's operations shall be to the account of and the responsibility of the Contractor.

Records and Audits

- 6.60 The Contractor shall retain all records, including but not limited to financial records that pertain to this Contract for at least three years after the Port has made final payment and all other matters related to this Contract are concluded.
- 6.61 The Port or its designee may, at any time, inspect, audit, and copy any of the Contractor's records retained pursuant to Item 6.60 to the extent necessary to: (1) evaluate and verify the costs incurred by the Contractor in performing the work under this Contract or the accuracy of any invoice, Change Order, payment, or claim submitted under this Contract by the Contractor or the Contractor's payees; (2) ensure that Contract costs are allowable, properly allocated, and reasonable; or (3) evaluate any claim asserted by the Contractor against the Port.
- 6.62 The Contractor shall provide the Port such assistance as may be required to allow complete access to such records within 10 Business Days from the original request. The Contractor shall make the records available at any time during regular business hours after reasonable advance notice. If records are located outside the city of Portland, Oregon, and cannot be provided to a location within Portland, Oregon, the Contractor agrees to reimburse the Port for expenses incurred in sending representatives to wherever such records are maintained. Such expense reimbursement shall include transportation, lodging, food, and other out-of-pocket expenses resulting from the necessity of leaving Portland, Oregon. The Contractor shall supply a table, a chair, a standard electrical outlet, lighting, and a weatherized space of adequate size at the site of the Contractor's records to allow the inspection, auditing, and copying of records. The Contractor agrees to provide free access to copiers, fax machines, and other needed office equipment. The Port will bear the cost of copying records.
- 6.63 The Contractor shall allow the Port to interview the Contractor's employees, and shall cooperate with the Port in arranging interviews with the Contractor's employees and former employees, for the purposes of identifying, evaluating, verifying, or auditing the records described in these requirements.
- 6.64 For the purpose of these requirements, a record may be in any format whatsoever including, but not limited to, paper, photographic, or electronic format. In those situations where the Contractor's records have been generated from computerized data, the Contractor agrees to provide the Port with native data files in a computer readable format on data disks, e-mail with attached files, or suitable alternative computer data exchange formats or devices.
- 6.65 The Contractor shall require all insurers, material suppliers, and Subcontractors at any tier to comply with these requirements.
- 6.66 The Contractor shall be entitled to no extra compensation for complying with these requirements.

ARTICLE 7 - WORK BY OTHERS

- 7.1 The Contractor shall afford utility service companies, other contractors and Port employees reasonable access to the Work. The Contractor shall allow storage of material and execution of work by others. The Contractor shall properly connect and coordinate its Work with work by others.
- 7.2 Notice will be given to the Contractor prior to the start of any additional work by others not noted in this Contract. If the Contractor believes that the performance of such additional work by the Port or others involves additional expense to the Contractor or requires an extension of the Contract Time, the Contractor shall notify the Port in writing.
- 7.3 If any part of the Contractor's Work depends upon the work of any other contractor, utility service company, or the Port, the Contractor shall inspect and promptly report to the Port in writing any reasons that render work by others unsuitable. The Contractor's failure to report unsuitability of work by others shall constitute the Contractor's acceptance of the work by others as fit and proper for integration with the Contractor's Work. Latent or non-apparent defects and deficiencies in the work by others shall be reported to the Port in writing promptly upon discovery.
- 7.4 The Contractor shall do all cutting, fitting, and patching of the Work that may be required to make its parts come together properly and integrate with such other work. The Contractor shall not endanger any work by others. The Contractor shall cut or alter work by others only with the written consent of the Port and those whose work will be affected.
- 7.5 Unless otherwise specified, the Port shall be the final authority regarding coordination issues between the Contractor and work by others.

ARTICLE 8 - PORT'S STATUS DURING CONSTRUCTION

Construction Contract Manager

- 8.1 The Port's Construction Contract Manager will be the Port's representative during the construction phase of the Work.
- 8.2 The Construction Contract Manager will resolve any and all questions which may arise as to Contract compliance. The Contractor shall at all times carry out and fulfill the instructions and directions of the Construction Contract Manager insofar as they concern the Work to be performed under this Contract.
 - A. The Construction Contract Manager's authority includes, but is not limited to:
 1. Determining the quantity, quality, and acceptability of material furnished and Work performed.
 2. Reviewing and approving/disapproving the manner of performance and rate of progress of the Work.
 3. Stopping the Work whenever such stoppage is deemed necessary.
 4. Administering this Contract.
 5. Determining acceptable fulfillment of this Contract by the Contractor.
 - B. Written approval by the Construction Contract Manager signifies favorable opinion and qualified consent. It does not carry with it: (1) certification, (2) assurance of completeness,

(3) assurance of quality, (4) assurance of accuracy concerning details, dimensions, and quantities.

- C. Written approval by the Construction Contract Manager will not relieve the Contractor from responsibility for: (1) errors, (2) improper fabrication, (3) nonconformance with requirements, (4) deficiencies within the Contractor's control.

Clarifications and Interpretations

- 8.3 The Construction Contract Manager will issue with reasonable promptness such written clarifications or interpretations of this Contract as may be necessary. If the Contractor believes that a written clarification or interpretation justifies an increase in the Contract Price or the Contract Time, the Contractor may notify the Port as provided in Article 9.

Rejection of Defective Work

- 8.4 The Construction Contract Manager is authorized to disapprove or reject Work which is Defective and to require additional inspection or testing of the Work whether or not the Work is fabricated, installed, or completed.

Port Inspectors

- 8.5 The Port will assign Port inspectors who are authorized to:
 - A. Inspect the Work as it is performed and all material being furnished. Such inspections may extend to all or any part of the Work and to the preparation, fabrication, or manufacture of the material to be used.
 - B. Call the attention of the Contractor to any failure of the Work to meet this Contract.
 - C. Reject material not meeting the requirements of this Contract.
 - D. Suspend that part of the Work affected by Contract nonconformance until the issue can be referred to and a decision issued by the Construction Contract Manager.
- 8.6 Port inspectors are not authorized to:
 - A. Supervise or perform any other duties for the Contractor, or interfere with the Contractor's management of the Work.
 - B. Give final approval or acceptance of any portion of the Work.
 - C. Issue instructions or directions contrary to this Contract.
- 8.7 No act or failure to act on the part of a Port inspector will render the Port liable in any way, nor shall it relieve the Contractor from fulfilling all of the terms and conditions of this Contract.

Limitations on the Port's Responsibilities

- 8.8 The Port is not responsible for the acts or omissions of the Contractor or the Contractor's employees, Subcontractors, manufacturers, fabricators, suppliers, distributors, or any other persons at the site or otherwise performing any of the Work, or their agents or employees.
- 8.9 The Port is not responsible for the Contractor's means, methods, procedures, sequences, or techniques of construction, or related safety precautions and programs except as specified in the Contract Documents.

- 8.10 The Port is not responsible for the Contractor's failure to perform the Work in accordance with this Contract.

ARTICLE 9 - CHANGE IN THE WORK

- 9.1 Without invalidating this Contract, changes (which may include additions and/or deletions) to the Work may be accomplished after execution of the Contract only by Change Directive or Change Order. All such changed Work shall be executed under the applicable conditions of this Contract.
- 9.2 No addition to Contract Price or extension of Contract Time will be allowed because of: (a) the acts or omissions of the Contractor or those for whom the Contractor is responsible, and (b) any condition of which the Contractor could have informed itself by examination, testing, sampling, review of records, or otherwise.
- 9.3 If the Contractor believes that a Change Directive will require a change in the Contract Price or the Contract Time, the Contractor shall so notify the Port in writing. Such notification shall be delivered to the Port within 7 days after the Contractor receives the Change Directive.
- 9.4 The Contractor shall submit, in the format required by the Port, an itemized cost estimate of any proposed adjustment to the Contract Price, either additive or deductive, resulting from the Change Directive. If applicable, the Contractor shall also submit a work progress schedule analysis or summary which demonstrates the effect of the Change Directive on the Contract Time. The itemized estimate and/or analysis shall be submitted within 15 days of receipt of the Change Directive. The Contractor shall submit such cost estimate or work progress schedule analysis in less than 15 days if so requested by the Port or if so required by work progress schedule limitations.
- 9.5 The Port may order the Contractor, in writing, to commence the Change Directive Work immediately and account for cost using the force account method if: the Contractor fails to submit the cost estimate within the 15-day period (or earlier if requested); the parties fail to agree as to the cost or schedule impact; or the Port for any reason deems it necessary. If direction to proceed has already been given and the Contractor fails to submit the cost estimate within the 15-day period (or earlier if requested), if the parties fail to agree as to the cost or work progress schedule impact, or if the Port for any reason deems it necessary, the Port may issue a lump sum unilateral change to the Contract Price in accordance with the Port's estimate of cost.
- 9.6 The Contractor shall proceed with changed Work either upon execution by both the Port and the Contractor of a Change Order or upon receipt of a Change Directive. When changed Work is authorized by Change Directive, the Contractor shall continue performance of the Work, including the change, during the negotiation of the Change Order, even if a dispute arises which delays or prevents agreement on the terms and conditions of the Change Order.
- 9.7 Any Change Order shall constitute an accord and satisfaction with respect to issues related to changes in the Contract Price or the Contract Time. The Change Order shall be deemed to contain all the costs and credits relating to changes in the Work and effects on the unperformed or unchanged Work. If the Contractor contends that inefficiency and cumulative impacts cannot be accurately assessed at the time the Change Order is to be signed, the Contractor shall give the Port notice of a potential inefficiency or cumulative impact claim as soon as the Contractor suspects grounds for the claim exists, and shall submit evidence thereof at the first reasonable opportunity.
- 9.8 No payment will be made for changes to the Work until a Change Order has been executed.
- 9.9 The Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Time for changes in the Work performed prior to receiving written direction from the

Port in a Change Directive or execution of a Change Order. Emergencies, as provided in Item 6.43, are an exception.

ARTICLE 10 - CHANGE OF CONTRACT PRICE

Contract Price Adjustment Methods

- 10.1 A Contract Price adjustment for the changes in the Work may be made in accordance with one or a combination of the following methods as the Port may elect:
- A. Fixed price method as supported by the breakdown of estimated costs. If agreement cannot be reached by the fixed price method, the Port may require the Work to be performed on the basis of force account.
 - B. Unit price method.
 - C. Force account method.

Fixed Price Method

- 10.2 The Contractor shall prepare a fixed price proposal in the following format:
- A. Direct Costs
 - 1. Material (itemize)
 - a. The cost to the Contractor for the material directly required for the performance of the changed Work. Such cost of material may include the cost of transportation. No delivery charges will be allowed unless the delivery is specifically for the changed Work and no other Work.
 - b. Trade discounts offered by the supplier to the Contractor shall be credited to the Port. If the material is obtained from a source owned wholly or in part by the Contractor, payment thereof will not exceed the current wholesale price for the material. The term "trade discount" includes the concept of cash discounting.
 - c. If, in the opinion of the Port, the cost of the material is excessive or if the Contractor fails to furnish satisfactory evidence of a cost from the supplier then, in either case, the cost of the material shall be deemed to be the lowest current wholesale price at which similar material is available in the quantities required.
 - d. The Port reserves the right to furnish such material as it deems advisable and the Contractor shall have no claims for cost or profit on material furnished by the Port.
 - 2. Labor (man-hours, rates by crafts)
 - a. Payroll costs shall include, but not be limited to, salaries and wages, and fringe benefits including social security contributions, unemployment, excise and payroll taxes, workers' compensation, health and retirement benefits, sick leave, vacation and holiday pay applicable thereto. The costs for all supervision, including general superintendents and foremen, shall be included in the markups established by this Contract. The only exception to this shall be working foremen who perform manual labor. No labor charges will be accepted for engineering or proposal preparation. These costs shall be included in the markups established by this Contract.

- b. Overtime and premium time pricing will be allowed only for labor which is authorized by the Port to be performed after normal working hours, or on Saturday, Sunday, or legal holidays.
- 3. Equipment (type, size, attachments, hours, rate)
 - a. The cost to the Contractor for the use of equipment directly required in the performance of the changed Work. No mobilization or demobilization cost will be allowed for equipment already on site.
 - b. For equipment owned, furnished, or rented by the Contractor, costs allowed shall be the actual usage costs incurred as supported by the Contractor's published standard equipment rates or rental invoices; provided, however, that such rates shall not exceed the rates established by the Rental Rate Blue Book.
 - c. The amount to be paid to the Contractor for the use of equipment as set forth above will constitute full compensation for the cost of fuel, power, oil, lubricants, supplies, small tools, small equipment, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, labor (except for equipment operators) and any and all costs incidental to the use of the equipment.
- 4. Direct costs shall not include:
 - a. Payroll costs and other compensation of the Contractor's officers, executives, principals of partnerships and sole proprietorships, general managers, engineers, architects, estimators, lawyers, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, superintendents and foremen, and similar administrative personnel. These costs shall be considered administrative costs covered by the Contractor's markup.
 - b. Expense of the Contractor's principal and branch offices other than the Contractor's office at the site.
 - c. Any part of the Contractor's capital expenses, interest on the Contractor's capital employed for the Work, or charges against the Contractor for delinquent payments.
 - d. Costs due to the negligence of the Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be responsible or liable. Negligence costs include but are not limited to those incurred for correction of defective Work, disposal of material wrongly supplied, and making good any damage to property.
 - e. Other overhead or general expense costs of any kind.
 - f. Cost of small tools and supplies.
 - g. Cost of safety programs.
 - h. Cost of warranty work.

B. Subcontract Costs

- 1. Direct costs shall be as outlined in Item 10.2, A.
- 2. Subcontractors' (at any tier) markups for overhead and profit shall not exceed 15 percent of the direct costs.

C. Contractor's Markup

1. The Contractor's markup for overhead and profit shall not exceed the following:
 - a. Costs incurred under Item 10.2, A: 15 percent
 - b. Costs incurred under Item 10.2, B, 1:
(No markup allowed on Subcontractor markup)
 - 1) First \$5,000 10 percent
 - 2) Amount above \$5,000 8 percent
 - c. In no case shall the total markups be greater than 30 percent of the total direct cost, regardless of the number of subcontract tiers existing. No markup is allowed for costs listed in Item 10.2, A, 4.
2. The amount of credit to the Port for a change which results in a net decrease in cost shall be the amount of the actual net decrease of direct costs plus a deduction in the Contractor's overhead and profit markup by an amount equal to that allowed in the table above.
3. When both additions and credits are involved in any one change, the adjustment in the Contractor's overhead and profit markup shall be computed on the basis of the net change in direct cost.

Unit Price Method

10.3 In the case of unit price bid items:

- A. The Port may increase the units of Work without limit or adjustment of unit prices.
- B. The Port may decrease the estimated quantity in a major item of Work. A major item of Work is any item in a unit price bid schedule which is equal to or greater than 10 percent of the Contract Price as bid. If the Port decreases the quantity in a major item of Work by more than 25 percent, the Port and the Contractor shall negotiate a reasonable adjustment in the unit price.
- C. The Port may decrease the estimated quantity or delete a minor item of Work. A minor item of Work is any item in a unit price bid schedule which is less than 10 percent of the Contract Price as bid. If accumulation of such changes decreases the Contract Price more than 25 percent based on the estimated quantities and prices bid by the Contractor, the Port and the Contractor shall negotiate a reasonable adjustment in the unit prices for the remaining items of Work.

Force Account Method

- 10.4 The force account method changes the Contract Price in accordance with the sum of all costs reasonably and necessarily incurred and paid by the Contractor in the proper performance of the Work plus overhead and profit. Except as otherwise may be agreed to in writing by the Port, such costs shall be in amounts no higher than those prevailing in the locality of the Work, shall include only the following items, and shall not include any of the costs itemized under Item 2.14. The Contractor and the Port shall compare records of force account costs at the end of each workday. Copies of these records shall be made in duplicate by the Contractor and shall be signed daily by both the Port and the Contractor. Fully itemized force account invoices shall be submitted monthly to the Port. The Contractor's submittal shall be in the format described in Item 10.2.

Payment will be included with regular periodic progress payments upon issuance of a Change Order for the Work. The Contractor shall submit final force account billing within 30 days after completion of that aspect of Work. Force account costs are limited to the following:

- A. Cost of all material furnished and incorporated in the Work, in accordance with Item 10.2, A, 1.
- B. Labor costs for employees in the direct employment of the Contractor in the performance of the Work in accordance with Item 10.2, A, 2.
- C. Cost of equipment furnished and used in performance of the Work in accordance with Item 10.2, A, 3 and the following limitations:
 - 1. Equipment will be eligible for payment when operated and used on a full-time basis. Equipment is considered to be used full time when the equipment must be manned and ready for use at all times.
 - 2. When the Port determines that equipment need not remain at the site continuously, payment will be limited to actual hours of use.
 - 3. Rental rates for equipment retained on the Work for an extended duration will be adjusted to the then-current rate on the anniversary of the Work Start Date.
 - 4. The hourly operating cost will be allowed for each hour that the equipment is in use. The rate will be the monthly rate divided by 176 hours for single-shift operations. Hourly rates will be adjusted for two- and three-shift operations as recommended by the Rental Rate Blue Book.
 - 5. Equipment attachments will be included in the rate only when deemed by the Port to be essential to the Work. When multiple attachments are approved for use (tractor with ripper, dozer or tractor with loader and backhoe, etc.) and the attachments are being used interchangeably, only the one attachment having the higher rate will be eligible for payment.
 - 6. Equipment standby time, when ordered by the Port, will be paid as follows: One-third of the total rate established in Items 10.4, C, 4 and 10.4, C, 5, rounded to the nearest 10 cents. Standby rates which are calculated at less than one dollar per hour will not be paid. No more than 8 hours of standby will be paid during a 24-hour period. No more than 40 hours of standby will be paid during a one-week period. In the event of breakdown, or shutdown by order of the Port, of part or all of the equipment being used, payment for such equipment that is idled shall cease. Labor that is idled and cannot be diverted to other Work will be paid through the one-half shift during which the breakdown or shutdown occurred. No other payment will be made for non-operating hours. Rental will not be allowed for equipment listed in the Shop Tools section of the Rental Rate Blue Book having a daily rate of less than \$5 each. Individual pieces of equipment not specifically covered by the Rental Rate Blue Book and having a value of \$350 or less shall be considered "small tools and equipment for which no rental is allowed."
- D. Payments made by the Contractor to Subcontractors for Work performed by Subcontractors in accordance with Item 10.2, B. If required by the Port, the Contractor shall obtain competitive bids from Subcontractors acceptable to the Contractor and award to the lowest responsive and responsible bidder. If a subcontract provides that the Subcontractor is to be paid by force account method plus markup, the Subcontractor's force account costs shall be determined in the same manner as the Contractor's force account costs.

E. Supplemental costs:

1. Sales, use, or similar taxes (but not Oregon's corporate activity tax) related to the Work, and for which the Contractor is liable, imposed by any governmental authority.
2. Costs for royalty payments, fees, permits, and licenses other than those caused by the negligence of the Contractor or the Contractor's employees, agents, or Subcontractors.
3. Losses, damages, and related expenses sustained by the Contractor in connection with the execution of the Work that are not caused by the negligence of the Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and are not compensated for by insurance recovery. Losses, damages, and related expenses shall include settlements made with the written consent and approval of the Port. No such losses, damages, or related expenses shall be included in the force account cost for the purpose of determining the Contractor's markup for overhead and profit. If, however, any such loss, damage, or related expense requires reconstruction and the Contractor is placed in charge thereof, the Contractor shall be paid for services in accordance with Item 10.4, G.
4. The cost of utilities, fuel, and sanitary facilities at the site.
5. Minor expenses in connection with the Work such as long distance telephone calls, telephone service at the site, expressage, and petty cash items.
6. Rental of all the Contractor-owned and -operated power tools and equipment which the Port approves for use in advance in writing.

F. Force account method costs shall not include:

1. Payroll costs and other compensation of the Contractor's officers, executives, principals of partnerships and sole proprietorships, general managers, engineers, architects, estimators, lawyers, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, superintendents and foremen, and similar administrative personnel. These costs shall be considered administrative costs covered by the Contractor's markup.
2. Expense of the Contractor's principal and branch offices other than the Contractor's office at the site.
3. Any part of the Contractor's capital expenses. Interest on the Contractor's capital employed for the Work. Charges against the Contractor for delinquent payments.
4. Costs due to the negligence of the Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Negligence costs include correction of defective Work, disposal of material wrongly supplied, and making good any damage to property.
5. The costs of any item not specifically and expressly included in Items 10.4, A through E.

G. The Contractor's markup for overhead and profit shall not exceed the following:

1. Costs incurred under Items 10.4, A; 10.4, B; and 10.4, C 15 percent
(No markup allowed for Item 10.4, E)
2. Costs incurred under Item 10.4, D less Subcontractor's markup:

- a. First \$5,000 10 percent
 - b. Amount above \$5,000 8 percent
3. If a subcontract is based on the force account method plus markup, the maximum allowable to the Subcontractor as markup for overhead and profit will be in accordance with Item 10.4, G, 1.
 4. In no case shall the total markups be greater than 30 percent of the direct cost, regardless of the number of subcontract tiers.

Cost Changes to Bonds and Insurance

10.5 When changes in the Work require new or increased premiums on bonds and insurance, the Port will reimburse the Contractor for such costs in the following manner:

- A. Costs for new bonds or insurance shall be submitted as part of the Contractor's request for progress payment and supported by invoiced costs from the bond or insurance supplier.
- B. Costs for increases to existing bonds or insurance shall be submitted as part of the Contractor's request for final payment and supported by invoiced costs from the bond or insurance supplier.

Rental Rate Blue Book

10.6 Equipment rental rates will be the lowest of: the Contractor's established company rates; actual rental rates; or the rates in effect in each section of the Rental Rate Blue Book on the Work Start Date.

- A. When the Rental Rate Blue Book, published by EquipmentWatch, is used to establish equipment rental rates, the following shall apply:
 1. For projects of more than one year duration, the rates shall be adjusted annually after the anniversary date of the Work Start Date to reflect published revisions of the Rental Rate Blue Book.
 2. The Rental Rate Blue Book denotes discontinued models. Many manufacturers continue the same model number through successive years. In the event the Port and the Contractor are unable to distinguish discontinued models from current models having different rates in the Rental Rate Blue Book, the lower rate shall apply. In the event a rate is not given for either a new model or an older model, a rate for the most similar model in the Rental Rate Blue Book will be used. Such characteristics as manufacturer, capacity, horsepower, and fuel will be used as the basis for selecting a similar model.
 3. In the event a rate has not been established for a particular equipment category in the Rental Rate Blue Book, the Contractor shall call the EquipmentWatch company for written documentation of a rental rate on the equipment and present it to the Port for written approval before use of the equipment.

Lump-Sum Breakdown

10.7 The price of changes in a lump-sum agreement or lump-sum bid items will be based on the lump-sum breakdown furnished in accordance with Item 2.14.

Deleted Work

- 10.8 Deletion of all or any portion of the Work shall not be a waiver of any requirement of this Contract nor invalidate any of its provisions. The Contractor will be paid for all Work performed toward the completion of the portion of the Work prior to its deletion as provided by the force account method. The Port will not be responsible for payment of overhead or profit (including but not limited to anticipated profits) on the deleted portion of the Work. If the deletion of the Work results in surplus material that is not returnable by the Contractor for a credit acceptable to the Port, or if the Port so desires, the material will be purchased from the Contractor by the Port at cost, without allowance for overhead or profit.

ARTICLE 11 - CHANGE OF CONTRACT TIME

- 11.1 All time limits stated in this Contract are of the essence. Contract Time will be changed only by a Change Order. Any extension in Contract Time will be based on written notice delivered to the Port within 7 days of the occurrence of the event precipitating the request. The Contractor shall deliver a work progress schedule analysis or summary justifying the time extension within 15 days of such occurrence. Failure to deliver any documentation to the Port within the time limits specified above shall completely foreclose consideration of an extension of Contract Time and all rights and remedies arising therefrom.
- 11.2 Time extensions will be granted only when conditions described in Items 11.3, 11.4, and 11.6 exist and when the Port agrees that the work progress schedule substantiates the need.
- A. An adjustment of Contract Time shall be the Contractor's sole remedy for any delay in meeting the specified Substantial Completion, Final Acceptance, or any milestone dates of the Work. Exception shall be to the extent the delay is caused by the acts or omissions of the Port or other contractors performing other work directly for the Port as contemplated in Article 7. To the extent the delay is caused by the acts or omissions of the Port or persons acting for the Port, the Contractor is not precluded from recovery of damages or from an equitable Contract Price adjustment.
- 11.3 Extension of Contract Time will be determined by the Port and will be an equitable adjustment if all or a part of the Work is hindered, delayed, or suspended by an Act of God, act of war, act of terrorism, or the acts or omissions of the Port or the Port's commissioners, employees, contractors, or agents.
- 11.4 Requests for extension of Contract Time will not be considered for: (1) contention that insufficient time was specified in this Contract; (2) delays which affect the Contractor's planned early completion but not the specified Contract Time; (3) suspensions made at the request of the Contractor; (4) delays caused by labor disputes involving the Contractor or its Subcontractors; or (5) delays caused by issues known and addressed in this Contract.
- 11.5 For those contracts which specify a completion date rather than contract duration, the specified Substantial Completion date will be adjusted by the number of days between the anticipated authorization to commence work date shown in the Agreement and the actual date authorizing work commencement shown in the Notice to Proceed, if the actual date is later than that shown in the Agreement. Any such adjustment of the completion date shall meet the requirements specified under Item 11.3 and shall be supported by the Contractor's work progress schedule. The Port may also request acceleration of the Work instead of adjustment of the completion date. If the Port requests acceleration of the Work, the Port will pay an agreed-upon reasonable cost resulting from the directed acceleration of the Work.

- 11.6 Work covered by a Change Order may require a Contract Time extension or reduction. The amount of time extension or reduction will be agreed upon by the Contractor and the Port as part of the negotiation of the Change Order.

ARTICLE 12 - WARRANTY; TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

Tests and Inspections

- 12.1 The Port will pay the cost of acceptance inspections, tests, and approvals unless otherwise specified.
- 12.2 The Contractor shall:
- A. Be responsible for compliance with laws, ordinances, rules, regulations, codes, and orders of any public body having jurisdiction over inspection, testing, or approval of the Work. The Contractor shall arrange for, obtain, and pay for such inspections, tests, approvals, and related fees.
 - B. Give the Port and appropriate inspection and approval authorities timely notice of readiness of the Work for required inspections, tests, or approvals.
 - C. Furnish the Port the required certificates of inspection, testing, and approval from inspection or approval authorities.
 - D. Be responsible for inspection or testing required for the Port's acceptance of a manufacturer, fabricator, supplier, or distributor of material and pay related fees.
 - E. Pay the cost of inspections, tests, and approvals required as a result of failure to pass acceptance testing by the Port, unless otherwise specified.
- 12.3 The following shall not relieve the Contractor from its obligation to perform the Work in accordance with this Contract: (1) observation by the Port, (2) inspections, (3) tests, (4) approvals by others.

Uncovering Work

- 12.4 The Contractor, at the Port's request, shall uncover, expose, and reconstruct, or otherwise make available for observation, inspection, testing, or approval, any portion of the Work. The Contractor shall furnish all necessary labor, material, and equipment. The cost shall be allocated as follows:
- A. The Contractor shall bear the cost if the Work was covered contrary to the direction of the Port.
 - B. The Contractor shall bear the cost if the Work was covered without concurrence of the Port unless the Contractor had given the Port timely notice of intent to cover such Work, and the Port did not act with reasonable promptness in response to such notice.
 - C. The Contractor shall bear the cost if the previously installed Work is found to be Defective.
 - D. For situations not covered above, the Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, and reconstruction if the Contractor makes a request therefor as provided in Articles 10 and 11.

Warranty

- 12.5 The Contractor warrants for one year after Substantial Completion, or for any longer period expressly provided by this Contract, provided by any special warranty or extended warranty required by this Contract or by a Subcontractor or supplier, or otherwise provided by Law, that all Work is not Defective for any reason.
- A. The Contractor shall pass through to the Port any warranty or maintenance obligation provided by a Subcontractor or supplier in excess of that required by this Contract.
 - B. In special circumstances where a particular item or area of Work is placed in continuous service before Substantial Completion of all the Work, the warranty period for that item will start to run from the later of the following dates: the date given in the Port's letter confirming Substantial Completion of the part of the Work; the date the Port receives training on the systems and equipment in that part of the Work; the date interim operation and maintenance manuals are approved; or the date the Port takes over operation or use in lieu of issuing a letter confirming Substantial Completion for that part of the Work.

Correction or Removal of Defective Work

- 12.6 The Contractor shall promptly correct all Defective Work without added cost to the Port, whether or not fabricated, installed, or completed or, at the Port's option, remove it from the site and replace it with Work that meets the Contract requirements. If the Contractor does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, the Port may have the Defective Work corrected or removed and replaced, and all direct and indirect costs of such correction or removal and replacement, including compensation for additional professional services, shall be paid by the Contractor or the Contractor's surety.

Port May Correct Defective Work

- 12.7 If the Contractor fails, within 3 days after written notice from the Port, to proceed to correct, or to remove and replace Defective Work as required by the Port, or if the Contractor fails to perform the Work in accordance with this Contract (including any requirements of the work progress schedule), the Port may correct and remedy any such deficiency. In exercising the rights under this paragraph, the Port will proceed expeditiously. To the extent necessary to complete corrective and remedial action, the Port may: (1) exclude the Contractor from all or part of the site; (2) take possession of all or part of the site; (3) suspend the Contractor's services related thereto; (4) take possession of the Contractor's tools, appliances, construction equipment and machinery at the site; and (5) incorporate in the Work material stored at the site or for which the Port has paid the Contractor but which has been stored elsewhere. The Contractor shall allow the Port's representatives, contractors, agents, and employees such access to the site as may be necessary to exercise the rights under this paragraph. All direct and indirect costs in exercising such rights will be charged against the Contractor. A Change Order will be executed incorporating the necessary revisions to this Contract and a reduction in the Contract Price. Such direct and indirect costs will include, in particular but without limitation: (1) additional professional services required; and (2) repair and replacement of the Work of others destroyed or damaged by correction, removal, or replacement of the Contractor's Defective Work. The Contractor will not be allowed an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise of the Port's rights under this paragraph.

ARTICLE 13 - PAYMENTS TO THE CONTRACTOR AND COMPLETION

Before Request for Progress Payment

- 13.1 Prior to submitting the first request for progress payment, the Contractor shall submit the following to the Port:
- A. Work progress schedule.
 - B. Final submittal schedule.
 - C. Cash flow schedule.
 - D. Lump-sum breakdown of the Work.
 - E. Warranty outline.
 - F. Wage certification.
1. If the Contractor is required to file a certified statement under ORS 279C.845, and the certified statement has not been filed as required, the Port will retain 25 percent of any amount earned under this Contract until the certified statement has been filed. The Port will pay the Contractor the amount retained within 14 days after the missing certified statement has been filed. Failure of a Subcontractor to file a certified statement required under ORS 279C.845 will not trigger retainage under this paragraph.

Request for Progress Payment

- 13.2 Thirty days or more following the Work Start Date, the Contractor may request the first monthly progress payment on Work completed by the date of the request. The request shall be made on the Contractor's Request for Payment form (form is located in the Port's online construction management system) and shall be accompanied by supporting documentation required by this Contract. Requests shall be signed by the Contractor and submitted to the Port for review.
- 13.3 All progress payment requests, except the first request, shall include the Contractor's Waiver of Claims to Date stating that all of the Contractor's obligations to date relating to the Work have been paid (form follows these General Conditions). Progress payment requests, except the first request, shall also include the Contractor's verification that Subcontractor payment data and workforce data (if applicable) for all tiers have been entered into the Port's online reporting system at www.portofportland.dbesystem.com.
- 13.4 Material delivered and stored on site but not yet incorporated in the Work may be included in the request for progress payment subject to approval by the Port and the following:
- A. No payment will be made for material costing less than \$50,000 total.
 - B. The Port's title to and interest in the material must be clearly established and free of all liens or other encumbrances.
 - C. Value shall be established by invoice, freight bill, or other document.
 - D. Payment for stored material will be limited to 90 percent of the net cost invoiced to the Contractor.
 - E. When there is a bid price on material in place, the Port will estimate the cost of placing. The progress payment will be limited to 90 percent of the bid price less the estimated cost of placing.

F. Risk of loss remains with the Contractor.

- 13.5 Progress payments shall not be construed as acceptance or approval of the Work or waiver of any defects in the Work.

Retainage

- 13.6 The Port will withhold from progress payments as follows:

A. The Port will retain 5 percent of the total earned for the work completed. The Contractor shall inform the Port if the Contractor wishes to exercise an option under ORS 279C.560.

Review of Request for Progress Payment

- 13.7 Within 15 days, the Port will review each request for progress payment and recommend payment or respond in writing to the Contractor with the reasons the Port is requiring resubmittal of the pay request before it can be approved.

- 13.8 The Port may refuse to make payment, in whole or any part, to the extent:

- A. The Work is Defective, or completed Work has been damaged requiring correction or replacement;
- B. Written claims have been made against the Port or liens have been filed in connection with the Work;
- C. The Port has been required to correct Defective Work or to complete the Work;
- D. The Contractor's prosecution of the Work in accordance with this Contract is unsatisfactory;
- E. The Contractor has failed to make payments covered by past progress payments to Subcontractors, or for labor or material; or
- F. The Contractor is in breach of this Contract.

Substantial Completion

- 13.9 When the Contractor considers the entire Work ready for its intended use, the Contractor shall certify in writing that the entire Work is Substantially Complete and request a letter confirming Substantial Completion. Within 15 days thereafter, the Contractor and the Port shall make an inspection of the Work to determine the status of completion. If the Port considers the Work Substantially Complete, the Port will, within 15 days of date of inspection, execute and deliver to the Contractor a letter confirming Substantial Completion with a list of items to be completed or corrected. The letter will state the date of Substantial Completion. If the Port does not consider the Work Substantially Complete, the Port will notify the Contractor in writing giving reasons therefor.

A. Final operation and maintenance manuals and warranties shall be submitted for review by the Port and training shall be completed for the Work to be considered Substantially Complete.

- 13.10 The Port may exclude the Contractor from that part of the Work after the date of Substantial Completion. The Port will allow the Contractor reasonable access to complete or correct items on the list.

- 13.11 The Contractor may request, in writing, that the Port confirm Substantial Completion for a part of the Work. The Port will only consider confirming Substantial Completion for a part of the Work if the Port desires that part to become operational.

- 13.12 The Port may allow the Contractor use of equipment installed as part of the Work prior to Substantial Completion, subject to the Contractor:
- A. Obtaining the Port's written approval.
 - B. Maintaining the equipment, and preparing and maintaining a log recording all maintenance activities.
 - C. Returning equipment to "as-new" condition upon Substantial Completion.

Partial Utilization

- 13.13 The Port may request, in writing, the use of any part of the Work which may be used without significant interference with construction of other parts of the Work. If the Port requests use of any part of the Work prior to Substantial Completion of all the Work, the Port will issue to the Contractor a letter granting Substantial Completion for that portion of the Work with a list of items to be completed or corrected. The Port will assume responsibility for security, safety, operation, maintenance, and utilities for that part of the Work while it is being used by or under the control of the Port.

Final Inspection and Final Acceptance

- 13.14 When the Contractor considers the entire Work, or an agreed-upon portion thereof, to be complete, the Contractor shall certify, in writing, that the Work is complete and request a letter granting Final Acceptance. Within 30 days after receipt of the Contractor's certification, the Port will inspect the Work and will notify the Contractor, in writing, of Final Acceptance or of all particulars in which this inspection reveals that the Work is incomplete or Defective. The Contractor shall immediately take such measures as are necessary to remedy such deficiencies and allow an additional 30 days for the Port to complete another inspection of the Work. The Contractor's certification shall be preceded or accompanied by all documentation called for in this Contract including but not limited to:
- A. Redline Drawings for creating record drawings.
 - B. Final operation and maintenance manuals, including warranty documentation.
 - C. Bonds, if any.
 - D. Software or code use rights documentation.
 - E. Certificates of inspection from jurisdictional authorities.
 - F. Releases, waivers, or exoneration of all liens arising out of or filed in connection with the Work.
 - G. The Contractor's Waiver of Claims To Date form certifying that all payrolls and material bills and other indebtedness connected with the Work for which the Port might in any way be responsible have been paid or otherwise satisfied.
 - H. Consent of surety, if any, to final payment.

Final Payment

- 13.15 The Contractor may request final payment after receipt of Final Acceptance. The Contractor shall request final payment following the procedure for progress payments.

- 13.16 Upon receipt of the Contractor's request for final payment, the Port will, within 15 days, review the request and recommend payment or respond in writing to the Contractor with the reasons the Port is requiring resubmittal of the request before it can be approved. The Contractor shall make the necessary corrections and resubmit the request.

Contractor's Continuing Obligation

- 13.17 The Contractor's obligation to perform and complete the Work in accordance with this Contract shall be absolute and cannot be waived in whole or in part by the Port except by express written instrument signed by an authorized Port representative. Any such waiver will specifically identify the Work that the Port is willing to accept and the manner in which that Work fails to meet the original requirements of the Contract. Accordingly, and by way of example only, none of the following will constitute acceptance of Work not in accordance with this Contract or release the Contractor from obligation to perform the Work in accordance with this Contract, regardless of whether any defect, deficiency, or damage is patent or latent:
- A. Any act of acceptance by the Port except in an express written instrument as described above.
 - B. Any correction by the Port of Defective Work.
 - C. Use, operation, or occupancy of the Work or any part of the Work by the Port.
 - D. Recommendation by Port staff for any progress or final payment.
 - E. Payment by the Port to the Contractor.
 - F. Issuance of a letter of Substantial Completion.
 - G. Issuance of a letter of Final Acceptance.

Contractor's Warranty of Title

- 13.18 The Contractor warrants that title to all Work and material covered by any request for payment, whether incorporated in the Work or not, will pass to the Port at the time of payment. Title shall be free and clear of all liens, claims, security interests, and encumbrances.

Waiver of Claims

- 13.19 The acceptance of final payment will constitute a waiver of all claims by the Contractor against the Port other than those previously made in writing and still unsettled.

Liquidated Damages

- 13.20 The Contractor acknowledges that the Port will incur significant damages if the Work is not completed within the Contract Time, including without limitation, damages in the form of: inability to use the Work and all related facilities (i.e., "Loss of Use") as well as other delay damages, including but not limited to, delay costs for delayed or resequenced portions of the Work, related work or related projects to be performed or constructed by the Port or the Port's separate contractors; or delay costs comprised of extended or additional services of the Port's project management staff, engineering or design staff, any outside construction management firms, any separate contractors, designers, and consultants, and others performing Work or services related to the project. In consideration of the factors set out in this paragraph, the Contractor acknowledges and agrees that time is particularly of the essence in the Contractor's performance of the Work in accordance with the agreed date of commencement of the Work, the agreed dates of Substantial Completion and Final Acceptance of the Work, and the approved Contractor construction schedule.

- 13.21 The Port and the Contractor acknowledge and agree that if Substantial Completion of the Work is not achieved by the Contract Time for Substantial Completion, the amount of the Port's actual Loss of Use damages (as described above) will be difficult, impractical, or impossible to determine. Accordingly, the parties agree that if Substantial Completion is not achieved by the agreed date of Substantial Completion as may be adjusted pursuant to the Contract Documents, the Contractor shall pay to the Port as liquidated damages for the Loss of Use of the Work the amount indicated in the Agreement for each partial day or full day of delay beyond the deadline for Substantial Completion.
- 13.22 The parties further acknowledge and agree that the Contractor's obligation to pay liquidated damages under this paragraph shall be in lieu of the obligation to pay actual delay damages for the Loss of Use damages. The parties agree that the daily rate agreed to is reasonable in comparison to the approximate scope of actual delay damages for Loss of Use that the parties anticipate as of the time of execution of the Agreement, and that the payment of such liquidated damages is not intended to be a penalty or forfeiture. The parties further acknowledge that these liquidated damages are meant to reimburse the Port only for Loss of Use delay damages and that the Port reserves the right to claim other types of damages against the Contractor resulting from delays, including but not limited to the other delay damages described in Item 13.20 above.
- 13.23 The parties further agree that the Port does not waive its right to liquidated damages or actual delay damages by allowing the Contractor to continue and finish all or any part of the Work after the scheduled Substantial Completion date, or after Substantial Completion is actually achieved. The parties also agree that payment of liquidated damages or actual delay damages does not release the Contractor from any duty under this Contract (other than the duty to pay liquidated damages and actual delay damages).
- 13.24 The Port may withhold liquidated damages and anticipated or incurred actual delay damages from progress payments, or may withhold the full amount of accrued liquidated damages and anticipated or incurred actual damages from final payment.
- 13.25 In the event, and to the extent, the liquidated damages provided for herein are deemed unenforceable, the Port may proceed to claim and collect from the Contractor the Port's actual damages for Loss of Use and the other delay damages described herein.

Other Damages

- 13.26 The Port will have the right to recover from the Contractor and, to the extent permitted by Law, to deduct from any payment due the Contractor, the amount of any loss suffered by the Port on account of the failure of the Contractor, Subcontractor, anyone directly or indirectly employed by any of them, and anyone for whose acts any of them may be liable to comply with the rules and regulations referenced or contained in this Contract.

ARTICLE 14 - SUSPENSION OR TERMINATION OF THE WORK

Port May Suspend the Work

- 14.1 The Port may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice, in writing, to the Contractor. This notice will fix the date on which Work shall stop and the date on which it shall resume. The Contractor shall resume the Work on the date so fixed. The Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to the suspension.
- 14.2 If the work is Defective, or if the Contractor fails to supply sufficient skilled workers or suitable material or equipment, or if the Contractor fails to perform the Work in such a manner that the

completed Work conforms to this Contract, the Port may order the Contractor to suspend the Work, or any portion thereof, until the cause for such order has been eliminated. However, this right of the Port to suspend the Work shall not give rise to any duty on the part of the Port to exercise this right for the benefit of the Contractor or any other party.

- 14.3 In the event the Contractor, Subcontractor, or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable fails to comply with the rules and regulations referenced in this Contract, the Port may suspend the Work or any portion thereof. The suspension shall continue until completion of any investigation or evaluation by the Port and full compliance with any corrective measures which the Port may reasonably require. The Port will not be liable to the Contractor for any delay caused by such suspension, nor will there be any adjustment in the Contract Price or Contract Time.

Port May Terminate the Work

- 14.4 The occurrence of any one or more of the following events will justify termination for cause:
- A. The Contractor is adjudged bankrupt or insolvent.
 - B. The Contractor makes a general assignment for the benefit of creditors.
 - C. A trustee or receiver is appointed for the Contractor or for any of the Contractor's property.
 - D. The Contractor files petition to take advantage of any debtor's act, or to reorganize under bankruptcy or similar laws.
 - E. The Contractor fails to supply sufficient skilled workers or suitable material or equipment.
 - F. The Contractor fails to make prompt payments to Subcontractors or for labor and material.
 - G. The Contractor disregards Laws, ordinances, rules, regulations, or orders of any public body having jurisdiction including, without limitation, ordinances adopted by the Port and referenced in this Contract, and the rules and regulations adopted by the Port's Executive Director or their designee.
 - H. The Contractor disregards the authority of the Port.
 - I. The Contractor otherwise violates in any substantial way any provision of this Contract.
- 14.5 The Port may, after giving the Contractor and its surety a 7-day written notice: (1) terminate this Contract for default; (2) exclude the Contractor from the site; (3) take possession of the site and the Contractor's tools, appliances, construction equipment and machinery at the site and use the same to the full extent they could be used by the Contractor without liability to the Contractor for trespass or conversion; (4) incorporate in the Work material stored at the site or for which the Port has paid the Contractor but which is stored elsewhere; (5) finish the Work as the Port may deem expedient, and (6) obtain an assignment of some or all of the subcontracts and purchase orders relating to the uncompleted Work. By executing this Contract, the Contractor consents to the assignment of those subcontracts and purchase orders in the event of termination of this Contract pursuant to this article. In such case the Contractor will not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the Work, including compensation for additional professional services, such excess will be paid to the Contractor. If such costs exceed such unpaid balance, the Contractor shall pay the difference to the Port. Such costs incurred by the Port will be verified by the Port and incorporated in a Change Order; but in finishing the Work, the Port will not be required to obtain the lowest figure for the Work performed.

- 14.6 Where the Contractor's services have been so terminated by the Port, the termination will not affect any rights of the Port against the Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due the Contractor by the Port will not release the Contractor from liability.

Port May Terminate the Work for Convenience

- 14.7 Upon giving the Contractor a 7-day written notice, the Port may, without cause and without prejudice to any other right or remedy, elect to terminate this Contract for the convenience of the Port. In such case, the Contractor will be paid for the costs of all Work acceptably performed and installed, together with reasonable profit and overhead on those costs, and any justifiable costs actually sustained in the process of termination. The Contractor will not be entitled to overhead or profit on the unperformed Work, and will not be entitled to payments in excess of the amount determined by multiplying the percentage of the Work actually and acceptably completed by the Contract Price, as adjusted. If this Contract is terminated for default and it is subsequently determined through mediation, arbitration, or litigation that the termination was improper, this Contract shall be treated as if it had been terminated for the convenience of the Port, and the Contractor shall be entitled to payment under the provisions of this paragraph.
- 14.8 In the event of a termination for convenience, the Contractor remains liable for all elements of the Work actually performed by the Contractor or Subcontractors, or those for whom any of them are responsible, regardless of whether: (a) such performance occurred before or after the effective date of termination; or (b) the Port provided an opportunity to cure. The Contractor's liability includes, but is not limited to, liability for having performed all Work according to the Contract Documents, industry standards, and the other standards incorporated in this Contract. The Contractor also remains liable for all representations, warranties, and guarantees to the extent applicable to the Work performed.

ARTICLE 15 - DISPUTE RESOLUTION

- 15.1 If the Contractor wishes to assert a claim, the Contractor shall submit to the Port a written statement of the claim within 30 Calendar Days after the Contractor first has knowledge of or reason to know of the facts upon which the claim is based. The statement of claim shall recite the facts upon which the claim is based and shall include copies of all documentary evidence in support of the claim. Within 15 Calendar Days after receiving a claim, the Port will respond in writing stating whether the claim is allowed, partially allowed, or denied. If the Contractor disputes the action taken by the Port, the Contractor shall deliver a written notice of dispute to the Port within 15 Calendar Days after the Contractor receives the Port's written response to the claim. The written notice of dispute shall be entitled "Notice of Dispute." A claim shall be barred if the Contractor fails to comply with the foregoing notice of dispute requirement or fails to timely deliver the notice of dispute to the Port.
- 15.2 The parties shall attempt to resolve all disputes by negotiation. Negotiation shall be initiated at the earliest opportunity. Each party shall freely share unprivileged information requested by the other and shall make a good faith effort to ensure that all relevant issues are fully developed and fairly presented to the other side.
- 15.3 If a dispute is not resolved through negotiation between the Contractor and the Port, the parties shall submit the dispute to mediation. Either party may request mediation. The requesting party shall suggest an independent mediator with the request for mediation. If the parties cannot agree upon a mediator, either party may apply to the Presiding Judge, Multnomah County Circuit Court, for appointment of a mediator. The parties shall share equally in the fees and costs of the mediator. Mediation shall be at Portland, Oregon, unless the parties agree otherwise.

- 15.4 If a dispute is not resolved by mediation, the parties may, but are not required to, agree to submit the dispute to binding arbitration. If the parties agree to arbitrate their dispute, it shall be submitted to the Arbitration Service of Portland for hearing in Portland, Oregon. The parties agree to arbitrate pursuant to the Arbitration Service of Portland's Rules, except for the following:
- A. For disputes with under \$1 million at issue not including attorney fees and legal costs, a single arbitrator shall be selected.
 - B. For disputes with \$1 million to \$3 million at issue not including attorney fees and legal costs, at the Port's discretion the Port may require that a panel of three arbitrators be selected.
 - C. For disputes with over \$3 million at issue not including attorney fees and legal costs, a panel of three arbitrators shall be selected.
- 15.5 If a dispute cannot be resolved by mediation, and the parties do not agree to submit the dispute to arbitration, either party may file a lawsuit to resolve the dispute in a court with proper jurisdiction located in Multnomah County, Oregon.
- A. For any such lawsuit, each party to this agreement irrevocably waives any and all right to trial by jury and instead agrees to resolve the dispute in a bench trial decided by a judge.
 - B. If another involved party will not consent to a bench trial, the Port, in its sole discretion, has the option to elect a consolidated jury trial. It is understood that the purpose of this paragraph is to allow the Port to determine the best means of achieving a single consolidated proceeding that will minimize duplicative processes and minimize the risk of inconsistent results, in the following order of preference: (1) a consolidated bench trial of all significant parties, if possible; or (2) alternatively, and as a last resort, a consolidated jury trial of all significant parties.
- 15.6 Should any lawsuit, arbitration, or other action be commenced in connection with any dispute arising out of this Contract, the prevailing party shall be entitled to recover its costs and disbursements, investigation costs and fees, expert witness costs and fees, and attorney costs and fees, as the court or arbitrator may adjudge reasonable, incurred in connection with such dispute before trial or arbitration, at trial or arbitration, upon any motion for reconsideration, upon any appeal or petition for review, and upon any collection efforts or proceedings. Only parties to this Contract are entitled to recover their costs and fees under this provision, and the Port does not agree to compensate any third party, including but not limited to design professionals, subcontractors, and suppliers, for costs or fees, whether on a pass-through basis or otherwise.
- 15.7 Except to the extent performance may be legally excused under the particular circumstances, each party shall continue to perform its duties under this Contract while the resolution of a dispute is pending. Failure to comply with this requirement shall be a material breach of this Contract.

ARTICLE 16 - MISCELLANEOUS

Giving Notice

- 16.1 When this Contract requires that written notice be given, notice shall be deemed valid if it is delivered to the individual who signed the Contract or to the Port's or the Contractor's Representative. Notice shall be deemed as delivered if it is:
- A. Sent through the Port's online construction management system, or
 - B. Hand-carried to the person to whom it is intended, or
 - C. Hand-carried to an officer of the firm for which it is intended, or

- D. Sent by registered or certified “Return Receipt Requested” mail, postage prepaid, to the last business address known to the giver of the notice.

Computation of Time

- 16.2 Any period of time referred to in this Contract by days shall be computed to exclude the first and include the last day of such period. If the last day of any time period falls on a Saturday or Sunday or on a day made a legal holiday by the Law of the applicable jurisdiction, such day shall not be included in determining the time period.

Liability Claims

- 16.3 Should the Port or the Contractor suffer injury or damage to person or property because of any error, omission, or act of the other party or of any of the other party’s employees, contractors, or agents or others for whose acts the other party is legally liable, claim shall be made: (1) in writing, and (2) to the other party within a reasonable time of the first observance of such injury or damage.

Rights and Remedies

- 16.4 These General Conditions impose duties and obligations on the Contract parties and provide for rights and remedies. The rights and remedies available to each party are in addition to, and shall not limit, actions allowed by Law or other parts of this Contract. All representations, warranties, and guaranties made in this Contract shall survive final payment and/or termination (whether for cause or convenience) and/or completion of this Contract. The content of this paragraph shall apply as if repeated specifically in this Contract in connection with each duty, obligation, right, and remedy.

Commencement of Limitations Period

- 16.5 As to acts, omissions, breaches of contract or warranty, negligence, misrepresentation, strict liability, fraud, or any other improper conduct of the Contractor or those persons or entities for whom the Contractor is responsible, whether occurring prior to or after completion of the Work, all applicable limitations periods shall not commence to run and any alleged cause of action shall not be deemed to have accrued unless and until the Port is aware of all three of the following: (1) the identity of all party(ies) responsible; (2) the actual magnitude of the damage or injury; and (3) the cause(s) of the damage or injury. The discovery rule provided herein applies in lieu of any otherwise applicable statute or case authority.

WAIVER OF CLAIMS TO DATE

_____ (“the Contractor”) and the Port of Portland (“the Port”) have entered into an agreement (“the Agreement”) for the construction of a certain improvements project at _____ commonly referred to as the _____ Project.

The Agreement provides monthly progress payments, provided, among other things, the Contractor executes and submits this Waiver of Claims to Date with respect to all claims through the end of the period covered by the immediately preceding progress payment.

The date of the request for progress payment with which this Waiver of Claims to Date is submitted (“Current Progress Payment”) is _____ (“Current End Date”). The end of the period covered by the immediately preceding progress payment (“Last Progress Payment”) was _____ (“Last End Date”).

The Contractor certifies that all work covered by the Current Progress Payment is complete.

The Contractor certifies that all subcontractors, laborers, suppliers, and materialmen have been paid in full, less any retainage properly withheld by the Contractor, for all work performed and material provided for which the Contractor received payment in the Last Progress Payment.

The Contractor certifies that no extras have been furnished prior to the Last End Date for which payment has not been received.

The Contractor certifies that no claims are reserved by the Contractor or the Contractor’s subcontractors, laborers, suppliers, or materialmen as of the Current End Date.

The Contractor, on behalf of the Contractor and all the Contractor’s subcontractors, laborers, suppliers, and materialmen, hereby waives and releases the Port from any mechanic’s lien, stop notice, bond right, or other claim related to the Agreement through the Last End Date.

Exceptions, if any:

I declare under penalty of perjury under the laws of the State of Oregon that the foregoing is true and correct.

CONTRACTOR’S REPRESENTATIVE

By:

(Signature)

Printed Name:

Title:

Date:

Date: _____ EAN Number: _____

Project
Name: _____Prime
Contractor: _____

Known Subcontractors:

The information in this form shall be kept up-to-date on a monthly basis at a minimum. In addition, the information shall be used as part of project safety briefings and posted at the job site.

Scope of Work Summary – Include Location(s):

Potential Work Hazards/Concerns Identified (check ALL that apply). Each hazard checked shall be addressed in Job Hazard Analyses (JHAs).

☐ Fall Exposure	☐ Traffic Control	☐ Scaffolding
☐ Excavation	☐ Chemicals	☐ Ladders
☐ Confined Space Entry	☐ Crane/Rigging	☐ Aerial Lift
☐ Electrical	☐ Demolition	☐ Airborne Contaminants/Dust
☐ Hazardous Energy/Lockout-Tagout	☐ Protection of the Public	☐ High Noise
☐ Asbestos/Lead	☐ Hot Work/Fire Hazard	☐ Painting
☐ Stainless Steel Welding	☐ Compressed Gas	☐ Silica
☐ Work Over/Near Water	☐ _____	☐ _____

Note: Attach any company safety programs, policies, or procedures that will apply to your work at the Port.

Responsible Persons

List onsite Competent Person(s) responsible for monitoring work performed on this project. Note: a “Competent Person” by OSHA definition has the ability to identify hazards and has responsibility and authority to take immediate corrective actions. This includes known subcontractors.

Name:	Competent Area(s):	Training (i.e., OSHA 30, etc.)

A. Personal Protective Equipment (PPE) required for workers at the job site:

☐ Hardhat	☐ High Visibility Clothing	☐ Safety Glasses
☐ Safety Boots	☐ Hearing Protection	☐ Gloves
☐ Respiratory Protection	☐ Welding PPE	☐ Fall Arrest Gear
☐ Personal Floatation Device	☐ _____	☐ _____
☐ _____	☐ _____	☐ _____

B. Mandatory PPE for visitors to the job site:

☐ Hardhat	☐ High Visibility Clothing	☐ Safety Glasses
☐ Safety Boots	☐ Hearing Protection	☐ Gloves
☐ Personal Floatation Device	☐ _____	☐ _____

First Aid/CPR/AED

Contractor or subcontractor person(s) trained and current in first aid/CPR/AED. Mandatory for electrical work per NFPA 70E.

Name:	Date Trained:

Safety Data Sheets (formerly MSDS)

List all known or anticipated products that will be brought onsite that require a Safety Data Sheet (SDS).

Product Name:	Flammable? Y/N If yes, Port Fire Department will review.

Contractor's Project Manager:

Name: _____ Phone: _____

Contractor's Primary Onsite Safety Contact:

Name: _____ Phone: _____

Worksheet Prepared by:

Name: _____ Title: _____ Date: _____

*****PORT USE ONLY*****

Port CCM/Project Manager:

Name: _____ Phone: _____

Lead Inspector(s):

Name: _____ Phone: _____

Name: _____ Phone: _____

Distribution: Safety Department

APPRENTICE UTILIZATION PLAN

PROJECT NAME _____

PRIME CONTRACTOR _____

CONTACT NAME AND PHONE NUMBER _____

CONTRACT NO. _____ SOLICITATION NO. _____

PRIME CONTRACT AMOUNT \$ _____

			ESTIMATED TOTALS		
Projected Start Date (mm/dd/yy)	Name of Contractor/ Subcontractor	Trade/Craft (Scope of Work) (choose from list below)	Apprentice Hours	Journeyman Hours	Total Labor Hours
<u>LIST OF TRADES/CRAFTS</u> Brick and stone masons, cement masons, carpenters, carpet installers, drywall installers, electricians, glaziers, glassworkers, insulation workers, laborers, operating engineers, painters, plasterers, plumbers, pipefitters, roofers, sheet metal workers, truck drivers, welders/cutters		Subtotal This Page			
		Continuation Sheet			
		Grand Total			

Contractor Authorized Signature

Print Name

Title

Date

Submit at preconstruction meeting.

DOCUMENT 007300
SUPPLEMENTARY CONDITIONS

1.1 GENERAL

- A. These supplements modify, delete from, or add to the General Conditions.
- B. Where an article, paragraph, or clause of the General Conditions is modified or deleted by these supplements, the unaltered provisions of that article, paragraph, or clause remain in effect.

1.2 INCREASED LIABILITY INSURANCE

- A. See General Conditions Item 5.4. Delete the first sentence and replace with, “The Contractor shall maintain liability coverages in the amounts set forth below.”
- B. See General Conditions Item 5.4, A. Delete the first sentence and replace with, “The Contractor shall maintain commercial general liability insurance in an amount not less than \$2,000,000 to protect against liability for bodily injury and property damage which may arise out of the Contractor’s operations under this Contract.”
- C. See General Conditions Item 5.4, B. Delete the first sentence and replace with, “The Contractor and any vendor delivering materials to the construction site which involves active airfield access at PDX shall provide business automobile liability insurance in an amount not less than \$5,000,000 per occurrence (primary or combined primary and excess insurance) to protect against liability arising from the use, loading, and unloading of all of the Contractor’s owned, hired, and non-owned automobiles in connection with this Contract.”

1.3 APPRENTICE UTILIZATION PROGRAM AND MONTHLY WORKFORCE REPORTING

- A. Contractors awarded construction contracts over \$500,000 shall:
 - 1. Submit an apprentice utilization plan to the Port at the preconstruction meeting (form follows these General Conditions). The plan shall be updated and resubmitted as the work progresses.
 - 2. Submit proof of registration with the Bureau of Labor and Industries Apprenticeship and Training Division as a training agent for each trade where apprentices will be employed. The Contractor shall also submit such proof for each Subcontractor employing registered apprentices if the subcontract is greater than \$100,000.
 - 3. Enter all labor hours worked using the Port’s online reporting system at www.portofportland.dbesystem.com. Labor hours shall include journeyman hours and registered apprentice hours by trade. Include hours worked by registered apprentices of Subcontractors if the subcontract is greater than \$100,000.
 - 4. In the event that the Contractor is unable to accomplish the Port’s target for registered apprentice participation, the Contractor shall demonstrate that a good faith effort has been made. In fulfilling the good faith effort, the Contractor shall perform and, when appropriate, require its Subcontractors to perform the following steps:
 - a. Solicit apprentices from registered or accredited programs.

- b. Document the solicitation and, in the event apprentices are not available, obtain supporting documentation from the registered or accredited programs.
 - c. Demonstrate that the plan was updated as required by the Contract Documents.
 - d. Submit documentation demonstrating what efforts the Contractor has taken to require Subcontractors to solicit and employ apprentices.
- 5. In the event that the preceding steps have been followed, the Contractor may also supplement the good faith efforts as follows:
 - a. Submit documentation demonstrating successful apprentice utilization on previous contracts.
 - b. Submit documentation indicating company-wide apprentice utilization efforts and percentages of attainment.

Oregon Bureau of Labor and Industries

Prevailing Wage Rates for Public Works Contracts

Current wage rates determined by the Oregon Bureau of Labor and Industries (BOLI) may be obtained from BOLI's web site at <https://www.oregon.gov/boli/Pages/index.aspx>.

The wage rates and amendments in effect at the time this project is advertised are the rates that shall apply for the duration of the work.

Christina E. Stephenson
Labor Commissioner
Rates Effective July 5, 2026



SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work includes but is not limited to:

Rehabilitation and conversion of one set of men's/women's restrooms into one all-user restroom.

- B. The existing state prevailing rate of wage and, if applicable, the federal prevailing rate of wage required under the Davis-Bacon Act (40 USC 3141 et seq.) apply to this work. See the contract documents for more information.
- C. The work will require the Contractor, its employees, and subcontractors to obtain and display security identification badges.

1.2 PROPOSED OCCUPANCY AND TYPE OF CONSTRUCTION

- A. Assembly, non-separated mixed occupancy, Type I-A Construction.

1.3 KNOWN SITE CONDITIONS AFFECTED BY REGULATORY AGENCIES

- A. The following materials or conditions may exist on the construction site. The Contractor shall comply with federal, state, or local agencies' ordinances or regulations pertaining to these conditions:
1. Asbestos.
 2. Paint containing lead, cadmium, hexavalent chromium, or other metals of toxic significance.
- B. Asbestos Conditions:
1. The Contractor shall not disturb items that contain or are suspected of containing asbestos.
 2. The Port will abate the asbestos-containing material that would be disturbed by the work, in compliance with OR-OSHA and ORS requirements for worker protection, prior to or in conjunction with the Contractor beginning work in the area.
- C. Lead, Cadmium, and Hexavalent Chromium:
1. The Contractor shall assume that all painted surfaces contain lead, unless proven otherwise, and shall perform work in accordance with OR-OSHA and ORS requirements for worker protection. Items with painted surfaces that are removed shall be recycled or disposed of in accordance with DEQ requirements. Collect loose paint chips and place into a drum or other appropriate storage container. The Port will test and dispose of the paint chips.
 2. There may be other toxic heavy metals present in painted surfaces. If cadmium or hexavalent chromium is found to be present, they shall be managed to ensure compliance with OAR-437-03-1000 (.1127 for cadmium and .1126 for hexavalent chromium).

1.4 UNEXPECTED SITE CONDITIONS

- A. Suspected Hazardous or Environmentally Sensitive Conditions:
 - 1. If the Contractor encounters suspected hazardous or environmentally sensitive conditions in the work area beyond those mentioned in these specifications or the drawings, the Contractor shall immediately stop all work in the area of the suspected condition and notify the Port.
 - 2. The Port will make arrangements for testing and appropriate abatement, if required.
 - 3. The Contractor shall alert its employees to these facts and shall assure that no operations occur that disturb the suspected hazardous or environmentally sensitive condition.

1.5 REGULATED BUILDING MATERIAL EMERGENCY PROCEDURES

- A. In the event of an asbestos or other regulated building material emergency such as an uncontrolled release or suspected release of asbestos fibers, lead dust, or mercury vapor that could impact human health or the environment, do the following:
 - 1. Notify the PDX Communications Center (503) 460-4000.
 - 2. Evacuate workers from the area and restrict access to the area with barricades, caution tape, etc. If possible, seal the area and post signage warning of potential hazard. Do not allow workers or the public to come in contact with the material.
 - 3. If air handling units serving the area are under the control of the Contractor, turn off the flow of air.
 - 4. Do not attempt to clear up the released material. This will be performed by the Port.

1.6 WELDING, CUTTING, AND BURNING PERMIT

- A. Obtain a welding, cutting, and burning permit from the Airport Fire Department prior to the start of any flame welding, cutting, or burning work. In addition, notify the Airport Fire Department prior to beginning each flame welding, cutting, or burning operation.

1.7 INTERNATIONAL BUILDING CODE

- A. Work shall conform to the International Building Code (IBC), as amended by the OSSC, State of Oregon and as enforced by the City of Portland Bureau of Development Services.

1.8 PLUMBING CODE

- A. Water systems (except fire sprinkler systems), sanitary sewers, and storm drainage work shall comply with the Uniform Plumbing Code as amended by the Oregon Plumbing Specialty Code (OPSC) by the State of Oregon and as enforced by the City of Portland Bureau of Development Services.

1.9 MECHANICAL CODE

- A. Work shall comply with the International Mechanical Code and International Fuel Gas Code as amended by the Oregon Mechanical Specialty Code (OMSC) by the State of Oregon and as enforced by the City of Portland Bureau of Development Services.

1.10 CODE FOR ELEVATORS, ESCALATORS, AND MOVING WALKS

- A. Work shall comply with the American Society of Mechanical Engineers (ASME) Code and the Oregon Specialty Lift Code as amended by the Oregon Elevator Specialty Code by the State of Oregon and as enforced by the authorities having jurisdiction.
- B. The Contractor performing electrical, mechanical, and/or erection work shall be, and remain, in compliance with licensing requirements of the authorities having jurisdiction. Personnel performing work on this project shall be individually licensed, as required by the State of Oregon.
- C. Submit complete shop drawings, plans, and material lists to the State of Oregon, 1535 Edgewater N.W., P.O. Box 14470, Salem, Oregon 97309-0404, for review and approval.
- D. The Contractor shall coordinate and pay for all required inspections, including those required for obtaining operating permits.

1.11 ELECTRICAL CODE

- A. Work shall comply with the National Electrical Code (NEC), as amended by the Oregon Electrical Specialty Code (OESC) by the State of Oregon and as enforced by the City of Portland Bureau of Development Services.
- B. The Contractor shall be, and remain, in compliance with licensing requirements of the State of Oregon and the City of Portland including required individual state electrical licensing for personnel performing electrical work on this project.

1.12 ENERGY CODE

- A. Work shall comply with the International Energy Conservation Code (IECC) as amended by the Oregon Energy Efficiency Specialty Code (OEESC) by the State of Oregon and as enforced by the City of Portland Bureau of Development Services.

1.13 BOILER AND PRESSURE VESSEL CODE

- A. Work shall comply with the Boiler and Pressure Vessel Safety Code as adopted by the State of Oregon and the following:
 - 1. 2021 Boiler and Pressure Vessel Code of American Society of Mechanical Engineers (ASME) including Section I, Section II Parts A through D, Sections IV through VIII Divisions 1, 2, and 3, Section IX, and Section X.
 - 2. 2020 ASME B31.1
 - 3. 2020 ASME B31.3

4. 2019 ASME B31.5
5. 2020 ASME B31.9
6. 2021 NBBI NB23
7. 2019 NFPA 85
8. 2018 ASME CSD-1

1.14 SOLAR CODE

- A. Work shall comply with the Oregon Solar Installation Specialty Code (OSISC), as developed by the State of Oregon and as enforced by the City of Portland Bureau of Development Services.

1.15 THIRD-PARTY CERTIFICATION REQUIREMENTS

- A. Electrical equipment furnished or installed shall bear the seal of a State of Oregon Electrical and Elevator Board approved testing laboratory.
 1. Underwriters' Laboratories (UL) and Canadian Standards Association (CSA) are approved laboratories for all categories of electrical products.
 2. Additional approved laboratories may exist. Examples of other approved laboratories include the Federal Aviation Administration (FAA) for airport lighting equipment specifically conforming to FAA standards, and FM Global (FM) for categories of equipment for hazardous locations, fire pump controls, and electronic protective systems. Other laboratories will be allowed if the Contractor can demonstrate that the laboratory is approved by the State of Oregon Electrical and Elevator Board.
- B. Equipment Without Proper Labeling:
 1. A letter of acceptance by a State of Oregon Special Deputy Electrical Inspector will be accepted in lieu of a testing laboratory certification for specific and/or unusual equipment not normally listed. Unless otherwise specified, costs, work, and time required for obtaining state acceptance shall be the Contractor's responsibility.
 2. Labels or permits will not be required for equipment and materials specifically considered exempt by the authority having jurisdiction.

1.16 SPECIAL INSPECTIONS

- A. In accordance with the International Building Code (IBC) Chapter 17, special inspections are required for the following types of work:
 1. Concrete
 2. Bolts Installed in Concrete
 3. Ductile Moment-Resisting Concrete Frame
 4. Reinforcing Steel and Prestressing Steel
 5. Welding
 6. High-Strength Bolting
 7. Structural Masonry
 8. Reinforced Gypsum Concrete
 9. Insulating Concrete Fill
 10. Spray-Applied Fireproofing
 11. Shotcrete

12. Special Cases (work which, in the opinion of the building official, involves unusual hazards or conditions)

- B. The Contractor shall be responsible for the timely coordination of all special inspections required. The Port will determine which testing agency or agencies to use and will make arrangements for the testing agency's or agencies' reimbursement.

1.17 WARRANTY REQUIREMENTS

- A. The Contractor shall be responsible for compliance with manufacturers' warranty requirements, including inspections.

1.18 PROGRESS MEETINGS

- A. Regularly scheduled job meetings will be held between the Contractor and the Port. The Contractor's representative at job meetings shall be the person directly responsible for the work. The time and place of the meetings will be established by the Port.
- B. Other unscheduled meetings may be required to resolve specific issues at the work area.

END OF SECTION 011100

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 PORT/TENANT OPERATIONS

- A. Work in coordination and cooperation through the Port with airlines, tenants, and other contractors so that normal operations may be carried on without interruption.
- B. The Port, airline, or tenant operations may require that certain of the Contractor's operations be scheduled around Port, airline, or tenant activities, and certain areas of the work may be required to be bypassed and accomplished when Port, airline, or tenant operations permit.

1.2 OTHER CONTRACTORS

- A. The Port reserves the right to award other contracts for work in the vicinity of work covered by this contract.
- B. The various contractors and the Port will mutually establish a schedule of construction for the use of common work areas.

1.3 MILITARY ACTIVITIES

- A. The site of the work is a military reservation, and rules and regulations established by the Base Commander must be complied with by the Contractor.
- B. The existing buildings and air base will be in full occupancy and operation during this contract. Arrange and schedule work in cooperation with the Base Civil Engineer, in order to cause the least possible disturbance, inconvenience, and noise.
- C. Schedule work so as not to interfere with opening, closing, and lunch hours. Avoid placement, storage, routing of materials, work, vehicles, or equipment which would block access to or interfere with access to existing buildings, parking or storage places, utility valves, or switches and fire protection devices.

1.4 CONTRACTOR'S COORDINATION

- A. The Contractor is responsible for overall coordination of the work.
- B. The drawings and specifications are arranged for convenience only and do not necessarily determine which trades perform the various portions of the work.
- C. Transmit to the trades doing the work of other divisions the information required for work to be provided under their respective sections (such as foundations, electric wiring, access door locations, etc.) in ample time for their installation.

- D. Consult with the trades doing the work of other divisions so that, whenever possible, motors, motor controls, pumps, valves, etc., shall be of the same manufacturer.
- E. Compare the drawings and specifications of the separate trades before proceeding, noting discrepancies and conflicts. Obtain written instructions for changes necessary. Before installation, make provisions to avoid interferences.
- F. Prior to the installation and connection of mechanical and electrical work for work of other sections, or of other contractors, verify the requirements indicated in those divisions with the requirements and characteristics of the other crafts or other contractors' equipment.
 - 1. Coordinate layout of mechanical and electrical work before fabrication and installation begins.
 - 2. Bring deviations and conflicts to the attention of the Port immediately.
- G. Mechanical and electrical drawings show the general arrangement of the work. Follow as closely as actual building construction and the work of other trades permit.
 - 1. Electrical drawings are diagrammatic and do not show all offsets, fittings, and accessories which may be required.
 - 2. Investigate the structure and finish conditions affecting the work and arrange the work accordingly.

1.5 OPERATIONS IMPACT DRAWINGS

- A. Provide operations impact drawings showing phases of work and necessary room and area closures, restrictions, and temporary provisions for continued safe operation of airport facilities. Update and reissue the drawings weekly. Items shown on the drawings shall include, but are not limited to, the following:
 - 1. Dates and times that each drawing covers.
 - 2. Rooms, roads, and areas closed.
 - 3. Location of emergency exits.
 - 4. Changes to baggage conveyor system showing segments of conveyor closed to use and newly opened for use.
 - 5. Changes to routing of baggage in the ticket lobby.
 - 6. Pedestrian and vehicle traffic routing and control devices.
 - 7. Perimeter fencing and barricades.
 - 8. Any aircraft movement restrictions, such as closures and areas of towing.
 - 9. Narrative describing construction activities, aircraft movement restrictions, aircraft parking, gate and taxiway closures, pedestrian and vehicle traffic routes, pavement marking, and barricade and fence changes.
 - 10. Labeling of features.
 - 11. Dimensions and coordinates for all features.
 - 12. Legend.

1.6 COORDINATION DRAWINGS

- A. Prepare and submit coordination drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, where limited space availability necessitates maximum utilization of space for efficient installation of different components, and for site utilities.

1. Show the interrelationship of components shown on separate shop drawings.
 2. Indicate required installation sequences.
 3. Comply with requirements contained in Section 013300, Submittal Procedures.
 4. Prepare as required and submit coordination drawings for areas of the work listed below:
 - a. Where utilities cross over or under baggage conveyor or catwalk.
 - b. Refer to the mechanical and electrical divisions for specific coordination drawing requirements for mechanical and electrical installations.
 - c. Coordinate information indicating locations and elevations of baggage handling system components and associated power, control, and data, fire protection piping, HVAC ductwork, plumbing piping, electrical and low voltage rough-in and fixtures.
 - d. Mechanical and electrical rooms.
 - e. Concrete formwork drawings (for shear walls only) with all mechanical, electrical, plumbing, fire protection, communications and security, and other such systems, coordinated for locations of all floor, wall, and beam penetrations, sleeves, and embeds.
 - f. All other work areas where congestion might necessitate a change in the ceiling heights, lighting, and diffuser locations, structure, or finishes.
 5. Note that contract drawings shall not be considered as fabrication or installation drawings. In some cases, they only indicate intent; they may be diagrammatic, and they may show only typical conditions; they do not indicate every item required to complete the work.
- B. Upon written request, CAD drawing files will be provided to the Contractor at no cost. The following information shall be understood:
1. The written request shall specifically state which sheets of the contract documents are requested.
 2. Plan views only will be provided (i.e., no details or sections, etc.).
 3. Allow five working days for delivery of CAD files.
 4. In many instances, multiple CAD files are referenced together to illustrate information on contract documents. The files are very large and contain extraneous information. The files will be provided as-is. The Contractor shall be responsible for organizing the files to show the information correctly.
 5. One copy of each CAD file will be provided unless otherwise requested.
 6. CAD file format will be AutoCAD.DWG.
 7. Use of the electronic media by the Contractor, subcontractors, and suppliers will be at the Contractor's sole risk and without liability, risk, or legal exposure to the Port, and the Contractor agrees to release and, to the fullest extent permitted by law, defend, indemnify, and hold harmless the Port, Port's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or relating to any such use by the Contractor or third parties.
- C. Prepare coordination drawings in sufficient time to allow for review by the Port and correction (if required) by the Contractor, so as not to delay the work.
- D. The Port will not approve the coordination drawings; this is the Contractor's responsibility under the contract.
- E. No work affected by the coordination drawings shall be started until the drawings have been reviewed by the Port and returned to the Contractor.

- F. When any section of the specifications requires the submittal of an “equipment layout drawing,” the Contractor shall coordinate all work under various sections of the specifications to assure that no interferences occur in the rooms or areas for which such drawings have been required and that necessary clearances are provided. Installation of affected equipment shall not proceed until required drawings have been reviewed by the Port, as specified in this section.
- G. Where mock-ups and coordination drawings are required for certain assemblies, the coordination drawings will not be reviewed by the Port until the mock-up affected by the coordination drawings is also complete and ready to be reviewed.
- H. The coordination drawings shall use a common architectural layout as a background. The drawings shall be prepared at the same scale to permit overlaying on light tables, shall be clearly dimensioned and shall show the work of all the trades, correctly scaled, in affected areas.
- I. Coordination drawings shall be keyed and cross-referenced to the contract documents.
- J. The sizes and bottom elevations shall be shown for all oval and rectangular ductwork; the sizes and centerline elevations shall be shown for all round ductwork and piping. All major components, such as dampers, valves, controls, pumps, in line devices, cleanouts, etc., shall be dimensioned from column centerlines.
- K. Double lines shall be shown for all ductwork and pipes 6 inches and above. Single lines shall be shown for lines below the sizes noted above.
- L. Coordination drawings shall show all offsets, fittings, and similar items which may interfere with the work of other trades in the areas covered by the coordination drawings so that the work will be installed without interference, within the dimensional limitations indicated, with proper clearances, and will meet the requirements of the contract documents at no additional cost to the Port.
- M. All dimensions shall be verified in the field, whenever possible.
- N. Deviations from the contract document shall be clouded or circled, approval requested in writing and the reasons for the deviations so noted.
- O. The CAD originals of the coordination drawings shall be kept up-to-date with revisions which reflect the record conditions. The CAD originals of the coordination drawing shall be submitted to the Port at completion of all work, corrected by the Contractor if so required, and delivered to the Port prior to final payment to the Contractor.
- P. Print and distribute coordination drawings in the same manner as required for shop drawings in Section 013300.
- Q. Coordination drawings, when submitted to the Port, shall bear the signature and approval stamp of each of the trades and/or subcontractors affected and of the Contractor, stating that they have been reviewed and approved for coordination.
- R. The coordination drawings of all trades shall be included in each submission.

END OF SECTION 013100

SECTION 013200 – CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work progress schedule requirement is established to ensure adequate planning, scheduling, management, and execution of the work by the Contractor, and to enable the Port to evaluate work progress and make contract time adjustments. The work specified in this section consists of submitting a contract schedule, monthly updates, four-week schedules for progress meetings, and a final as-built schedule. The planning, scheduling, management, and execution of the work in accordance with the contract is the responsibility of the Contractor.

1.2 SUBMITTALS

- A. Except as modified in this section, the procedures required by Section 013300, Submittal Procedures, shall be observed.
- B. Submit a statement of Critical Path Method (CPM) capability within 10 days following the Port's delivery of the fully executed contract, stating that the Contractor has in-house capability, or if not, naming a scheduling subcontractor to be employed by the Contractor to prepare the schedules required. Include with this submittal scheduler's name and list of qualifications demonstrating that the scheduler has performed scheduling for projects of the same magnitude and complexity of this project. Failure to provide this information may result in disqualification of the proposed scheduler.
- C. At least one week prior to the preconstruction meeting or sooner if requested by the Port, submit for review by the Port, a work progress schedule meeting the requirements below.
- D. Within 5 days of receipt of review comments from the Port, incorporate the Port's comments, finalize, and resubmit the work progress schedule for Port approval.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 CONTRACT SCHEDULE SUBMITTAL REQUIREMENTS

- A. Develop the contract schedule submittal in CPM format using Primavera Project Management (P6)®, Microsoft Project®, or equal. It shall include:

1. A CPM Network Diagram:
 - a. Time-scaled (by week, starting Monday), grouped by work areas and sorted by early start dates.
 - b. The diagram shall be clear, neat, and legible. Each sheet shall contain a title block, a revision block, project name and contract number, Contractor, type of tabulation (initial, update, project status), project duration, scheduled substantial completion date, and a legend explaining the basic notation, terms, and codes used.
 - c. Identify critical path activities, including critical paths to contract milestone dates.
 - d. Activity durations shall not exceed 10 days. Should an activity require more than 10 days, it shall be subdivided to define appropriate activities. The Port may approve using longer durations on such non-construction activities as the procurement and fabrication of materials and equipment.
 - e. All activity descriptions shall clearly define the location and type of work to be performed.
 - f. Show schedule critical deliverables (i.e., permits, submittals, etc).
 - g. Schedule fabrication and delivery of all materials and equipment.
 - h. Scheduled start or completion dates imposed on the schedule by the Contractor shall be consistent with contract milestone dates and other restrictions. Contract milestone dates are the work area starting and completion dates and shall be clearly identified and connected to the appropriate activities.
 - i. Schedule shall include contingencies for normal weather delays and seasonal periods of heavy traffic flow.
 - j. Schedule shall list resources required to perform work within durations shown. Indicate the estimated quantities of work anticipated where applicable.
 - k. Failure to include any element of work required for performance of this contract shall not excuse the Contractor from timely completion of work required to achieve the contract milestones, notwithstanding the acceptance of the contract schedule submittal.
 - l. The contract duration shall be the duration specified in the contract documents and awarded by the Port.
 - m. Schedules extending beyond the contract completion date will not be accepted.
 - n. Schedules showing the work completed in less than the contract duration may be found by the Port to be impractical, requiring resubmittal.
 - o. Schedules showing the work completed in less than the contract duration, if practical to the Port, shall be considered to have Float. Float is the time between the scheduled duration of the work and the contract duration. Float is a resource available to both the Contractor and the Port, and is non-compensable. Acceptance of a schedule showing the work completed in less than the contract duration shall not constitute a change to the contract completion date.
 - p. Schedule shall be coded by activity identifying shift work, restricted hours, electrical work, etc.
 - q. All Port-required activities shall be shown as part of the critical path.
2. Narrative: The contract schedule submittal shall include a “stand-alone” document that conveys, in writing:
 - a. The Contractor’s schedule assumptions; constraints; critical path/critical activities and why they are critical; permit requirements; coordination required with the Port, airlines, other contractors, utilities or any other parties; and long lead delivery items.
 - b. Basis for resources. Include anticipated quantities of work for each activity and the production rates used in determining resource allocation for activities.

3. The contract schedule submittal shall include a compact disc containing a copy of the project files. All data shall be written to disk via the Primavera Project Management (P6)®, Microsoft Project® Backup, or equal utility.
- B. The final, accepted work progress schedule shall be the baseline from which changes in duration and logic shall be determined and shall be the basis for planning, scheduling, managing and executing the work.

3.2 MONTHLY UPDATE REPORT

- A. No later than 30 days after acceptance of the contract schedule and monthly thereafter, the Contractor shall submit a Monthly Update Report.
- B. The Monthly Update Report shall consist of:
 1. An updated CPM Network Diagram of the contract schedule, format as previously specified herein, and a compact disc containing an exact copy of the submittal. All data shall be written to disk via the Primavera Project Management (P6)®, Microsoft Project® Backup, or equal utility.
 2. A narrative which identifies the work actually completed and reflects the progress along the critical path in terms of days ahead of or behind the contract milestone dates. Specific requirements of the narrative are as follows:
 - a. If the Monthly Update Report indicates an actual or potential delay to the contract milestone dates, the narrative shall identify the problem, cause, and the activities affected.
 - b. The narrative shall also address the following:
 - 1) A detailed change in duration of any activity and/or logic changes to activities which were performed in a sequence different from the accepted contract schedule.
 - 2) Activities proposed to be added to or deleted from the contract schedule.
 - 3) Identification of executed change orders.
 3. Incorporation of all Port-accepted schedule revisions.
 4. The mutually agreed-to Monthly Update Report shall be the basis for evaluating the Contractor's progress. Documents in a single Monthly Update Report shall have the same data date irrespective of the dates of preparation of the individual documents.
 5. If the latest completion time for any required contract milestone date as indicated by the current Monthly Update Report does not fall within the time allowed by the contract, the Contractor shall prepare and submit a plan to recover the lost time.
- C. The Port may call for more frequent status meetings (weekly, biweekly, etc.), at no additional cost to the Port, at which the Contractor shall provide the required information.
- D. Review of Monthly Update Report:
 1. The Port will review the monthly report and respond within 7 days after receipt.
 2. If necessary, the Contractor shall resubmit within 7 days of receipt of review comments.
- E. Applications for Payment: Submission of monthly schedule updates shall accompany applications for progress payments, and will be a condition of payment.

3.3 PROGRESS MEETING SCHEDULES

- A. During on-site construction, at each progress meeting, provide a one week back and three-week forward activity schedule. This schedule shall be in Gantt bar chart form and include, but not be limited to, reporting of the following:
 - 1. Detailed listing of specific work items, duration of work items, actual work hours, resources to be used in accomplishing work items, work area closing and opening dates and times, operational impacts, and other pertinent items.
 - 2. The weekly progress meeting schedules shall be submitted not less than 24 hours in advance of the scheduled progress meeting.

3.4 SCHEDULE MONITORING

- A. If the progress of critical path activities falls behind the time lines shown on the latest, accepted version of the CPM schedule by 7 days, the Contractor shall document the means it will employ to bring work back on schedule.

3.5 CONTRACT SCHEDULE REVISIONS

- A. Proposed revisions to the accepted contract schedule shall be submitted to the Port on a separate fragnet for review and acceptance prior to incorporation into the current contract schedule. This fragnet shall clearly outline the impact of the revision within the context of the contract schedule. Each proposed revision shall be submitted with the following minimum components:
 - 1. A CPM Network Diagram showing revised and affected activities.
 - 2. An Activity Report and Predecessor/Successor Report for all revised and affected activities.

3.6 CONTRACT TIME ADJUSTMENTS

- A. Float is not for the exclusive use or benefit of either the Port or the Contractor. Extensions of time for contract performance as specified in the contract will be granted only to the extent that time adjustments to the affected work items exceed the total float time along the affected path(s) of the contract schedule current at the time of the delay.

3.7 AS-BUILT SCHEDULE AND DOCUMENTATION

- A. Within 15 days after substantial completion, the Contractor shall submit for the Port's acceptance a final, as-built CPM Network Diagram.

3.8 SUSPENSION OF PAYMENTS

- A. If the Contractor fails at any time to submit a schedule or update as noted above, the Port reserves the right to suspend progress payments wholly or in part until the Contractor submits a schedule which is accepted by the Port.

END OF SECTION 013200

SECTION 013300 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes administrative and procedural requirements for all types of submittals.

1.2 PROCESS, CONTENT, AND FORMAT – ALL SUBMITTALS

- A. Unless specified otherwise in the applicable technical sections, transmit submittals electronically using the Port's online construction management system as described in this section. See the General Conditions for information regarding account set up and system access requirements. The Contractor shall also use Adobe Acrobat X Professional software, Bluebeam, or pre-bid approved equal, as part of this process.
- B. Update the Submittal Register and create submittal packages in the Submittals module of the Port's online construction management system.
- C. Accepted Submittal Attachment File Types:
 - 1. PDF: Each file shall be a resolution of 300 dpi or greater.
 - 2. DOC, DOCX, XLS, XLSX: Convert these file types to PDF format prior to submission. If this is not possible, only one Microsoft Word document and/or one Excel document is allowed for each submittal.
 - 3. The use of any other file types requires the Port's approval prior to submission.
- D. Organize each submittal by specification section and paragraph number as directed by the Port. Do not include items from more than one specification section per submittal package.
- E. Include the following information with each submittal:
 - 1. The names of: The subcontractor, supplier, and manufacturer.
 - 2. Identification of product or material, with the appropriate specification section and paragraph number marked on each item.
 - 3. Relation to adjacent critical features of work or materials. A clearly detailed sectional drawing of each system, identifying all components and their method of attachment to supporting structure, adjacent Contractor-designed work, or both.
 - 4. Field dimensions, clearly identified as such.
 - 5. Applicable standards.
 - 6. Identification of deviations from contract documents. Products shall be accompanied by a substitution request form.
 - 7. The Contractor's stamp.
- F. Resubmission Requirements:
 - 1. Revise initial submittals as directed by the Port and create a revision of the submittal package in the Port's online construction management system to resubmit as specified for the initial submittal.
 - 2. Indicate on the submittals any changes which have been made to the initial submittal.

- G. If the submittal content includes material samples, systems manuals, or operation and maintenance manuals, or if requested by the Port, the following revisions to this article shall apply:
 - 1. Complete an electronic submittal in the Port's online construction management system, noting in the Comments section that hard copies are being forwarded under separate cover.
 - 2. Submit three packages of sorted and collated documentation and samples.

1.3 SHOP DRAWINGS

- A. Submit complete shop drawings as required by the applicable technical sections.
- B. Present data in a clear and thorough manner.
 - 1. Drawings shall be identified by reference to the specification section and paragraph number when the item is called out in the specifications and by the original sheet and detail number, schedule, or room numbers when the item is shown on the drawings.
 - 2. Structural items shall be identified by location in the completed structure.
- C. Shop drawing quality:
 - 1. All line work shall be clean and crisp with no feathering or fading.
 - 2. Line work important to the drawing shall be emphasized by increasing the line weight and density.
 - 3. Text size shall be a minimum of 1/8 inch in height and shall be Helvetica style font.
 - 4. Notes shall be clear and concise.
 - 5. CAD-generated drawings are preferred.

1.4 PRODUCT/MATERIAL DATA AND OTHER INFORMATION

- A. Submit for Port review prior to commencement of related on-site work all product/material data and other information required by the applicable technical sections.
- B. Product/material data consists of manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data. Catalog cuts or brochures for items which are standard products shall show the type, size ratings, style, color, manufacturer, and catalog number of each item and be complete enough to provide for positive and rapid identification in the field. Catalog data shall be organized by specification section and paragraph number. Each product/material data item shall be clearly marked and annotated with the appropriate specification section and paragraph number. General catalogs or partial lists will not be accepted.
 - 1. Clearly mark each copy to identify pertinent product, or models.
 - 2. Show dimensions, weights, and clearances required.
 - 3. Show performance data consisting of capabilities, RPM, KW, pressure drops, design and operating pressures, temperatures, performance curves, noise level curves, power characteristics and consumption; conforming as closely as possible to the test methods referenced in the drawings and specifications.
 - 4. Show wiring or piping diagrams and controls.
 - 5. Modify manufacturer's standard schematic drawings and diagrams to indicate which information is not applicable.
 - 6. Supplement standard information to provide information specifically applicable to the work.

1.5 WARRANTY OUTLINE

- A. Within 30 days of Notice to Proceed, submit an outline of warranties required in the contract documents. Include a list of associated products and services, and available warranty requirements such as for registration, inspection, installation, etc.
- B. See the technical specification sections for specific warranty requirements.

1.6 SAMPLES

- A. Office Samples:
 - 1. Provide samples of sufficient size and quantity to clearly illustrate the item.
 - 2. Show functional characteristics of product or material, with integrally related parts and attachment devices.
 - 3. Provide full range of color samples.
 - 4. After review, samples may be used in the work, if approved by the Port.
- B. Where “match sample” is specified, the Contractor’s samples shall match the Port’s existing sample.
- C. Field Samples and Mock-Ups:
 - 1. Construct, at the work area, at a location acceptable to the Port.
 - 2. Size or Area: As specified in the respective specification section.
- D. Submit the number and type stated in each specification section, or two copies, whichever is less.

1.7 OPERATION AND MAINTENANCE MANUALS

- A. Prior to preparation and 10 weeks prior to the anticipated date of substantial completion, submit to the Port proposed outlines of operation and maintenance manuals. In an effort to produce comprehensive, high quality, useable manuals, provide examples and preliminary information when available. Within specified submittal review period, the Port will review and return comments.
- B. At least 45 days prior to anticipated date of substantial completion submit an electronic copy of draft operation and maintenance manuals. Within specified submittal review period, the Port will review and return with comments.
 - 1. The draft manuals shall be indexed and organized by specification section and paragraph number. Clearly mark each item with the appropriate specification section and paragraph number.
 - 2. Data shall include, but not be limited to, manufacturer’s catalog information, shop drawings, installation, startup, and operation and maintenance guides, warranty requirements and forms, recommended spare parts list, wiring and termination diagrams, control system schematic diagrams, operators’ and programmer’s manuals, field and factory test reports, equipment performance curves, calculations and certifications, and other information needed for startup, operation, troubleshooting, preventative maintenance, repair, restoration, and overhaul of systems and equipment.

- C. Submit two sets and an electronic copy of interim operation and maintenance manuals for work areas, systems, or equipment that will be complete and available for beneficial use prior to substantial completion of the entire project.
1. Submit interim operation and maintenance manuals with similar information and format to the final operation and maintenance manuals.
 2. Prior to beneficial use of system and maintenance instruction, each interim operation and maintenance manual shall have successfully completed the review process.
 3. Interim operation and maintenance manuals shall be comprehensive to ensure safe and orderly operation and maintenance of equipment and system.
 4. Information provided in interim operation and maintenance manuals shall be included in the final operation and maintenance manual. The interim operation and maintenance manuals will be discarded after the final operation and maintenance manuals have successfully completed the review process.
- D. At substantial completion, submit an electronic copy of final operation and maintenance manuals. Allow 15 days for the Port to review and return with comments. Within 30 days following substantial completion, revise and resubmit those items noted as deficient.
- E. As a condition of final acceptance, submit two complete sets and an electronic copy of final operation and maintenance manuals.
- F. Hard copy manuals shall be clearly organized and loose-leaf bound, complete with information needed or useful for the continued operation, maintenance, and repair of the system. If the Contractor's standard maintenance manuals and parts catalogs apply to more than one model or size of unit, cross out nonapplicable data.
1. The binders shall be D-ring and maximum 3-inch.
 2. Do not overfill the binders.
 3. Organize with tabs to match specification section and section title. Organize in order of specification section number and paragraph number.
 4. Include an index at the beginning of each new section listing all the items included in that section.
 5. Warranty documentation shall be submitted in a separate binder and not combined with material from other divisions.
 6. Mechanical, electrical, and baggage conveyor divisions shall be in separate binders and not combined with material from other divisions.
- G. The electronic copy of the manual shall have specifications bookmarked in accordance with the manual's index.
- H. Manuals shall include:
1. A cover page containing the name and date of the project, the Contractor's company name, address, and telephone number, the names of the Contractor's project managers and foremen. Additionally, if applicable, list the company names, addresses, telephone numbers, and staff personnel of subcontractors utilized on the project.
 2. A detailed table of contents for all items included in each division and section.
 3. For each section include a separate tab with all applicable information in that section. Include for each of these items:
 - a. The supplier's company name;
 - b. The local representative's name and telephone number;

4. A complete copy of as-constructed data, including the following:
 - a. Copy of approved product and material data, including description of the equipment, products, quantities supplied, and physical locations;
 - b. Operating data, operating instructions including sequence of operation and response to the total system;
 - c. Maintenance data, installation, repair, overhaul, and maintenance instructions, including adjustments, tolerances, and replacement and repair procedures; recommended practices, logic diagrams, and diagnostic and troubleshooting procedures; and preventative maintenance procedures and schedules.
 - d. Updated shop drawings, including illustrations and/or exploded views identifying each part and subassembly by name, applicable catalog or part number; schematics of electrical, electronic, and any other type of control equipment, and electronic circuit board diagrams, in a separate manual, for all printed circuit diagrams, including parts lists with commercial part numbers. Manufacturers' part numbers will not be acceptable. The Port acknowledges the proprietary nature of circuit diagrams. Subject to the requirements of evaluation of the manufacturer and public disclosure laws, the Port will endeavor to protect against unnecessary disclosure of information, drawings, or design details so designated. Shop drawings shall be updated to accurately show changes made during fabrication, installation, or final adjustment. Include electronic files of the native CAD-generated format.
 - e. Manufacturer and service provider warranty procedures, receipts, completed reports, registrations and questionnaires, purchaser responsibilities, certification requirements, and any other documentation necessary for the Port to avail itself of the full benefit of all warranties required in the contract documents.
 - f. Test reports, certificates, calculations, valve tag directory, equipment nameplate directory, and other information which would be required by an owner to be able to operate and maintain that equipment.
 - g. Recommended spare parts list noting the location of each item, and a cross-reference to local available sources.
 - h. Software documentation, in a separate user's manual, with complete description of all functions, including sample written programs and reports.
 - i. Johnson Controls data in a separate manual, which shall include: system drawings, equipment data, software data, testing submittals, and operating and maintenance data (hardware manual, software manual, operator's manual, and maintenance manual).
 - j. Balancing report in a separate manual, including logs, equipment data sheets, and instrument certification.
 - k. Fire protection data in a separate manual, including certified shop drawings, product data, test reports, operating and maintenance data, and as-built drawings.

I. Cross out non-applicable data from the Contractor's standard maintenance, operation, or software manuals or parts catalogs which include data for other models.

J. See technical specification sections for additional operation and maintenance manual requirements.

1.8 OPERATIONAL AND FUNCTIONAL TESTING PLANS, PROCEDURES, AND REPORTS

A. For each new system tested by the Contractor, submit copies of the test plan for each testing phase for review by the Port. Detail the objectives of all tests. The tests shall clearly demonstrate that

the system and its components fully comply with the requirements specified in the contract documents. At a minimum, define participant responsibilities, documentation for tests, duration and schedule of tests, explicit requirements to demonstrate contractual compliance, and procedures for dealing with discrepancies and failures during the test. Unless specified otherwise, submit test plan no less than 30 days prior to the scheduled start of the first test.

- B. Test Procedures: Submit copies of the test procedures document which shall be the means by which all tests specified in the test plan are executed. Unless specified otherwise, submit test procedures for each test to the Port for review 60 days prior to the start of each test. Describe each step-in detail such that an operator would need no other document or prior knowledge of the system to execute the test. Divide test procedures into logical sections and as a minimum include in each section:
1. A statement of purpose so that the goals and methods of testing can be understood.
 2. An outline of the section, if further subdivision is required.
 3. A specification of the equipment, component, hardware, and/or software to be tested in that section.
 4. A specification of the software, equipment, hardware and/or data communications, required to execute that section.
 5. Installation Test Procedure form, to be used during testing for initialing by the Port and the Contractor. Include in the form:
 - a. Test number, name and description for each test.
 - b. Step-by-step procedures, providing the expected response for each step and providing space for the actual response.
 - c. Space for approval by both the Port and the Contractor at each test.
 6. An overall test schedule that includes time for unstructured testing.
- C. Test Report: Prepare, for each test, a test report document which shall certify successful completion of that test. Submit copies of the test report to the Port for review and acceptance within seven days following each test. The test report shall contain, at a minimum:
1. Commentary on test results.
 2. A listing and discussion of all discrepancies between expected and actual results and of all failures encountered during the test and their resolution.
 3. Complete copy of test procedures and test data sheets with annotations showing dates, times, initials, and any other comments entered during execution of the test.
 4. Signatures of persons who performed and witnessed the test.
 5. Graphs, tables, and charts necessary for the execution of the test.

1.9 REDLINE (AS-CONSTRUCTED) DRAWINGS

- A. At the start of construction, the Port will provide the Contractor with a full-sized set of drawings for use in recording changes that develop during construction. These changes shall be shown on the drawings as “redlines” using red pencil or pen to indicate the actual installation where it varies appreciably from the installation shown originally.
1. Special attention shall be paid to legibility and reproducibility of redline drawings. Give particular attention to information on concealed elements which would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:
 - a. Dimensional changes to the original drawings.
 - b. Changes to details shown on the original drawings.
 - c. Depths of foundations below the first floor.

- d. Locations and depths of underground utilities (if different by more than 1 inch in depth or more than 1 foot in location).
 - e. Changes to routing of piping and conduits (if different by more than 1 foot from where shown).
 - f. Changes to electrical circuitry.
 - g. Actual equipment locations, including baggage conveyor, if applicable (located to within 1 inch).
 - h. Routing and size of ductwork, piping, and conduit (located to within 1 inch).
 - i. Locations of concealed internal utilities (located to within 1 inch).
 - j. Details not on original drawings.
 - 2. Completely and accurately redline contract drawings.
 - 3. All attached documents to the redline drawings shall reference original drawings and sheet numbers.
 - 4. Redline important additional information which was either shown schematically or omitted from original drawings.
 - 5. Note construction contract change numbers, alternate numbers, change order numbers, RFI numbers, and similar identification.
 - 6. Accurately record information in an understandable drawing technique.
 - 7. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the redline prior to concealment.
- B. Store the Contractor's redline drawings in the field office, apart from contract documents used for construction. Do not permit redline drawings to be used for construction purposes. Maintain redline drawings in good order, and in a clean, dry, legible condition.
- C. The Contractor's redline drawings shall be available at all times for inspection by the Port.
- D. As a condition of final acceptance:
- 1. Submit the final redline drawings in both electronic and hardcopy format for Port review and approval. Revise and resubmit any items noted as deficient.
 - 2. Submit final updated shop drawings.

1.10 TRAINING PLANS

- A. Thirty days prior to scheduled commencement date of training sessions, submit a final course schedule and outline for each training course to be conducted for Port personnel.
- B. In addition to the subject matter, include in each course outline a short review of the prerequisite subjects (where appropriate); how this course fits into the overall training program; the objective; the standards of evaluation; and any other topics which will enhance the training environment.

1.11 APPRENTICE UTILIZATION PROGRAM

- A. See the Supplementary Conditions for submittals required under the Port's apprentice utilization program.

END OF SECTION 013300

SECTION 013513 - AIRPORT SECURITY, SAFETY, AND OPERATING REGULATIONS

PART 1 - GENERAL

1.1 AIRFIELD SECURITY

- A. The Contractor shall maintain security against unauthorized access to the airfield area through openings in the building exterior, which are within the work area, into portions of the Sterile Area and/or Restricted Area.
- B. Modifications to the airport security perimeter requires a 45-day notice to the TSA. The Port will submit the application for any changes required and the Contractor shall provide information regarding schedules, phasing, temporary measures, materials, methods, etc. Changes to the access control system requires close coordination and active communications between the Port and TSA thus the Contractor may be required to provide additional information during the 45-day review period.
- C. Access to the work site located within the Restricted Area shall be through the project security gate as shown on the drawings. If requested, the Port will provide a security officer at this gate who will control access to the Restricted Area. Valid PDX security badges and appropriate vehicle markings will be verified at each checkpoint. Individual vehicles and/or contents may be subject to inspection.
- D. The Contractor may be allowed to construct a temporary opening in the security fence provided need and location are approved by the Aviation Security Department. Temporary openings are allowed for no more than 60 days, unless otherwise approved by the Aviation Security Department. If a temporary opening is authorized, the Contractor shall provide a security officer to attend the opening in the security fence during the hours of operation. The Contractor-provided security officer(s) shall meet all entry control requirements as directed by the Port.
- E. Temporary openings in the security fence shall be properly secured when not in use or when they cannot be attended to by the authorized officer. Secure temporary openings with replaceable panels, temporary fencing, or a locked gate when not in use. Gates in temporary openings shall be locked with Port-provided locks. Only the Port will retain a key. The Contractor shall make arrangements with the Port to unlock such gates.
- F. Temporary fence replacement panels and gates shall provide the same level of security and protection against unauthorized access as the adjacent security fence. Temporary fences may utilize undamaged salvaged fence materials. Fence materials need not be galvanized, and posts may be driven. Temporary fence or gate fabric shall be 7 feet high, woven with 9-gauge carbon steel in a 2-inch mesh, and topped with 1-foot-high extension brackets and 3 strands of barbed wire. Temporary terminal posts shall be round, 2.875 inches O.D., and 5.79 pounds per foot. Line posts shall be round, 2.375 O.D., and 2.27 pounds per foot. No more than a 2-inch gap at the bottom of the fence will be allowed. Top rail need not be used provided a 7-gauge steel tension wire is utilized. Use of such panels is subject to the Port's approval.

- G. All equipment and vehicles shall be positioned a minimum of 10 feet away from either side of the perimeter security fence.

1.2 REGULATIONS FOR CONTRACTORS

- A. This section contains rules and regulations related to construction activities at Portland International Airport (PDX). To the extent that any rules and regulations contained in this section conflict with the rules and regulations now or hereafter adopted by the Port (PDX Rules), the PDX Rules shall control.
- B. The regulations contained in this section and the PDX Rules are subject to change at any time without notice. Current PDX Rules can be found on the Port's public website at https://popcdn.azureedge.net/pdfs/PDX_Rules.pdf.

1.3 DEFINITIONS AND ABBREVIATIONS

- A. Air Operations Area (AOA): This area includes aircraft movement areas, aircraft parking areas, loading ramps, and safety areas for use by aircraft regulated under FAA and TSA regulations, and any adjacent areas (such as general aviation areas) that are not separated by adequate security systems, measures, or procedures. This area does not include the Secured Area but is part of the Restricted Area (RA). The AOA is a Security Identification Display Area (SIDA).
- B. Airport Duty Manager: Airside operations staff who is responsible for managing the day-to-day operations on the airfield.
- C. Airport Security Coordinator (ASC): The person appointed by the airport operator to serve as the primary and immediate contact for security-related activities and communications with TSA.
- D. Airport Security Program (ASP): A PDX security program that describes security measures, policies, and procedures which are mandated and regulated by the TSA.
- E. Apron: All areas and facilities used for aircraft support and servicing operations. It includes the following subcomponents:
 - 1. Aircraft parking positions - used for parking aircraft to enplane and deplane passengers, load or unload cargo.
 - 2. Aircraft service areas - on or adjacent to an aircraft parking position. These areas are used by airline personnel/equipment for servicing aircraft and staging baggage, freight, and mail for loading and unloading of aircraft.
 - 3. Taxilane - reserved to provide taxiing aircraft with access to and from parking positions.
 - 4. Service/Fire lanes - identified routes on apron designated for aircraft ground service vehicles and fire equipment.
- F. Authorized Signatory: Person(s) named by each Contractor employee who will sign for the company's PDX security badges and will validate that each applicant from their company and any subcontractors have a valid need for a PDX security badge and construction keys.

- G. Criminal History Record Check (CHRC): A review of a fingerprint-based criminal history record to determine if a person has been convicted of a disqualifying crime as mandated in TSR §1542.209.
- H. Central Utility Plant (CUP) environment: Areas restricted to public access within the fenced area surrounding the CUP or within the CUP itself.
- I. Equipment: Every self-propelled vehicle not capable of being used on a street or roadway.
- J. Ground control procedures: System of metering aircraft access between the parking and movement area that is controlled by the FAA Airport Traffic Control Tower (ATCT).
- K. Loading bridge: A device that facilitates the movement of passengers to/from a terminal gate to/from a parked aircraft.
- L. Movement area: The area of an airport open and used by aircraft for taxiing, takeoff, and landing. Aircraft or vehicle operations within this area require an air traffic control clearance.
- M. Operations Impact Coordinator: The person who is responsible for coordinating all operational impacts resulting from airside and landside construction/maintenance projects.
- N. Restricted Area (RA): All the areas within the perimeter fence, including the SA and AOA, are classified as Restricted Areas and access is limited to those personnel who possess and appropriately display PDX security badges issued in accordance with this ASP. The GA is the only non-SIDA portion of the RA.
- O. Ramp: Paved areas adjacent to runways and taxiways where aircraft are positioned for servicing or parking.
- P. Secured Area (SA): The area around the terminal where aircraft operators enplane and deplane passengers and sort and load baggage, and any adjacent areas not separated by adequate security measures. The SA is designated as a SIDA.
- Q. Security gate: Any controlled, securable opening in the security fence.
- R. SIDA: Security Identification Display Area.
- S. Security Threat Assessment (STA): The TSA process of verifying that an individual is not a threat to civil aviation security by checking the individual against various U.S. Department of Homeland Security records.
- T. Sterile Area: The area in the terminal beyond the security screening checkpoints providing access to aircraft boarding gates and to which access is controlled by the TSA through the screening of persons and property.
- U. Terminal gate: An area where passengers enplane and deplane to/from an aircraft.
- V. Transportation Security Administration (TSA): The U.S. federal agency under the Department of Homeland Security responsible for regulating aviation security standards.

- W. Vehicle: Every licensed, self-propelled vehicle capable of being used on a street or roadway.
- X. Work Area: Limits of work established by a perimeter boundary shown on the drawings or otherwise designated by the Port.

1.4 PERSONNEL SECURITY REGULATIONS

A. Access to Restricted Areas (Secured Area, AOA, CUP) and Sterile Areas:

1. The Contractor shall obtain and thoroughly review all PDX security badging requirements and PDX Rules pertaining to badging and airport security before commencing any work under this contract. Copies of security and badging information, and PDX Rules are available from the Port upon request. The Contractor shall warrant and ensure that any person who receives a PDX security badge meets all of the requirements for having a badge.
2. No personnel will be permitted within the airfield, CUP, Restricted Area, or Sterile Area environment without PDX security badges or authorized escorts. PDX security badges shall be obtained through the PDX Security Badging Office once all requirements have been met. Security training and fingerprint appointments shall be scheduled through the PDX Security Badging Office.
3. PDX security badges will be issued at the sole discretion of the Port and only to personnel physically working in the Airfield, CUP, Restricted Area, or Sterile Area environments.
4. All unbadged Contractor personnel, subcontractor personnel, material delivery personnel, or visitors with a legitimate business need shall be escorted by an individual who has been issued a valid PDX Secured Area badge in the Secured Area or a valid PDX AOA badge in the AOA locations. An individual with an appropriate and valid PDX security badge with an 'E' icon may escort no more than three unbadged personnel at any one time. Without exception, the PDX security badged individual shall stay within 10 feet of the people they are escorting and be within sight and sound at all times. All escorts must be registered at <https://www.pdx.com/escort>. Escorting may not be used to avoid the badging application process. An individual who has been disqualified through the CHRC or STA process will not be allowed access to the Secured Area, AOA, CUP, and Sterile Area; no exceptions will be made and escorting is not authorized. Contractor personnel can only be escorted up to five times within the course of a year.
5. The Contractor shall ensure that its employees, agents, subcontractors, suppliers or other invitees obtain PDX security badges and wear the badges provided by the Port at all times, or be escorted, when they are engaged in work at the airport. The PDX security badge shall be worn on the outermost garment above the waist and in plain view of those interacting with the employee. The Contractor shall ensure that any PDX security badge provided by the Port is returned promptly to the PDX Security Badging Office when the person to whom the PDX security badge was provided leaves the Contractor's employment, no longer engages in work under this contract at the airport, or has an expired PDX security badge.

B. Additional Access Requirements for Sterile Areas:

1. In addition to requirements of Paragraph 1.4 A, above, access to Sterile Areas necessitates the following be met:
 - a. Tools and other prohibited items may not be carried through any TSA-controlled security screening checkpoint into the Sterile Area. Arrangements shall be made for delivery of tools into the Sterile Area from the Secured Area. Tools and other prohibited items carried or utilized in the Sterile Area shall be under the direct

control of the Contractor at all times, and shall not be left unattended and unsecured in the Sterile Area. Failure to adhere to this requirement will prompt an investigation as a violation of the ASP and PDX Rules.

- b. No Contractor personnel may enter the Sterile Area in a manner that circumvents security screening at a TSA-controlled security screening checkpoint and board a plane as a passenger.

C. Airport Security Identification Badges:

1. All PDX security badge applicants will be required to complete a CHRC and STA prior to issuance of a PDX security badge. The background check information will be evaluated for disqualifying criminal convictions before a PDX security badge is issued. Applicants authorized to receive PDX security badges shall successfully complete PDX security badge and applicable construction and endorsement/icon training classes provided by the Port. The average background investigation process takes approximately 3 days to 1 week. However, it may take 1 to 4 weeks to gain applicant approval in some situations.
2. There are four main types of PDX security badges and four endorsement/badge icons:
 - a. Badges:
 - 1) AOA Badge: This purple photo identification badge shall be worn by all Contractor personnel (including subcontractors) who are working in AOA areas of the airport and are not authorized to enter the Secured Area and Sterile Area.
 - 2) Secured Area Badge: This red photo identification badge shall be worn by all Contractor personnel (including subcontractors) who enter the Secured Area.
 - 3) Sterile Area Badge: This gray photo identification badge shall be worn by all Contractor personnel (including subcontractors) who enter the Sterile Area without needing access to the AOA or Secured Area.
 - 4) General Aviation Badge: This blue badge shall be worn by all Contractor personnel (including subcontractors) who are working in general aviation areas.
 - b. Endorsements/Badge Icons:
 - 1) All endorsements/icons will be issued at the sole discretion of the Port.
 - 2) 'C' Construction Endorsement/Icon: Designates that an individual is employed by a Contractor or subcontractor. Computer-based training is required for airfield construction.
 - 3) 'D' Restricted Area Driver Endorsement/Icon: This icon authorizes personnel to drive vehicles in the non-movement portions of the airfield. Issuance of this icon requires the individual to complete the computer-based Non-Movement Area Driver course in the Security Badging Office.
 - 4) 'E' Escort Endorsement/Icon: This icon authorizes personnel to escort up to three individuals and/or three vehicles in Restricted Areas. Escort training is included in security badge training for all badge holders. Issuance of this icon is at the discretion of the Contractor's Authorized Signatory and no additional training is required.
 - 5) 'F' Flagger Endorsement/Icon: This icon authorizes personnel to conduct flagging services on the airfield. Prior to issuance, individuals must complete a flagger hands-on training class in addition to all applicable security badge and construction training.
 - 6) 'M' Movement Area Driver Endorsement/Icon: This icon authorizes personnel to drive vehicles within the movement area of the airport (runways and taxiways). Prior to issuance, individuals must complete a computer-based

Movement Area Driver training course, employer-provided driver training, and a check-ride with the PDX Airport Operations Department.

- 7) 'P' Pilot Car Escort Driver Endorsement/Icon: This icon authorizes individuals to escort up to three construction vehicles on the airfield without completing an escort registration. Prior to issuance, individuals must complete a Construction Driver computer-based training course and hands-on training with the PDX Airport Operations Department.

D. The Contractor shall submit to the Port the names of those Authorized Signatories who have the authority to sign for all Contractor and subcontractor personnel.

1. The Authorized Signatories will be required to obtain and maintain a PDX security badge.
2. In addition, the Authorized Signatories shall complete an Authorized Signatory training course and all training courses associated with applicable endorsement/icon training courses.

E. The Contractor's Authorized Signatories shall be responsible for the following:

1. Submitting accurate and complete PDX security badge new and renewal application information to the PDX Security Badging Office for all Contractor and subcontractor personnel scheduled to receive Secured Area access badges, AOA access badges, Sterile Area access badges, or General Aviation access badges. Application information shall be submitted via the Authorized Signatory Portal or a paper application.
2. Ensuring that each applicant brings valid identity and employment eligibility documents to the PDX Security Badging Office as outlined below. Applicant may either present a document from List A or shall present documents from both List B and List C. All applicants shall present original and unexpired documents. Acceptable forms of identification and eligibility shall consist of the following:
 - a. List A (documents that establish both identity and employment eligibility):
 - 1) U.S. Passport or U.S. Passport Card.
 - 2) Permanent Resident Card or Alien Registration Receipt Card (Form I-551).
 - 3) Foreign passport that contains a temporary I-551 stamp or temporary I-551 printed notation on a machine-readable immigrant visa.
 - 4) Employment Authorization Document containing a photograph (Form I-766).
 - 5) In the case of a non-immigrant alien authorized to work for a specific employer incident to status, a foreign passport with Form I-94 or Form I-94A bearing the same name as the passport and containing an endorsement of the alien's non-immigrant status, as long as the period of endorsement has not yet expired and the proposed employment is not in conflict with any restrictions or limitations identified on the form.
 - 6) Passport from the Federated States of Micronesia (FSM) or the Republic of the Marshall Islands (RMI) with Form I-94 or Form I-94A indicating non-immigrant admission under the Compact of Free Association Between the United States and the FSM or RMI.
 - b. List B (documents that establish identity):
 - 1) Driver's license or ID card issued by a state or outlying possession of the United States provided it contains a photograph or information such as name, date of birth, gender, height, eye color, and address.
 - 2) ID card issued by federal, state, or local government agency or entity provided it contains a photograph or information such as name, date of birth, gender, height, eye color, and address.
 - 3) School ID card with a photograph.

- 4) Voter's registration card.
 - 5) U.S. military card or draft record.
 - 6) Military dependent's ID card.
 - 7) U.S. Coast Guard Merchant Mariner Card.
 - 8) Native American tribal document.
 - 9) Driver's license issued by a Canadian government authority.
 - 10) For persons under age 18 who are unable to present a document listed above:
 - a) School record or report card.
 - b) Clinic, doctor, or hospital record.
 - c) Daycare or nursery school record.
 - c. List C (documents that establish employment authorization):
 - 1) Social Security Account Number card other than one that specifies on the face that the issuance of the card does not authorize employment in the United States.
 - 2) Certification of Birth Abroad issued by the Department of State (Form FS-545).
 - 3) Certification of Report of Birth issued by the Department of State (Form DS-1350).
 - 4) Original or certified copy of a birth certificate issued by a state, county, municipal authority, or territory of the United States bearing an official seal.
 - 5) Native American tribal document.
 - 6) U.S. Citizen ID Card (Form I-197).
 - 7) Identification Card for Use of Resident Citizen in the United States (Form I-179).
 - 8) Employment authorization document issued by the Department of Homeland Security.
 3. The following additional requirements apply for employees born outside the U.S.:
 - a. If employees are not U.S. citizens, they shall provide an Alien Registration number or an I-94 Arrival/Departure number.
 - b. If employees hold non-immigrant visas, they shall present the visa number.
 - c. If employees are U.S. citizens born abroad, they shall provide either a U.S. Passport number, a Certificate of Naturalization number, or a Certification of Birth Abroad number.
 4. Ensure that each applicant for a PDX security badge provides the required identity and employment eligibility documents required by the Port and TSA for an STA and CHRC. Eligibility for a PDX security badge will be determined by screening applicants and existing badgeholders against federal regulations and against Port standards for criminal arrest and conviction history. The list of federal regulations and Port standards for criminal history can be found in the PDX Rules.
 5. Set appointment times with the PDX Security Badging Office to fingerprint and train applicants. Currently, fingerprinting and training are done Monday through Friday between the hours of 8 a.m. and 4 p.m.
 6. After the CHRC and the STA have been approved, the Contractor may then pick up its badge from the PDX Security Badging Office any time during business hours.
- F. At the pre-construction meeting, the Contractor shall submit an estimated number of Secured Area, AOA, Sterile Area, or General Aviation badges necessary to adequately perform the work. The Port will pay all fingerprinting, background, and badging processing costs for the estimated number of each type of PDX security badge. If the Contractor exceeds the estimated number by more than 25 percent, the Contractor will be charged a badge processing and background

(criminal history) check cost for each additional application requested. The current badge processing and criminal history check cost is posted in the PDX Security Badging Office and on the PDX Security Badging website. The cost for each Secured Area, Sterile Area, AOA, or General Aviation badge application denied will be deducted from any payments due.

- G. Report lost PDX security badges to the PDX Security Badging Office and/or Port police immediately. The charge for replacement of a lost PDX security badge is \$150 for the first occurrence and \$250 for the second. Badge reissuance after a third lost badge requires approval from the PDX Airport Security Coordinator. Any person who loses three PDX security badges will not be eligible to obtain additional badges.
- H. Prior to final acceptance of the work, the Contractor shall return all PDX security badges to the PDX Security Badging Office and obtain written acknowledgement from the PDX Security Badging Office of their return. Submit a copy of the written acknowledgement to the Port construction contract manager. At final acceptance of the work, \$1,000 will be deducted from the final payment for each PDX security badge not returned to the PDX Security Badging Office.
- I. Employees of Contractors who are continuously working on multiple airport projects without a break in service may keep their PDX security badges from project to project. PDX security badges are deactivated on the expiration date of each project. Personnel changing projects will not be required to repeat the Port training class if they have received security badge training, and they have not been without a PDX security badge for more than 30 days, unless a change in one or more endorsement/icon is requested. PDX security badges are valid for 1 year, and security and endorsement/icon training is valid for 2 years. The Port will pay the cost for badge renewal for badged Contractor employees assigned to the work. Contact the PDX Security Badging Office for additional guidance.
- J. If the Contractor fails to comply with any PDX security badge regulations described herein, the Port may stop the work until compliance is attained. The Contractor will also be subject to any fines levied against the Port, as described in Article 1.9, Remedies of the Port Upon Violation of Regulations Referenced or Contained in this section, as a result of its failure to comply.

1.5 CONSTRUCTION KEYS

- A. Non-Security Keys
 - 1. Non-security keys unlock doors or gates that do not provide direct access to any part of the Restricted Area, or any area with critical infrastructure components, as determined by the Port.
 - 2. To receive a non-security key, the Contractor shall follow the same process as for security keys.
- B. Security Keys
 - 1. Security keys unlock doors or gates providing direct access to any part of the Restricted Area or any area with critical infrastructure components, as determined by the Port.
 - 2. Security keys providing direct access to any part of the Restricted Area will be issued only to those persons in possession of valid PDX security badges which authorize unescorted access to that area.

- C. Application for Construction Keys
1. At the pre-construction meeting, the Contractor shall submit the estimated number of keys necessary to adequately perform the work.
 2. Security keys identifiable by the Port logo are not transferable.
 3. The Contractor or its Authorized Signatories shall submit key requests for all Contractor and subcontractor personnel scheduled to receive keys. Requests shall be submitted via the Authorized Signatory Portal or a paper application.
 4. Allow a minimum of 5 days to process key applications.
 5. Report lost keys to the PDX Security Badging Office immediately. The charge for replacement of a lost security key is \$50 for the first occurrence, \$100 for the second, and \$200 for the third. Any person who loses three keys will not be eligible to obtain additional keys.
 6. When keys are no longer needed for access to a Restricted Area or area with critical infrastructure components, the Contractor shall return it to the PDX Security Badging Office.
 7. At final acceptance of the work, \$1,000 will be deducted from the final payment for each key not returned to the Port's badging office.

1.6 TRAINING INFORMATION

- A. As part of the requirements to obtain a PDX security badge, all Contractor personnel who will be working within the Restricted Area shall complete security badge training and, if applicable, endorsement/icon training classes with additional hands-on training conducted by the Port. Upon successful completion of training, the Port may issue an airfield driving permit for personnel required to operate vehicles within the Restricted Area such as superintendents, supervisors, foreman, and escorts. In accordance with FAA policy, driving permits will be kept to a minimum and only issued on an as-required basis, as determined by the Port.
- B. The Contractor shall contact the PDX Security Badging Office by calling 503-460-4500 to schedule training classes for all Contractor's and subcontractors' personnel. A limited number of people can be trained at one time. Training classes are available Monday through Friday at varying times. Personnel approved to receive a Flagger, Movement Area Driver, or Pilot Car Escort endorsement/icon shall successfully complete additional hands-on training with Airside Operations staff before the appropriate icons are added to the PDX security badge.
- C. The Contractor shall provide as much notice as possible, a minimum of 2 business days, to schedule training class requests for large PDX security badge groups.
- D. Classes will not be scheduled until the CHRC and STA have been completed and approved.
- E. The approximate duration of the training classes are as follows:
- | | |
|--|---------|
| 1. Security badge training class (no endorsements/icons) | 1 hour |
| 2. Security badge, Construction and Non-Movement driver training | 3 hours |
| 3. Security badge, Construction, and Movement Area driver training | 4 hours |
| 4. Flagger/Pilot Car Escort Driver | 2 hours |

1.7 DRIVING REGULATIONS

- A. The purpose of these regulations is to maintain the safety of vehicle operations in the Restricted Area.
- B. Enforcement of these regulations will be by Port police and Port Airside Operations.
- C. Violations of the regulations may be cause for the project to be stopped and project safety procedures evaluated. The Port will decide if and when work will continue.
- D. The driving regulations are as follows:
 - 1. Yield the right-of-way to moving aircraft, whether under tow or their own power, and pedestrians.
 - 2. Within the Restricted Area, equipment, vehicle, and personnel travel outside the work area is restricted to the route(s) shown on the drawings.
 - 3. Obey stop signs and markings.
 - 4. Do not drive under loading bridge or between an aircraft and a terminal gate.
 - 5. Under no circumstances may a vehicle drive between an aircraft and a terminal gate during ramp deplaning or enplaning of passengers.
 - 6. Yield right-of-way to emergency vehicles displaying rotating beacons (other than yellow) and/or using sirens and other audible emergency signals.
 - 7. Observe the posted speed limits.
 - 8. Regardless of a posted speed limit, a lower speed may be required in order to account for congestion, reduced visibility, slippery surfaces, or other hazardous condition. No vehicle shall be driven in a manner that endangers persons or property.
 - 9. The speed limit of off-ramp service roads (perimeter road) is 35 MPH or as posted.
 - 10. Non-motorized equipment shall have reflective devices displayed on the front, back, and sides.
 - 11. Operators shall have a current and valid state driver's license on their person.
 - 12. Do not leave the engine running on an unattended vehicle.
 - 13. Park unattended vehicles clear of service and perimeter roads.
 - 14. Loads being carried shall be contained by sufficient means to assure no loss of any portion of the load.
- E. Vehicles within the Restricted Area shall display professionally manufactured company identification markings on both sides of the vehicle. In accordance with FAA AC 150/5210-20A, decals, corporate signs, or company logos shall be at least 12 inches in diameter/square. Lettering shall be at least 3 inches in height with contrasting background color. Vehicles shall also be equipped with headlights, taillights, and flashers that shall be used between sunset and sunrise, or when visibility is low.
- F. Vehicles which operate unescorted within the Restricted Area but outside the work area shall be equipped with an omni-directional amber flashing light mounted above the cab, which can be seen from a distance of 300 feet, and which shall be used whenever the vehicles is within the Restricted Area. Such vehicles shall be operated by personnel possessing authorized PDX security badges and Port driving permits.
- G. When outside the work area, all Contractor personnel, vehicle, and equipment movement within the airside security fence shall be under control of the Contractor's personnel authorized by the Port to perform escort driver responsibilities with the Contractor's approved escort vehicle(s).

1. In addition to being equipped with the amber omni-directional flashing light and company identification markings described in Paragraphs E and F above, the Contractor's escort vehicle(s) shall have signs mounted on the front and back. Signs shall consist of a black background and yellow lettering containing the Contractor's name and the words, "ESCORT ONLY." Signs shall be readable from a distance of 300 feet. Escort vehicle(s) shall have an FAA orange and white checked flag, 3 feet by 3 feet minimum, attached to a pole mounted on the rear bumper, and visible from 300 feet at all angles.
2. Prior to assuming escort driver responsibilities, the escort vehicle driver shall possess an authorized PDX security badge with escort driver endorsement/icon.
3. The escort vehicle driver shall serve as liaison and shall be responsible for transporting all workers to and from the work area.
4. Personnel and vehicles authorized to be in the Restricted Area shall remain with the escort vehicle(s) while traveling to and from the work area.
5. Vehicles may be escorted in convoy formation. Convoy vehicles shall travel in close formation, and the escort vehicle driver shall control speed to maintain safety. Convoys shall normally consist of no more than three vehicles or two trucks and trailers plus the escort vehicle, unless otherwise approved by the Port.
6. All of the Contractor's activities within aircraft movement areas shall have an additional escort provided by Port personnel.

1.8 OTHER SECURITY AND SAFETY REGULATIONS

- A. No smoking will be allowed within the Restricted Area except as designated by the Port.
- B. Adequate hearing protection (earplugs or earmuffs) shall be furnished by the Contractor for personnel in AOA's to eliminate the chance of ear damage.
- C. While driving or working in the Restricted Area, there shall be no devices in or on ears other than those used to protect hearing or communicate company business.
- D. Use a guide person when it is necessary to back vehicles out of work areas within the Restricted Area.
- E. Confine parking, loading, and unloading of vehicles and equipment to within the work area.
- F. Construction equipment that extends 20 feet or more above ground level shall be approved by the Port prior to being moved onto worksite. Equipment that may be lowered readily shall be lowered at night, during reduced daytime visibility, and when not in use.
- G. If directed by the Port, construction equipment that cannot be lowered below the 20-foot height limitation shall be lighted at night and during periods of reduced daytime visibility. Light shall be mounted on highest point of equipment; shall be omni-directional; and shall consist of, as a minimum, one 100-watt bulb or equivalent A19 or A21 LED enclosed within an aviation red lens. Also, for daytime operations, mount an FAA-approved three-foot-square orange and white checkered flag at the high point.
- H. Place barricades or stakes around perimeters of work areas as shown on the drawings. Work area limits shall be staked with 3-foot stakes at 50-foot intervals in areas of dirt or grass.

- I. All radio communication with FAA ground control will be coordinated through Port Airside Operations and performed by Port personnel only.
- J. Ensure that the Restricted Area is kept continuously free of construction debris, equipment, and/or materials that might endanger or be ingested by aircraft.
- K. The use of caution tape is not allowed within the Restricted Area.
- L. For emergency purposes, all escort vehicles shall be equipped with radio, telephone, or similar devices for contact by Port security or operations personnel. In the event of an emergency, be prepared to move workers, vehicles, and equipment immediately at the direction of the Port.
- M. Report emergencies to the Port and to the airport communications center (503-460-4000).
- N. When cranes are used, the following requirements shall be met:
 - 1. An FAA-approved, 3-foot orange and white checkered flag and a solid red light shall be mounted at the highest point on the crane.
 - 2. During daylight hours with severe visibility problems or heavy fog, cranes shall not operate.
 - 3. The Port will determine when visibility problems exist and will coordinate and designate requirements for position and location of flag and light.

1.9 REMEDIES OF THE PORT UPON VIOLATION OF REGULATIONS REFERENCED OR CONTAINED IN THIS SECTION

- A. In addition to any other rights or remedies that the Port may have in the event that the Contractor, subcontractor, anyone directly or indirectly employed by any of them, and anyone for whose acts any of them may be liable fails to comply with the regulations referenced or contained in this section, the Port shall have the right to:
 - 1. Revoke the PDX security badge, superintendent endorsement/icon, escort driver endorsement/icon, flagger endorsement/icon, or driving permission of the offending individual and/or the Contractor permanently or for a prescribed period of time.
 - 2. Suspend the work or any portion thereof and continue the suspension until completion of any investigation or evaluation by the Port and full compliance with any corrective measures which the Port may reasonably require.
 - 3. Require the Contractor to provide to the Port a written plan, satisfactory to the Port, to demonstrate the Contractor's ability to prevent future violations.
- B. The Contractor shall be fully liable to the Port for any costs or damages incurred by the Port as a result of any breach of security or violation of security regulations by the Contractor. The Contractor shall also be liable to reimburse the Port for any fines, penalties, assessments, judgments or other costs imposed upon the Port as a result of the Contractor's breach of security or violation of security regulations, as described herein. As used herein, reference to the Contractor shall include all of its employees, agents, subcontractors, suppliers, or other invitees.
- C. The Contractor shall defend, indemnify, and hold harmless the Port against any and all claims of any nature made against the Port by any party resulting, in whole or in part, from the Contractor's breach of security or security violations. Defense shall be provided by legal counsel acceptable

to the Port. As used herein, reference to the Contractor shall include all of its employees, agents, subcontractors, suppliers, or other invitees.

END OF SECTION 013513

SECTION 014500 - QUALITY CONTROL

PART 1 - GENERAL

1.1 INSPECTION AND TESTING

- A. No work shall commence or be covered until approved by the Port.
- B. Unless otherwise specified, the Port will perform acceptance tests (surveys, measurements, or evaluations called for in the specifications or deemed necessary by the Port).
- C. Prior to requesting acceptance tests, the Contractor shall perform check tests (monitoring of construction products, methods, and progress to assure work acceptability). Include check testing costs in the price(s) bid; no separate payment will be made for this work.
- D. The Port will have the right to perform various types of tests at any time prior to formal acceptance. This may include evaluation of line, elevation, grade, depth, thickness, compaction, density, material, composition, pressure, or other analyses deemed necessary by the Port.
- E. Acceptance tests by the Port will be initiated by the Contractor's request for approval.
 - 1. Acceptance surveys will be performed by the differential leveling method, using a mutually agreed upon grid not to exceed 25-feet transverse by 50-feet longitudinal.
 - 2. Compaction testing will be conducted in accordance with ASTM D6938 for subgrade, subbase, and aggregate base.
- F. The Contractor shall allow sufficient time in its schedule to accommodate Port acceptance testing. No separate payment will be made for delays or standby during this time.
- G. Results of the Port's acceptance tests will be made known to the Contractor as soon as practical; however, it remains the responsibility of the Contractor to obtain the specified requirements at all times. Any delay in advising the Contractor of test results shall not act as a waiver of this responsibility.
- H. Acceptance tests which fail to meet the specified requirements may be re-checked by the Port after the Contractor takes remedial action. The cost of re-checking shall be borne by the Contractor.
- I. Furnish, for approval or evaluation by the Port whenever requested, samples of materials as directed. These samples shall be completely representative of the materials or products proposed to be used in the work. The results will be used as a basis for acceptance or rejection in accordance with the specifications for the particular material(s).
- J. Notify the Port at least 24 hours before burying underground utilities such as storm sewers, electrical conduits, lights, catch basins, manholes, etc. Upon notification by the Contractor, the Port will arrange for its surveyor to verify locations and elevations of catch basins, manholes, lights, and similar structures. The Contractor shall take corrective measures if the Port's survey finds unacceptable discrepancies with the contract documents.

- K. Pressure tests called for in the specifications or deemed necessary by the Port shall be performed by the Contractor and witnessed by the Port.
- L. The monitoring of asphalt plants shall be the Contractor's responsibility. The Port will sample from the grade for material acceptance only.
- M. Specific testing tasks are specified in individual sections as required.

1.2 WELDING

- A. The Port will hire an approved third-party testing agency to provide the inspection and testing of all welds as required by Chapter 17 of the IBC and OSSC.
- B. Coordinate the fabrication/erection inspection and testing of all welds through the Port. This inspection and testing will be performed by an AWS-certified welding inspector in the case of visual inspection and by an NDT Level II-certified inspector in the case of nondestructive testing. The inspectors and inspection will be as outlined in AWS D1.1, Clause 6.
- C. All fabrication/erection welds will be inspected 100 percent visually and all "tension complete penetration" welds will be 100 percent nondestructively tested by the designated welding inspector(s) unless otherwise approved by the Port. All "compression complete penetration" welds will be 25 percent nondestructively tested. The inspection/acceptance criteria of all welds will be AWS D1.1, Clause 6.
- D. The Port's designated inspection/testing company will submit original copies of test reports directly to the Port with copies to the Contractor.
- E. In addition to the required fabrication/erection inspection, the Port may also provide verification inspection (both visual and NDT) of the Contractor-installed welds. Allow some contingency in the work schedule to allow for Port inspection. No time extensions or standby charges will be allowed in the event that the Port elects to provide additional inspection. Visual, U/T, and magnetic particle inspection methods will be used for pipe piles and fabricated steel inspection.
- F. Rejection of any portion of a weld inspected on a less than 100 percent basis shall require inspection of 100 percent of that weld. All welds which do not meet the requirements of the specifications shall be repaired and retested as necessary at no additional expense to the Port. Inspection by the Port shall in no way relieve the Contractor of responsibility for the performance of welding which meets the requirements of said specifications for quality and workmanship.
- G. All welders, welding operators, and tackers shall be City of Portland-certified by an independent testing laboratory (approved by the Port) as qualified for the materials, processes, and types of welds being performed. The testing and certification shall be as specified in AWS D1.1. Welds installed using unqualified procedures or welding performed by non-qualified or incorrectly qualified welders shall be rejected, removed, and replaced by the work of properly qualified personnel at no additional expense to the Port.
 - 1. All welders shall be project-qualified 3G and 4G unless the Contractor can provide documentation that all project-related welding will be performed in either the flat or horizontal positions, in which case 2F and 2G qualifications are acceptable.

2. Prior to commencement of welding, submit copies of certification for each person who will do welding on the job.

END OF SECTION 014500

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 TEMPORARY UTILITIES

- A. The Contractor may use water and electric power from Port-owned facilities at no cost, as available.
- B. Maintain temporary facilities in a safe and proper manner and completely remove from the site prior to final acceptance.
- C. Provide labor and equipment for temporary lines and services at no additional cost to the Port.

1.2 SANITARY FACILITIES

- A. Toilet facilities will be available without charge, as designated by the Port.

1.3 TEMPORARY HEAT

- A. Furnish and maintain temporary movable heating units where temporary heat is required or requested by the Port. When temporary heat is required in a space for operations such as plastering and painting, provide temporary radiators, fans, piping, etc., and fuel required for same until final acceptance of the building.

1.4 FIRE PROTECTION

- A. Provide adequate firefighting equipment to contain an equipment fire. Make available and accessible in the work area.
- B. Provide fire protection as required by Oregon Administrative Rules, Division 3, Chapter 437, Subdivision F, for building construction and demolition.
- C. Only type B:C dry chemical fire extinguishers shall be used within 500 feet of aircraft parking areas or in the vicinity thereof. Type A:B:C multi-purpose fire extinguishers in these areas are prohibited.

1.5 WATER VALVES

- A. Existing domestic water and fire protection services shall be maintained operational at all times unless specified, scheduled, and/or approved otherwise.

- B. All requests for scheduling water valve closures of any type shall be submitted 3 business days in advance. Requests shall include a proposed shutdown plan indicating which valves will be closed, how long each valve will be closed, and the purpose of the closure.
- C. Broken water lines or other water emergencies shall be reported to the PDX maintenance trouble line at 503-460-4683 and to the Port inspector.

1.6 TEMPORARY CONSTRUCTION WALLS AND BARRICADE WALLS

- A. Where fire-resistance-rated temporary walls are indicated or are required by authorities having jurisdiction, construct walls according to the rated assemblies.
- B. For non-rated temporary walls, construct partitions consisting of 3 5/8-inch metal studs at 16 inches on center, with 5/8-inch thick Type X gypsum board applied to the public side of the wall. Finish public side of gypsum board to a level 4 finish unless it is in a back-of-house area or will have applied graphics. If the wall will have graphics applied to it finish the public side to a level 5 finish. If the wall is in a back-of-house area provide a level 2 finish. Paint public-facing side of walls with one coat of primer and one coat of Port white. Confirm height of walls with the Port prior to installation. No mechanical fasteners shall be used to attach temporary walls to terrazzo flooring. All materials and workmanship shall be in accordance with Division 9.
- C. Temporary Barricade Walls:
 - 1. Where temporary barricade walls are indicated and allowed by authorities having jurisdiction, provide one of the following or equal:
 - a. Rented barricade walls obtained from Mal-Wal Barricades that are erected, maintained, and removed by a Mal-Wal authorized installer such as Diamond Specialties Inc., 22825 NW Dogwood, Hillsboro, OR 97124; contact Brian Hathaway; by office phone: (503) 640-4699, by cell phone: (503) 860-7984, or by email: malwal@frontier.com.
 - b. RealWall from STARC Systems.
 - c. Temporary construction wall from Edge Guard.
 - 2. Temporary barricade walls are non-rated and non-structural and shall not be used to support personnel, materials, or other structures in any way.
 - 3. Height shall be from floor to ceiling unless indicated otherwise.
- D. Locks for Doors within Temporary Walls and Temporary Barricade Walls:
 - 1. Locks, including cylinders, shall be Schlage, no substitution.
 - 2. Locks shall be of the type that remain locked so that when the doors are shut they are automatically locked and are openable from the inside with the knob, latch, or handle and from the outside with a key.
 - 3. Door thickness of 1 3/8 inch or less: Provide a Schlage F series lock or equivalent with a Schlage C/SC4 keyway 6 pin KNK cylinder.
 - 4. Door thickness of 1 3/4 inch or more: Provide a Schlage ND or L series lock with a Schlage C/SC4 keyway 6 pin LFIC cylinder.
 - 5. Provide construction cylinders with a zero bitting (blank key with no cuts). Schlage construction core SCH 23-030-ICX.
 - 6. The Port will provide the core inserts. Coordinate the timing of the core insert replacement with the Port.

1.7 INTERIOR BARRIERS

- A. Install and maintain barricades to keep the public out of areas where work is being performed, material is being stored for acclimating, adhesive is being cured, or for any other reason people or materials need to be protected. Remove barriers when not needed in an area.
- B. Temporary construction type barriers, such as candlesticks with caution tape, will be accepted in the following situations:
 - 1. Night-time work hours. Remove at the end of each night's work.
 - 2. Where material is laid out to acclimate.
- C. Barriers at holdrooms may be rows of holdroom seating lined up end to end.
- D. All other barriers will be Port-furnished, Contractor-installed Tensabarrier.

1.8 DIESEL EMISSIONS CONTROLS – VEHICLES AND EQUIPMENT

- A. Establish staging areas for diesel-powered vehicles and equipment (collectively, “equipment”) in a location where exhaust emissions have a minimal impact on personnel or nearby communities.
- B. Limit idling of diesel-powered equipment to 5 minutes when the equipment is not in use or in motion, except as follows:
 - 1. When traffic conditions or mechanical difficulties, over which the operator has no control, force the equipment to remain motionless.
 - 2. When operating the equipment's heating, cooling, or auxiliary systems using a diesel-powered engine is necessary to accomplish the equipment's intended use.
 - 3. To bring the equipment to the manufacturer's recommended operating temperature.
 - 4. When the outdoor temperature is below 20°F.
 - 5. When needed to repair the equipment.
 - 6. When the safety of job site personnel or visitors may be compromised if diesel equipment is turned off; for example, where the equipment protects workers that are working in a trench.
 - 7. When the equipment meets the most stringent EPA emissions standards or has been retrofitted with a diesel particulate filter (DPF).
 - 8. Under other circumstances specifically authorized by the Port.
- C. The Contractor shall post “Five Minute Diesel Idling Limit” signs in high foot-traffic areas of the job site, visible to equipment operators and site workers.

1.9 EXTERIOR DUST CONTROL

- A. If work includes clearing, grubbing, excavating, grading, hauling, placing, stockpiling, sawing, coring, drilling, sandblasting, general demolition, or other activities that will create dust or blowing soil, review the work plan with the Port prior to starting the work. The work plan shall include all methods required to retain or control dust and soil so that they do not leave the immediate work site, present health hazards, or enter any public areas.

- B. If conditions exist that cause dust or soil to become windblown or otherwise entrained in the air by vehicular traffic or equipment activities, employ methods to control and abate nuisance dust conditions including, but not limited to:
 - 1. Covering excavated, graded, disturbed areas, or stockpiles with tarps or sheeting until removed from the site or finished in accordance with the contract documents.
 - 2. Cleaning, sweeping, or vacuuming areas to remove the dust source.
 - 3. Removing or relocating dust-creating materials or activities to other areas that will eliminate the dust problem.
 - 4. Applying dust control agents such as water, or water misting, to the dust source. Application of any wetting agents other than water require the written approval of the Port prior to use.
 - a. Application of dust control agents is not acceptable for materials that will dissolve in water or become friable.
 - b. Materials that will dissolve in water or become friable when wetted shall be stored only on impervious surfaces, field-installed ground sheeting, or other barriers.
 - c. Run-off from wetted materials shall be controlled to prevent contamination of other portions of the site.
- C. The Contractor shall take precautions to contain the particulate matter from sandblasting operations and provide covered storage of the spent abrasive materials. Sandblasting shall be managed as hazardous or solid waste in accordance with applicable state, federal, and local regulations.

1.10 INTERIOR DUST CONTROL

- A. Submit a dust control plan when work includes demolition, removal of materials, or other building interior activities that could create dust or other small airborne particles.
- B. The dust control plan shall include, but not be limited to, the following:
 - 1. Measures to be implemented before, during, and after any dust generating activity for the duration of the work.
 - 2. Measures to ensure there are no visible dust emissions in the air or collecting on surfaces outside the work area.
 - 3. Measures to prevent tracking of dust into non-work areas by feet or equipment.
 - 4. Measures for clean-up of settled or tracked dust found outside the work area.
- C. Do not proceed with the work until the Port has approved the plan. Perform dust control in accordance with the approved plan.
- D. Excessive airborne particles within the work area may require that the Contractor cover smoke detectors during that portion of the work and then uncover them when opening the area for use at the end of the work shift.
- E. If plastic sheeting is used for containment of dust, it shall be fire-retardant treated sheeting.
- F. Do not allow general nuisance dust outside the work area to exceed the American Conference of Governmental Industrial Hygienists guideline of 10 mg/m³. The Port reserves the right to perform dust level monitoring to ensure there is no violation of this limit.

1.11 CONTROL OF SILICA IN CONCRETE

- A. When coring, cutting, breaking up, grinding, or removing concrete or performing other such activities, control the release of dust from concrete that contains or has the possibility to contain silica that could be released with the dust in levels greater than those allowed under the OR-OSHA Silica Rule, OAR-437-002-0382, Table Z3. Control measures shall comply with Table 1 of the new OR-OSHA silica rule, OAR-437-002-1057.

1.12 NOISE CONTROL

- A. Comply with the requirements of OAR 437, Division 2/G, 1910.95, Occupational Noise Exposure.
- B. Where the public and tenants are exposed to construction noise that is harmful or disruptive, take steps to mitigate the noise level. Adequate mitigation may require performing some items of work outside of normal working hours. Coordinate with the Port.

1.13 SOLID WASTE MANAGEMENT

- A. The Contractor shall be solely responsible for determining the proper disposition of all solid waste, including documentation showing that the solid waste and recyclables are not regulated as hazardous waste in accordance with state and federal regulations. Upon request, this documentation shall be made available to the Port.
- B. Receptacles:
 - 1. All drop boxes, bins, totes, and cans located in areas exposed to wind or precipitation shall be equipped with metal, canvas, or plastic covers. Drop boxes, bins, totes, and cans shall be kept closed at all times, except when adding waste material.
 - 2. Where possible, large receptacles such as drop boxes, bins, and totes shall be placed on impervious areas such as concrete or asphalt pavement at locations away from public traffic, storm drain inlets, ditches, and other conveyances.
 - 3. If any receptacle is observed to be leaking any liquid, it shall be considered a solid waste leachate. The Contractor shall immediately take action to contain the leakage.
 - 4. Discarding of aerosol cans, used oil, paints, solvents, fluorescent light tubes, or any hazardous waste into the receptacle is strictly prohibited.
 - 5. Receptacles larger than 33-gallon capacity used for recyclables and general solid waste and portable toilets shall not be located within 50 feet of a storm drain inlet, drainage ditch, surface water, or wetland.
 - 6. Ensure that all recyclable and solid waste receptacles are kept closed, are not overfilled, are not leaking, and general housekeeping is performed in the area.
 - 7. All recyclable and general solid waste hauled from the Port shall be secured prior to leaving the work site so that no waste material blows out, falls out, or leaks out during transportation to the designated offsite location.

1.14 DISPOSAL

- A. Dispose of waste material off Port property and in accordance with applicable state, federal, and local regulations.

- B. Burning or burying of waste material within Port property is not permitted.
- C. Disposal of waste material within the area cleared, a river, stream, wetland, or other waterway or waterfront is not permitted.

1.15 OWNERSHIP OF MATERIAL REMOVED FROM PORT PROPERTY

- A. Unless directed otherwise in the specifications, the Contractor accepts ownership of material removed from Port property under this contract, and accepts all costs and liability associated with its handling, transportation, removal, and disposal. The Contractor releases the Port from any claims, actions, proceedings, damages, liabilities, and expenses of every kind, whether known or unknown, resulting from or arising out of such material.

1.16 PDX TERMINAL DELIVERIES

- A. Schedule the delivery of major system components with the Port at least one 24-hour business day in advance.

1.17 MOVEMENT AND PROTECTION

- A. Movement of construction tools, materials, supplies, fixtures, and demolition debris through the building shall be performed in accordance with the following restrictions:
 - 1. The Port will determine route and time restrictions, as well as time windows for material movement or work that may disturb building occupants.
 - 2. Do not block or prevent public use of building areas without the Port's approval.
 - 3. Use of hand trucks or carts with metal, plastic, or hard rubber wheels/casters will not be permitted. Only pneumatic tires will be allowed.
 - 4. Handle with care to prevent damage to equipment and to property. Should soiling or damage occur, items will be cleaned/repared by the Port at the Contractor's expense. (Exercise special care to protect carpeting, terrazzo, ceramic tile, wall surfaces, elevator surfaces, and doors.)
 - 5. Packing and debris shall be transported in enclosed containers or carts and disposed of off Port property.
 - 6. Clean up any dirt or debris dropped while moving items and equipment through the building.

1.18 PROTECTION OF PORT CARPET

- A. Use only pneumatic tire carts and vehicles on newly installed carpet within the first 72 hours after installation.
- B. Minimize the potential for new and existing carpet delamination, scuffing, or fiber tear-out by operating carts, storage boxes, lifts, and other wheeled items such that all directional changes are made in gentle turns. Otherwise place protection boards over the carpet where hard turns will be made.

- C. Limit use of adhesive-backed plastic protection sheets over new and existing carpet to non-traffic (including foot traffic) areas only. Do not use the protection sheets at any given location for longer than necessary and in no instance shall the duration be longer than one week.

1.19 STAGING, PARKING, AND WORK AREA

- A. Access to and from staging, parking, and work areas shall be as shown on the drawings.
- B. Perform operations and movement within the staging, parking, and work areas in strict conformance with Port rules and regulations.
- C. Employees' vehicles shall be parked in the staging/employee parking area. The Contractor shall be responsible for transporting workers between the parking area and the work area.
- D. Only marked Contractor-owned or operated vehicles required for proper execution of the work will be allowed in the work area. No private passenger vehicles will be admitted.
- E. The area around the terminal building is extremely congested. The Port will attempt to accommodate the Contractor's requests for use of perimeter areas; however, the Port will make the final determination for use of space.

1.20 STORAGE AND PROTECTION OF MATERIAL AND EQUIPMENT

- A. The Port will designate the area in which the Contractor may store material and equipment.
- B. Protect materials and equipment from damage, pilfering, etc., and fully relieve the Port of this responsibility.
- C. Upon completion of the work, remove unused materials and equipment and restore the area to original condition, including any grading necessary to restore drainage patterns and surface smoothness.
- D. Store materials to be salvaged by the Contractor in the staging area.
- E. Store materials and equipment at least 10 feet from the airport security fence.

1.21 CRANE LIFTS

- A. Coordinate all lift activities with the Port.
- B. Submit a complete lift plan for review by the Port. The lift plan shall be prepared by a qualified person, as defined by OR-OSHA, and shall include, but not be limited to, the following information:
 - 1. A brief narrative describing the reason for the lift, a description of the lift, the lift procedure, and any safety concerns. Include date and time of lift, anticipated weather conditions and wind speeds, and the load weights. Calculated load weights may be used in lieu of measured load weights only when the latter are unavailable.

2. A scaled plan view of the lift site including:
 - a. Work area, including position and configuration of the crane, and any set-up, support, and/or haul vehicles. Include any buildings or other obstructions that may interfere with the lift.
 - b. Initial lifting position and final placement of the load including load radius.
 - c. Safety zones to be established and demarcated around the crane to deter entry into the work area, to include pinch points.
 - d. Safety zones to be established, demarcated, and controlled by qualified Contractor personnel inside buildings, if applicable, to identify the swing of the load with a buffer.
 - e. Utilities above and below ground and associated structures located within the work area.
3. A scaled elevation view of the lift site including:
 - a. Crane location relative to the final placement site.
 - b. Buildings with heights clearly marked.
 - c. Boom height and lifting radius.
4. Specification for the crane to be used in the lift including make, model, dimensions, weights, working range diagram, and lift capacity chart. Include a copy of the crane's current certification.
5. A lift analysis including:
 - a. Tabulation of the gross load weight including the weight of all blocks and rigging tackle.
 - b. Rigging attachment points and special rigging requirements. Include a rigging diagram showing the configuration of all rigging to be used in the lift.
 - c. Gross rated capacity of the crane in the configuration specified.
 - d. Calculation of the percentage of the crane's rated capacity at which the lift will be made.
 - e. Crane-imposed loads.
 - 1) Axle loads of crane in transit configuration.
 - 2) Outrigger loads at load radius in the configuration that produces the greatest load effect on any one outrigger.
 - 3) If required by the Port, provide calculations signed and stamped by a structural engineer licensed in the State of Oregon showing these loads do not exceed Port design criteria of lift site and access route.
6. A copy of the current load test shall be submitted to the Port. Load tests shall be performed:
 - a. In accordance with the manufacturer's requirements, generally on an annual basis.
 - b. If a load bearing component on the crane requires assembly at the work site. This would include lattice boom cranes that necessitate reassembly of booms that were disassembled for transit to the work site, however this does not include installation of counterweights.
 - c. At 100 to 110 percent of the anticipated load.
7. A list of all personnel involved and a copy of their National Commission for the Certification of Crane Operators (NCCCO) certifications for the crane operator, and proof of training for riggers and signal persons. In addition, submit documentation from the crane employer that the operator has been trained and evaluated in the safe operation of assigned crane activities. Designate one qualified person to supervise and manage all lift activities.
8. A communications plan detailing methods of communication to be used with personnel operating the crane. Provide radio communications for all nighttime lifts and any time Contractor personnel are not in visual contact with the crane operator. Provide make,

model, and operating frequency of radios used for approval (by FAA if within airport transition zones). Designate one person to handle all communications with the crane operator.

9. A list of all Port, tenant, or other activities affected by the lift activities and how each effect will be remedied.

- C. Upon request, the Port will provide existing drawings of the work area and/or design criteria for work area and access route.

1.22 EXTERIOR WARNING SIGNS AND BARRICADES

- A. Before starting work, provide and have available all signs, flaggers, escort vehicles and drivers, barricades, and lights necessary for protection of the work.
- B. Install and maintain adequate warning signs and lighted barricades to protect property and personnel in the work area. Barricades shall be weighted or anchored to prevent overturning from wind or jet engine blast.
- C. Barricade design shall conform to recommendations in the Manual on Uniform Traffic Control Devices, Type II barricade, minimum. Mount a Type A red omni-directional barricade warning light flasher on top of each barricade. Keep flashers visible and operating at all times.
- D. Space barricades a maximum of 20 feet apart unless directed otherwise by the Port.
- E. Relocate barricades, at the direction of the Port, whenever required to maintain protection of the work area or when changing work areas.
- F. Open trenches, excavations, or obstructions not being actively worked shall be marked with lighted and weighted barricades which can be seen from a reasonable distance.
- G. Barricades and warning signs within air operations areas shall be a maximum of 18 inches high.

1.23 EXTERIOR SITE PROTECTION

- A. Take extreme care to ensure no work-related debris or other loose items are allowed to be blown by wind or jet engine blast. The Contractor shall be responsible for any resulting damage to jet engines and/or other property arising from failure to secure and/or protect debris, tools, supplies, or other loose items.

1.24 TRANSPORTATION OF MATERIAL

- A. If shipments of hazardous material (including hazardous debris, contaminated soil or water, and hazardous waste) will be unloaded onto or loaded from Port property, the Contractor shall have a qualified person available onsite when shipments are received or made who is current with U.S. Department of Transportation (DOT) approved training for the transportation of hazardous materials. The storage and shipment of hazardous waste shall also comply with the requirements of these specifications.

- B. Ensure that hazardous goods and material delivered to or from the construction site meet applicable DOT labeling and placarding requirements.
- C. Properly characterize and manifest waste material leaving Port property for disposal.
- D. Minimize and abate the creation of nuisance dust conditions during the loading and unloading of vehicles used to haul debris, rubble, soil, trash, or other material that may create dust during loading or unloading operations.
- E. Before leaving the loading area, adequately secure and cover vehicles used to haul debris, rubble, soil, trash, or other material that may be blown or fall during transportation onsite or over public thoroughfares.
- F. In areas that may result in the tracking of soil, sediments, or hazardous materials on the wheels of hauling equipment outside areas that are enclosed by erosion and silt/sediment control devices, the Contractor shall provide the means and methods to remove these materials prior to the vehicle exiting the controlled area. If water wash stations are used, the Contractor shall provide systems for the collection, treatment, and disposal of wheel wash water and accumulated sediment.

1.25 TRAFFIC CONTROL

- A. The work is in areas where there will be traffic involved in terminal activities and cargo handling. Make arrangements for the safe handling of traffic in the work area, and coordinate the work with the Port.
- B. Construct and maintain bridges across trenches and/or temporary access ways to carry appropriate traffic in a safe manner. Mark open trenches, excavations, or obstructions with lighted and weighted barricades which can be seen from a reasonable distance. Plan for traffic interruption in the work progress schedule.
- C. Schedule and phase work to maintain movement of traffic through the work area. Provide signing, barricades, markers, flaggers, and other traffic regulation to maintain safe and efficient control of traffic around or through the work area. Types of devices and their use shall conform to Part VI of the Manual on Uniform Traffic Control Devices for Streets and Highways - USDOT/FHWA.
- D. Keep pavement surfaces free and clear of dirt, mud, and debris.
- E. Keep a minimum of one lane of traffic open at all times. Provide flaggers to control congestion. At the end of each workday, open all lanes to traffic.
- F. Backfill excavation and provide an all-weather topping (crushed aggregate is not acceptable), or cover with steel plates capable of handling H-25 loading, minimum. Openings greater than 4 feet in width may require thicker steel plating and/or addition of steel beams. Verify loading requirements with the Port prior to ordering steel plate or beams. If loading requirements cannot be met, the opening shall be backfilled prior to plating. If plating thicker than 1 inch is required, plates shall be constructed as a ramp where each step is no greater than 1 inch thick and each plate is offset 12 inches for every 1 inch in plate thickness.

1.26 HAUL ROUTE CONSTRUCTION AND MAINTENANCE

- A. The term “haul route” applies to any designated paved or unpaved road used by the Contractor for travel of construction equipment.
- B. Construction equipment shall follow agreed-upon haul routes.
- C. Do not cross electrical or communication cables unless protected by approved means.
- D. Equipment operated on haul routes over existing pavements shall conform to legal load limits for public highways unless approved protection is provided. Keep pavement areas free of material spillage and foreign matter at all times. Continuously clean pavement surfaces with regenerative-air vacuum sweepers.
- E. Maintain haul routes over unpaved areas in good usable condition during the course of the work. Sprinkle roads as necessary to prevent dust.
- F. Restore paved roads to original condition at the conclusion of construction and prior to final acceptance.
- G. Construct, maintain, and restore haul routes to the satisfaction of the Port. Cost shall be considered an incidental item.

1.27 HARD HATS AND SAFETY CLOTHING

- A. Wear hard hats and high visibility clothing that comply with current ANSI requirements. All safety equipment shall be in good repair.

1.28 CONFINED SPACES

- A. Performance of contract work will require workers to enter confined spaces. The Contractor is solely responsible for ensuring compliance with proper applicable confined space entry and working procedures in accordance with state and federal OSHA regulations. The Port may review those procedures and perform its own tests for the limited purpose of ensuring the safety of its own employees.
- B. The Contractor shall request and, if available, have a copy of any Port history on the confined space prior to entry.
- C. Currently, all confined spaces at Portland International Airport are categorized as “Permit-Required Confined Space.”
- D. At the end of each month, submit the following:
 - 1. A copy of all entry permits generated in the course of the work for the Port’s use in building history of the confined space.

1.29 SIGN POLICY

- A. Policy for Contractor identification signs at Portland International Airport:
1. Sign, and all aspects of installation, shall have prior approval of the Port.
 2. Displayed sign shall be for the prime Contractor only.
 3. Exterior sign shall not exceed 3 feet by 5 feet. The size of an interior sign shall be approved by the Port prior to use.
 4. Sign shall be professionally prepared.
 5. Signing is allowed only at work area.
 6. No lighted sign permitted.
 7. Sign shall be removed upon completion of work.

END OF SECTION 015000

SECTION 015719 - ENVIRONMENTAL CONSTRUCTION CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes required environmental practices for construction work on Port property.

1.2 SUBMITTALS

- A. Where hazardous materials or products are stored in quantities of 42 gallons or more, submit a spill response that includes a map indicating storage site locations.
- B. If total petroleum product storage, including fuels and oil (e.g. drummed lubricants), exceeds 1,320 gallons, obtain special approval from the Port and submit a Spill Prevention Control and Countermeasures (SPCC) plan in accordance with federal regulations (40 CFR 112). Total storage is equal to the sum of all drums, receptacles, tanks, etc. equal to or greater than 55 gallons, including mobile storage tanks that are parked on site.
- C. Submit a monthly written report that provides:
 - 1. A complete inventory of all hazardous waste generated that month;
 - 2. The current inventory of Contractor-generated hazardous waste stored on Port property; and
 - 3. The date(s) the waste was placed into onsite storage.
- D. Submit documentation required for refrigerant management as described later in this section.

1.3 EMERGENCY CONTACT AND NOTIFICATION INFORMATION

- A. Provide a notification sign with Contractor's appropriate emergency contact information, and including the Port's emergency dispatch number, in the following locations:
 - 1. Areas where fuel, hazardous waste, or hazardous liquid products are dispensed or stored.
 - 2. Areas where more than 42 gallons of hazardous materials are stored.
 - 3. On-board mobile motor fueling equipment. (If the mobile fueling equipment leaves Port property, the Port emergency dispatch notification sign shall be removed prior to leaving.)
 - 4. Tank farms on Port property.
 - 5. Asphalt or concrete plants on Port property.

1.4 RELEASE OF CONTAMINANTS

- A. Protect against the entry of petroleum products and other contaminants into a waterway (including river, stream, slough, wetland, etc.), other drainage system (including stormwater collection systems) or overland to any drainage ditch or swale.

- B. In the event of a spill outside a containment area:
 - 1. Notify the Port immediately if a spill occurs or if contamination is discovered which indicates a release of petroleum products or other contaminants to the environment.
 - 2. Immediately contain and remove the spilled material.
 - 3. If contaminants enter a waterway, immediately begin containment and cleanup.
- C. Notify the appropriate regulatory agencies and provide written follow-up. Submit to the Port copies of all reports, written follow-ups, documentations, and agencies responses.
- D. All cleanup costs, reporting requirements, fines, and fees shall be the sole responsibility of the Contractor.

1.5 SPILL KITS

- A. A clearly labeled spill kit shall be located within 50 feet of the following:
 - 1. Fueling areas.
 - 2. Liquid products storage and dispensing areas.
 - 3. Hazardous materials storage areas.
 - 4. Vehicle and equipment maintenance areas.
 - 5. Tank farm areas on Port property.
 - 6. Asphalt or concrete plant areas on Port property.
 - 7. Any surface water if work is being performed in the vicinity.
- B. Spill kits shall contain an ample supply of oil-absorbent ground booms, socks, pads, bagged sorbents, flat-blade shovels, salvage drums suitable for collection of spilled materials and absorbents, provisions for preventing spilled materials from entering any storm drain inlet or conveyance, supplies to protect at least two storm drain inlets, and personnel protective equipment suitable for the quantity and type of hazardous substances handled.
- C. Provide spill kits as described above for the following types of mobile equipment:
 - 1. Mobile fueling, maintenance, and storage equipment.
 - 2. Mobile equipment service vehicles (including oilers).
 - 3. Mobile tanker equipment (e.g. tanker vehicles used to apply bituminous tack material) and hazardous material transport vehicles.

1.6 HAZARDOUS MATERIAL MANAGEMENT

- A. General:
 - 1. Minimize the volume and number of locations where hazardous material is used and stored by the Contractor on Port property.
 - 2. Minimize the type and volume of material used onsite that will be regulated as hazardous waste when the material becomes spent or unfit for further use.
 - 3. Ensure that any hazardous material or hazardous substance for which the use, storage, or disposal is regulated under federal, state, or local requirements is handled and managed in accordance with the requirements applicable to those substances.
 - 4. The use of degreasing or cleaning products containing chlorinated solvents such as 1,1,1-trichloroethane, perchloroethylene, and methylene chloride is prohibited unless approved by the Port.

5. Immediately clean up hazardous material spilled outside any designated secondary containment system in accordance with Oregon DEQ, U.S. EPA, or Oregon OSHA requirements. Clean up, as soon as possible, any hazardous materials spilled inside a secondary containment system.
6. Where hazardous materials or products are stored in quantities of 42 gallons or more, submit a spill response plan including a map indicating storage site locations.
7. Ensure that every hazardous material container is clearly labeled with its contents or original product label. Indicate the Contractor's name and contact number on the side of every container greater than 5 gallons in size with legible size lettering. If hazardous material is transferred into a secondary container (i.e., any container used to transfer material from a storage location to a point of use or storage prior to use, including but not limited to buckets, pails, pans, drums, bottles, cans, etc.), this container shall also be labeled with the contents, the Contractor's name, and contract number.
8. Storage of flammable or reactive hazardous material/waste on Port property or within 50 feet of the Port property line is not permitted unless stored inside a building or other portable device approved by the Fire Marshal (or airport fire department within the PDX security fence).
9. Keep an up-to-date file or notebook of Safety Data Sheets (SDS) for all hazardous materials located by the Contractor on Port property. Upon request, this information shall be made available to the Port.
10. All containers used for storing, dispensing, or accumulating hazardous materials shall be placed inside a structure or under cover whenever possible. All containers not inside a structure shall be equipped with secondary containment.
11. Do not locate fuel and hazardous substances storage and dispensing areas where runoff flows from nearby roof drains.

B. Onsite Storage of Petroleum Products:

1. Do not install or use underground storage tanks (USTs) on Port property.
2. Storage racks and vehicles shall be equipped with drip collection devices and enclosures.
3. Provide an emergency dispenser shut-off switch. Switch shall be located at least 15 feet from tanks or the minimum distance approved by the Fire Marshal (or airport fire department within the PDX security fence), whichever is greater.
4. Use bollards or other vehicle restraint devices (e.g., Jersey barriers) to prevent vehicles from damaging tanks and containment area.
5. Tanks, containment areas, and dispensing pads shall be under cover or under a temporary shelter to minimize contact with, or accumulation of, precipitation, unless otherwise approved by the Port.

C. Large Containers (20 Gallons or More):

1. Store containers of hazardous liquids on an impervious surface (i.e., concrete, asphalt, or field-erected system [heavy plastic ground sheeting] capable of withstanding normal wear and tear from construction equipment and other traffic throughout the course of the work) and inside or under cover in a location that does not have any storm drain inlets or floor drains within 50 feet of the storage location.
2. For containers of liquids that are not, or cannot, be stored inside a structure, equip the storage area with some form of secondary containment. Acceptable secondary containment devices may include, but are not limited to:
 - a. Field constructed secondary containment area such as a perimeter berm with impervious interior surface; or

- b. Movable pallet systems with integrated secondary containment and covers (these systems are available in one, two, and four drum capacities).
- 3. Secondary containment systems shall have sufficient capacity to contain 10 percent of the total volume of hazardous material containers stored, or 110 percent of the volume of the largest container, whichever volume is greater.
- 4. Dispense from liquid-filled containers using a manually operated pump. Do not dispense from gravity feed spigots. Containers shall be used in an upright vertical position.
- D. Small Containers (Less Than 20 Gallons):
 - 1. Store containers of flammable liquids in National Fire Protection Association (NFPA) Code 30 approved safety cabinets, or equal.
 - 2. Store containers of non-flammable liquids in cabinets or other devices equipped with secondary containment.
- E. Empty Containers:
 - 1. A container is deemed empty when all possible material has been removed using normal practices (e.g. pouring, pumping, aspirating, etc.) and no more than 1 inch of residue remains on the bottom of the container or inner liner.
 - 2. Transferring of the liquid heel at the bottom of containers into other containers shall be done only in areas equipped with secondary containment.
 - 3. Do not store empty containers upside down, although they may be stored in a horizontal position if the bungs/lids are securely fastened.
 - 4. Do not rinse empty containers on the work site.
 - 5. Manage empty or unwanted containers as solid waste in accordance with the requirements of this section.
 - 6. Do not offer empty containers to employees or the public on Port property.

1.7 HAZARDOUS WASTE MANAGEMENT

- A. General:
 - 1. Obtain the necessary generator identification numbers from the Oregon Department of Environmental Quality (DEQ). Perform required characterization tests to determine if waste material produced is regulated as hazardous waste. Manage, transport, and dispose or recycle such waste in accordance with state and federal regulations.
 - 2. In addition to that required by federal or state regulations, the storage of containers containing hazardous waste shall be in accordance with the requirements described elsewhere in this section.
 - 3. Disposal of hazardous waste down any floor drain, sink, storm drain inlet, onto the ground, or into any water conveyance is strictly prohibited by state and federal law.
 - 4. Submit a monthly written report to the Port that provides:
 - a. A complete inventory of all hazardous waste generated that month;
 - b. The current inventory of Contractor-generated hazardous waste stored on Port property; and
 - c. The date(s) the waste was placed into onsite storage.
 - 5. Keep all required hazardous waste documentation, including, but not limited to, testing records, inspection logs, manifests, and contingency plans onsite during the course of the work. Upon request, the Contractor shall make this information available to the Port.
 - 6. Loading and transportation of hazardous waste from Port property shall be in accordance with the requirements described elsewhere in this section.

1.8 VIOLATION OF STORM WATER SYSTEM REQUIREMENTS

- A. The Contractor is responsible for reviewing Port Ordinance 361, Storm Water Regulation, available at https://cdn.portofportland.com/pdfs/Ordinance%20361_%20Storm%20Water%20Regulation.pdf or from the Port upon request, and the Port's Storm Water System Enforcement Rules adopted in accordance with Ordinance 361 (also available upon request). Violation of Ordinance 361 and the Storm Water System Enforcement Rules will be considered acts or omissions for purposes of the Contractor's indemnification obligation set forth in the Contract Documents, and will represent a material breach of the Contract for which the Port may exercise all remedies available at law or under this Contract, including but not limited to the enforcement mechanisms and penalties provided for under such ordinance and rules. Such enforcement mechanisms and penalties may include, but not be limited to:
1. Suspension or revocation of a permit or other authorization to engage in a particular activity on Port property; and
 2. Issuance of a citation punishable by a fine as authorized under ORS 777.990(2) and 778.990.

1.9 WASHDOWNS

- A. The washdown or hosing of hazardous material storage areas, refueling areas, or tank farm and containment areas is prohibited unless the Contractor provides for the collection and disposal of the washdown liquids.
- B. Limit washdown of vehicle and equipment service pads and other work areas. Limit steam cleaning and high pressure or other types of washing of vehicles and equipment. Liquids from these activities shall be collected, managed as contaminated wastewater, and properly disposed.

1.10 APPLICATION AND MANAGEMENT OF COATING SYSTEMS

- A. General:
1. Onsite storage, dispensing, and management of coating systems, paints, solvents, thinners, and related products that contain hazardous materials shall be in accordance with the requirements of this section.
 2. Unless otherwise specified by the Port, make all reasonable attempts to use low volatile organic compound (VOC) content coating systems in the course of the work.
 3. Minimize the use of aerosol spray products containing VOCs or VOC propellants.
 4. Do not dispose of aerosol spray product containers as general solid waste unless the can has been depressurized and all liquid contents drained into a waste container outfitted with a device specifically designed to puncture aerosol cans. The waste container shall also be outfitted with a carbon filter apparatus to minimize the loss of VOCs into the air and managed as solid or hazardous waste in accordance with the requirements of this section.
 5. Take all reasonable steps to minimize public exposure to VOCs and nuisance odors.
 6. Waste generated from painting operations such as scrap paint and solvents may be regulated as hazardous waste. Manage these materials in accordance with the requirements of this section.
 7. If a spray booth is used at the work site for the application of coating systems, ensure that the spray booth is properly serviced, maintained, and operated in accordance with local, state, and federal worker safety and environmental regulations, including permitting.

8. Containers with small amounts of residual paint or solvent, unapproved paints, bad batches, or dirty cleaning solvents shall not be allowed to evaporate in open air. All liquids shall be poured, pumped, aspirated, or otherwise placed into a waste container, reused, or returned to the vendor.
9. The mixing and dispensing of all coating systems and paints for use, as well as the cleaning of coating system and painting equipment, shall be conducted over an impervious surface at least 50 feet from the nearest storm drain inlet, drainage ditch, surface water, or wetland. Any spill shall be immediately cleaned up.
10. Other Conditions: If sandblasting operations are performed, take all reasonable precautions to prevent particulate matter from becoming airborne. Reasonable precautions include, but are not limited to, providing temporary enclosed shelters for sandblasting operations and providing covers or containment for the storage of spent abrasive materials. Sandblasting waste shall be collected and managed as hazardous or solid waste.
11. Disposal of any latex paint or washwater down any drain, onto the ground, or into any stormwater conveyance system is prohibited.
12. Manage empty containers in accordance with the requirements of this section.

B. Coating Systems, Paints, and Solvents Containing VOCs:

1. Take all reasonable precautions to minimize VOC emissions to the environment during the storage and use of these products, including, but not limited to:
 - a. Keeping all product and waste containers tightly closed, except when dispensing or filling the container.
 - b. Using airless sprayers to the maximum extent practicable.
 - c. Assuring that the spray nozzles are appropriately sized for the application.
 - d. Minimizing the use of thinners to the amount recommended by the manufacturer for the specific application.
 - e. Minimizing the volume of coating systems and paints that is premixed for use, but may not be immediately applied.
 - f. Not spraying cleaning solvents through spray equipment to clean buckets, lines, guns, and nozzles into the open air. Spray cleaning solvents into a container to capture and reuse as much cleaning solvent as possible.

C. Latex Paints:

1. Take all reasonable precautions to prevent latex paint emissions to the environment during the storage and use of these products, including, but not limited to:
 - a. Keeping product and waste containers tightly closed, except when dispensing or filling the container.
 - b. Minimizing the use of solvents, water, and detergents for the cleanup of latex painting equipment.
 - c. Not spraying cleaning solvents or water through spray equipment to clean buckets, lines, guns, and nozzles into the open air. Spray cleaning solvents or water into a container to capture and reuse as much cleaning solvent as possible.

1.11 EQUIPMENT FUELING AND MAINTENANCE

A. Ultra Low Sulfur Diesel (ULSD) Fuel:

1. All diesel-powered off-road vehicles and equipment used on the project site for three consecutive days or more shall be fueled with ultra low sulfur diesel. This includes

vehicles with engine horsepower ratings of 50 HP and above, and internal combustion engines used to power generators, compressors, and similar equipment.

2. The ULSD fuel shall contain no more than 15 parts per million sulfur.
3. If sufficient quantities of ULSD are not available, or if the price of ULSD is at least 3 percent greater than diesel fuel with a sulfur content in excess of 15 parts per million, the Port may allow the use of higher sulfur fuel. Such exceptions will be made on a case-by-case basis.

B. Fueling Operations:

1. Do not top off vehicle tanks when fueling on Port property.
2. Where practicable, fuel and liquid product dispensing shall be done over an impervious surface such as a concrete pad or field-constructed temporary pad (e.g. an aggregate pad with membrane bottom and side liner), at least 50 feet from the nearest storm drain inlet, drainage ditch, surface water, wetland, or other drainage conveyance. Install temporary impervious covers over storm drain inlets. Provide storm drainage diversion away from drainage ditches, surface water, wetlands, or other drainage conveyances.

C. Equipment and Vehicle Maintenance Operations:

1. Comply with requirements specified elsewhere in this section regarding onsite storage and use of hazardous material and management of hazardous or solid waste produced during the course of the work.
2. Perform daily equipment checks for leaking oil and fluids. Visible spills shall be immediately cleaned up.
3. Equipment with leaking oil or fluids shall be repaired prior to being operated on Port property.
4. To the extent practicable, park vehicles and equipment indoors, under a roof, or on an impervious surface to prevent stormwater contact in the area.
5. If a vehicle or equipment is known to be leaking oil or other fluids, and service cannot be completed that day, install a drip pan or absorbent materials to contain the leak until service and repair is completed.

D. Equipment Maintenance Areas:

1. To the extent practicable, vehicle and equipment servicing shall be done indoors or under cover.
2. Perform vehicle and equipment maintenance over an impervious floor or pad (concrete, chemical-resistant coated asphalt, or other field-erected system). Ensure that contaminated liquids including, but not limited to, contaminated stormwater are not discharged to any storm drain inlet, drainage ditch, swale, or other surface water conveyance.
3. For equipment that cannot practicably be moved to an equipment service area, take all reasonable precautions to prevent chemical spills onto the ground or into water. Use protective ground sheeting or absorbent materials beneath and around equipment areas that may be vulnerable to chemical spills.
4. Contaminated stormwater from vehicle and equipment maintenance areas shall not be allowed to discharge into the stormwater collection system, discharge onto the ground, or run overland to any drainage ditch or swale.
5. Solvent or caustic parts washing stations shall not be used outdoors, unless the area is covered and equipped with appropriate secondary containment as described elsewhere in this section.

- E. Mobile Equipment Service Vehicles (Including Oilers):
1. Multi-purpose mobile equipment maintenance vehicles (oilers) that are equipped with multiple tanks or containers of lubricants, fuels, hydraulic fluids, greases, chemicals, etc., may be used on Port property under the following conditions:
 - a. The vehicle is equipped with a spill kit.
 - b. The vehicle is equipped with a sufficient supply of containers for the collection of fluids that may be removed from the equipment being serviced (e.g. used oil, waste antifreeze, chemicals, etc.).
 2. If equipment service is performed within 50 feet of a storm drain inlet, drainage ditch, surface water, or wetland, the Contractor shall install a flexible storm drain cover over the storm drain inlet or place oil absorbent booms or socks around the inlet or other drainage conveyance prior to commencing work.
 3. Mobile tanker, mobile fueling, or equipment service personnel shall be appropriately trained in spill response techniques. At least one spill response-trained person shall be present at all times where fueling, fuel staging, or fuel transfers are made.
 4. Mobile motor fueling equipment shall be equipped with an emergency dispenser shutoff switch located in the cab or on the opposite side of the vehicle or trailer from the pump(s).
 5. Overnight/weekend parking of mobile equipment service vehicles shall not occur within 50 feet of the nearest storm drain inlet, drainage ditch, surface water, or wetland area unless the storm drain inlet, ditch, and all drainage conveyances leading to the surface water or wetland have been equipped with oil absorbent booms or pads.
- F. Storage and Handling of Waste Oil, Fluids, and Filters:
1. The Contractor shall determine whether or not waste oil, fluids, filters, and other materials generated from onsite maintenance activities are regulated as hazardous waste under state and federal regulations.
 2. Regardless of the regulatory status of waste oil, fluids, filters, and other material, if the waste material is accumulated and stored on Port property, the Contractor shall provide proper storage.

1.12 REFRIGERANT MANAGEMENT REQUIREMENTS

- A. When any equipment containing more than 5 pounds of refrigerant is installed, appropriate documentation shall be submitted for maintaining an accurate refrigerant management inventory. This requirement shall be fulfilled by completing Refrigerant Equipment Installation Form A, available at https://cdn.portofportland.com/eng-specs-gdline/PoP_RefrigerantManagement_WI-POR-AIR-004.pdf, and submitting to the email address indicated on the form.
- B. Where any work is performed on refrigerant-containing equipment that may compromise the integrity of the refrigerant circuit, including installation, maintenance, service, or disposal, the Contractor shall ensure that the technician performing such work has the appropriate level of certification under Section 608 of the Clean Air Act (CAA) [40 CFR Part 82 Subpart F] and observes all applicable refrigerant management practices as detailed in Port Work Instruction WI-POR-AIR-004, available at https://cdn.portofportland.com/eng-specs-gdline/PoP_RefrigerantManagement_WI-POR-AIR-004.pdf. The knowing release of any non-exempt refrigerant is strictly prohibited.
- C. If at any point during the installation, operation, maintenance, service, or disposal of refrigerant-containing equipment a significant leak occurs, notify the Port immediately with the type and

quantity of refrigerant released so that appropriate documentation and reporting requirements can be met.

- D. When refrigerant-containing equipment with greater than 5 pounds of refrigerant is disposed of intact, or more than 5 pounds of refrigerant is removed separately for disposal, appropriate records shall be kept and retained. This requirement shall be fulfilled by completing Refrigerant Equipment Disposal Form D (included in Port Work Instruction WI-POR-AIR-004) and submitting to the email address indicated on the form.

END OF SECTION 015719

SECTION 016116 - VOC (VOLATILE ORGANIC COMPOUND) CONTENT RESTRICTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes volatile organic compound (VOC) restrictions for product categories listed below under the definitions article. All products of each category that are installed shall comply; Port project goals do not allow for partial compliance.

1.2 DEFINITIONS

- A. VOC-Restricted Products: All products of each of the following categories when installed or applied on-site in the building interior:
 - 1. Carpet, carpet tile, and adhesive.
 - 2. Cement-based underlayment.
 - 3. Resilient base.
 - 4. Terrazzo.
 - 5. Resilient flooring.
 - 6. Moisture mitigation.
 - 7. Paints and coatings.
- B. Interior of Building: Anywhere inside the exterior weather barrier.
- C. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives and seam sealers, resilient base adhesives, and pipe jointing adhesives.
- D. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

1.3 REFERENCES

- A. CAL (VOC) - Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers (including Addendum 2004-01); State of California Department of Health Services.
- B. CRI (GLP) - Green Label Plus Carpet Testing Program - Approved Products; Carpet and Rug Institute.
- C. GreenSeal GS-36 - Commercial Adhesives; Green Seal, Inc.
- D. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; www.aqmd.gov.

- E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168;
www.aqmd.gov.
- F. SCS (CPD) - SCS Certified Products; Scientific Certification Systems.

1.4 SUBMITTALS

- A. Evidence of Compliance: Submit for each different product in each applicable category.
- B. Product Data: For each VOC-restricted product used in the project, submit product data showing compliance, except when another type of evidence of compliance is required.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Tests shall be performed by an independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All VOC-Restricted Products may not be listed below. Provide products having VOC content of types and volume not greater than those specified in State of California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current Carpet and Rug Institute Green Label Plus certification; www.carpet-rug.org
 - b. Current SCS Floorscore certification; www.scs-certified.com.
 - c. Current SCS Indoor Advantage Gold certification; www.scs-certified.com.
 - d. Product listing in the CHPS Low-Emitting Materials Product List at www.chps.net/manual/lem_table.htm.
 - e. Current certification by any other agencies acceptable to CHPS.
 - f. Report of laboratory testing performed in accordance with CHPS requirements for getting a product listed in the Low-Emitting Materials Product List; report shall include laboratory's statement that the product meets the specified criteria.
 - 2. Product data submittals showing VOC content are NOT acceptable forms of evidence.
- B. Adhesives, Coatings, Seam Sealers, Primers, and Joint Sealants: Provide only products having volatile organic compound (VOC) content not greater than required by South Coast Air Quality Management District Rule No.1168.
 - 1. Evidence of Compliance: Report of laboratory testing performed in accordance with requirements.
- C. Aerosol Adhesives: Provide only products having volatile organic compound (VOC) content not greater than required by GreenSeal GS-36.
 - 1. Evidence of Compliance: A current GreenSeal Certification.

- D. Paints and Coatings: Provide products having VOC content not greater than that required by South Coast Air Quality Management District Rule No. 1113.
 - 1. Provide coatings that comply with the most stringent requirements specified in 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.
 - 3. Evidence of Compliance: Report of laboratory testing performed in accordance with requirements.
- E. Carpet, Carpet Tile, and Adhesive: Provide products having VOC content not greater than that required for CRI Green Label Plus certification.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current Green Label Plus Certification.
 - b. Report of laboratory testing performed in accordance with requirements.
- F. Other Product Categories: Comply with limitations specified elsewhere.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. The Port reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Port.
- B. All additional costs to restore indoor air quality due to installation of non-compliant products shall be borne by Contractor.

END OF SECTION 016116

SECTION 017000 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 INSPECTION OF WORK AREA

- A. Examine the work area and become satisfied as to the conditions of the work involved and the quantities of materials required for the performance of the work.
- B. Prior to any drilling, coring, or cutting of existing floor slabs, use ground-penetrating radar or similar to identify location of embedded items such as utilities, conduit raceways, prestressing/post-tensioning cables, reinforcing steel, etc.
- C. Address penetrations through new or existing structures as indicated in the contract documents. Where the contract documents do not cover the conditions encountered, submit a coordinated plan showing penetration sizes and locations required by all trades for Port approval prior to proceeding with the work.

1.2 NOTIFICATION TO PORT

- A. Notify the Port at least 48 hours before intent to commence work. Do not start work until authorized to do so by the Port.

1.3 VERIFICATION OF MEASUREMENTS

- A. Before ordering material or doing work, verify measurements of the building and be responsible for the correctness of same. Submit discrepancies to the Port before proceeding with the work. The Contractor will not receive extra compensation for verification of measurements or for work performed based on incorrect measurements that, could have been, but were not verified by the Contractor.

1.4 EXISTING UTILITIES

- A. Notify the Oregon Utility Notification Center (OUNC), and owners of underground utilities within the construction area or within affected public rights-of-way or easements, via the “one-call” notification system (1-800-332-2344) in advance of the commencement of excavation activities, as prescribed in Oregon Revised Statutes (ORS) 757.541 to 757.571, Excavation Regulations.
- B. Notify the Port when the “one-call” request is being initiated.
- C. Protect existing utilities, and other public and private facilities and improvements which are to remain in place, from damage in the course of the work.

- D. Perform any shutdown of utilities only when such shutdown will not interfere with Port or tenant operations. Schedule shutdowns through the Port, allowing time for adequate coordination.
- E. In the event of interruption to field-located utility services as a result of the work, promptly notify the Port first, and then the proper authority. Cooperate with said authority in restoring service as promptly as possible. If required, the Contractor shall install suitable temporary service until permanent repair is completed and bear the cost of repair and temporary service.
- F. Unless noted as abandoned, expose utilities only by hand excavation.
- G. Notify the Port of all utilities exposed. Do not disrupt or cut utilities until identified and the Port has approved the cut.
- H. Repair damages that result from execution of the work at no additional cost to the Port. Repairs shall be subject to approval of the Port.

1.5 CEILING SYSTEMS

- A. Work requiring the temporary removal and subsequent replacement of existing ceiling systems shall be performed in a manner such that, when complete, the ceiling is equal to its original condition.
 - 1. All components shall be clean and free of damage.
 - 2. The ceiling plane shall be maintained at a constant elevation.
 - 3. Light fixtures, if present, shall be reinstalled at their original location if removed.
 - 4. Insulating materials, if originally present, shall be replaced, providing uniform coverage.
- B. Portions of the terminal building have an aluminum slat type suspended ceiling system — Alcan “Planar.” This system is composed of parallel formed aluminum strips, approximately 4 inches wide by 10 feet in length, snapped into special suspended cross-bars which are on about a 4-foot spacing. In some areas, approximately 1 1/2-inch-thick insulating batting is lying atop the system. The following are some recommendations concerning the handling of this ceiling system.
 - 1. The slats are formed from relatively thin aluminum and are susceptible to damage, kinking in particular, if improperly handled. Where applicable, slats are provided with end caps; butt joints have a hidden splice piece.
 - 2. When a small area of ceiling is to be removed temporarily, mark each piece (use a method that will not damage the surface) so it can be replaced at the same location, then carefully snap out individual slat pieces and store them in a secure location where they will be properly supported and kept free from accidental damage. A recommended procedure is to fabricate simple wire hooks which hook to cross bars of the ceiling system immediately adjacent to, and unaffected by, the removal work; the individual slats can then be suspended individually from these hooks.
 - 3. If insulating batting is present, simply slide it to the side, atop adjacent ceiling and batting.
 - 4. After necessary inspections, the ceiling shall then be reinstalled in the reverse procedure with insulation in place. The finished ceiling system shall be level.
 - 5. The Port will inspect the reinstalled portion of the ceiling. Repair or replacement of any damaged elements shall be the Contractor’s responsibility under the direction of the Port.
- C. Port personnel will, upon request, be available to advise and train the Contractor’s personnel in the procedure described.

1.6 POWER-ACTUATED FASTENERS (PAFs)

- A. Do not use PAFs for attachments for any work other than the following.
 - 1. Attachment of confined space signage.
 - 2. Anchorage of non-structural light gauge cold-formed steel framing to structure.
 - 3. Attachment of steel floor decking.
 - 4. Suspended ceiling applications, in accordance with ASCE 7-10, Chapter 13, if accompanied by calculations stamped and signed by an engineer registered in the state of Oregon, and in the following applications:
 - a. Shear loading.
 - b. Tension loading where the service load on any individual fastener in concrete does not exceed 90 pounds, or in steel does not exceed 250 pounds.
 - 5. Slack wires where there is no continuous loading in tension for items such as light fixtures.
- B. PAFs shall have silencers.
- C. PAFs may only be used during night work hours when the public and tenants are not present and during the day in areas where the public and tenants are well separated from the sound. Coordinate with the Port prior to performing the work.

1.7 EXISTING PORT CARPET

- A. The existing Port carpet is a custom broadloom carpet that is abnormally thick and dense, and is difficult to work with. The field carpet is tufted with some loop and the border carpet is loop. Any new carpet required by the work for patching or repairing existing carpet shall be obtained from Port maintenance. All work with new and existing carpet shall be performed by individuals skilled at working with broadloom carpet.
 - 1. Match finish elevation at seams including between the new and existing carpet. This requires extra care at the border carpet because some of the cushion attached to the border carpet has differing thickness.
 - 2. Coring holes through concrete floor slab: Carefully cut and remove the carpet 1/4-inch beyond the diameter of the hole that will be cut or bored into the floor. Align drill bit or coring bit in center of the carpet cut-out and hold securely so drill bit or coring bit doesn't wander and catch on the carpet edge. Do not bolt the core drill to the floor without prior approval from the Port. Attach the drill to a large piece of steel plate that is heavy enough to hold it in place. If the core drill needs to be bolted to the floor, do not bolt core drill to slab through carpet; instead, carefully cut and remove approximately 3' x 3' of carpet and adhesive so that core drill can be attached directly to the floor. Locate and size the area to be removed by cutting across pattern in as few spots as possible. Cut across areas of solid color where possible as this best hides the seam and helps hide pattern match issues. When removing carpet from floor, start from the center and work out toward an edge to reduce possible damage to the edge of the carpet. Follow instructions for installing patches as described above.
 - 3. In all instances, apply sealer to both primary and secondary backings. This is most critical for the border carpet which has an attached cushion. The sealer shall be applied to the backing yarns where they meet the attached cushion. Allow sealer to dry before gluing the patch into place so as not to contaminate the face yarns.
- B. Patching Existing Carpet:

1. Submit a drawing identifying where each patch will be located. Show size of each patch and dimensions from adjacent features and existing seams. Obtain Port approval for location and dimensions prior to proceeding with the work. The following are guidelines for patching existing Port carpet.
2. To patch very small holes (less than 1" x 1") or pulls in carpet: Cut yarn strands off and apply super glue to the small hole or where yarn pull came out of.
3. To patch small holes in carpet (larger than 1" x 1"): Top cut just outside of problem area. Remove excess carpet and clean substrate. Super glue or seam seal raw edge of cut carpet. Locate same area of pattern in a small scrap of carpet, furnished by Port maintenance, and cut out a fill piece of the appropriate size. Once trimmed to a good fit, seam seal or super glue the fill piece edges. Apply adhesive to substrate and insert patch. Protect area during drying time.
4. To install medium sized patches (e.g. 3' by 3'): Trim existing carpet edges to remove loose or damaged material and so that the patch will cut across pattern in as few spots as possible. Cut across areas of solid color where possible as this best hides the seam and helps hide pattern match issues. Clean adhesive and prep floor as required. Cut the new piece from carpet furnished by Port maintenance, matching fill size and pattern as close as possible. Seal edges of existing carpet on the floor as well as edges of new carpet to be inserted. Adhere carpet to floor and protect area during drying time.
5. Large areas of replacement or where abutting new carpet to existing: Measure four pattern repeats across the width (about 143 inches) of existing adjacent carpet. Measure five pattern repeats down length (about 145 inches) of existing adjacent carpet. Look at the overage roll measurement chart, obtained from Port maintenance, and request from Port maintenance a roll of the same width or slightly narrower than that measured on the existing carpet and has five pattern repeats that is the same or slightly shorter than that measured on the existing carpet, because it is easier to stretch the carpet then to shrink it. Clean any adhesive from substrate and prep floor as required. Seal edges of existing adjacent carpet as well as edges of new carpet being installed. Adhere carpet to floor. Stretch as required to align pattern along edges and within field. Protect area during drying time.

END OF SECTION 017000

SECTION 017329 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes cutting, coring, fitting, and patching as required in existing construction.
- B. Perform the work of this section as necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair existing areas and new work damaged by subsequent work.
 - 7. Remove and replace defective and non-conforming work.
 - 8. Repair or removal of hazardous or unsanitary conditions.
 - 9. Uncover portions of the work to provide for installation of ill-timed work.
 - 10. Remove abandoned items and items serving no useful purpose, such as abandoned piping, conduit and wiring.
- C. Upon Written Instructions:
 - 1. Uncover designated portions of the work for observation of covered work.
 - 2. Remove samples of installed materials for testing beyond that specified.
 - 3. Remove work to provide for alteration of previously installed work.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 017000, Execution: For inspection requirements applicable to cutting and patching; for cutting and patching carpet and requirements for existing suspended ceilings.

1.3 SUBMITTALS

- A. Submit a written request to the Port prior to cutting, coring, or alteration which affects the work, the existing facility, or which may affect the structural safety of any portion of the facility. Include:
 - 1. Identification of the project.
 - 2. Description of the affected work.
 - 3. The necessity for doing the cutting, coring, or alteration.
 - 4. The effect on the work, the existing facility, or the structural integrity of the facility.
 - 5. Description of the proposed work:
 - a. The scope of cutting, patching, coring, or alteration.
 - b. The Contractor and trades who will execute the work.
 - c. Products proposed to be used.
 - 6. Alternatives to cutting, coring, or patching.

- B. Submit a written notice to the Port designating the date and the time the work will begin.

1.4 UTILITY SERVICES

- A. Maintain existing utilities indicated to remain, keep in service, and protect against damage.
- B. Include interruptions to existing utilities in the Work Progress Schedule.
- C. Confirm scheduled interruptions with the Port 7 to 14 days in advance of the scheduled interruption. Do not proceed until Port approval has been obtained.
- D. Maintain operation of existing fire sprinkler system. Notify the Port 7 days before system or parts of system must be inactive to allow tie-in of new work. Minimize hazardous exposures during time fire sprinkler system is out of service.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. New Materials: Use materials specified in technical sections of these specifications.
- B. Existing Materials: Determine type and quality of existing materials by inspecting and testing products where necessary.
 - 1. Request documentation from the Port for in-place materials.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect existing conditions of the project, especially elements subject to damage or to movement during cutting, coring, patching, and alterations.
- B. Comply with the requirements of Section 017000, Execution Requirements, for investigation prior to penetration of floor slabs.
- C. After uncovering work, inspect the conditions affecting the installation of products or performance of the work.
- D. Report unsatisfactory or dubious conditions to the Port in writing. Proceed with the work only after the Port has provided further instructions.

3.2 PREPARATION

- A. Provide shoring, bracing, and other support as necessary to prevent movement of the structure and to assure the structural safety of that portion of the work.

- B. Provide devices and methods to protect the existing facility and other portions of the work from damage.
- C. Provide protection from the elements for that portion of the existing facility and work which will be exposed by cutting and patching and alterations work.
- D. Roofing: Before work begins near the existing roof, conduct a meeting with the Port. The roof shall be maintained waterproof during the construction period. Do not store materials on the roof.

3.3 CUTTING AND PATCHING

- A. Execute cutting, coring, and demolition by methods which will assure safety, will prevent damage to other work or existing areas to remain, and will provide proper surfaces to receive repairs.
- B. Pneumatic tools will not be allowed without prior written approval.
- C. Fit work air-tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- D. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.
- E. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes. Where not specified, match existing materials and finishes for color, texture, and appearance.
- F. Where removal results in adjacent spaces becoming one, rework floors and ceilings to provide smooth planes without breaks, steps or bulkheads, unless otherwise indicated.
- G. Unless shown otherwise, perform cutting so that a smooth transition with new work is possible and terminate existing surface along a straight line at a natural line of division.
- H. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Port review and request instructions.
- I. Restore work that has been cut or removed.
- J. When new work abuts or finishes flush with existing work, make a smooth and workmanlike transition. Patched work shall match existing adjacent work in texture and appearance so that the patch or transition is invisible from a normal viewing distance.
- K. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
 - 1. For continuous surfaces, refinish to nearest intersection or natural break.
 - 2. For an assembly, refinish the entire unit.
- L. At completion of work of each trade, clean area and make surfaces ready for work of successive trades.
- M. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

- N. At completion of work in each area, return space to a condition suitable for use.

3.4 ALTERATIONS

- A. Remove existing work as indicated and as required to accomplish new work.
 - 1. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 2. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- B. Adhere to requirements for cutting and patching where applicable.
- C. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
- D. Verify that construction and utility arrangements are as shown.
 - 1. Report discrepancies to the Port before disturbing existing installation.
 - 2. Beginning of alterations work constitutes acceptance of existing conditions.
- E. Keep areas in which alterations are being conducted separate from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary stanchions or barricades.
 - 2. Noise, Dust, Vibration, and Odors: Operations that may result in high levels of noise and dust, vibration, odors, or other disruption to occupants will not be allowed without mitigating measures acceptable to the Port.
- F. Services (including but not limited to HVAC, plumbing, baggage conveyor, fire protection, electrical, and telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation. Maintain access to equipment and operational components and if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and the work requires reactivation, put back into operational condition. Repair supply, distribution, and equipment as required.
 - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections. Minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 - 4. Verify that services shown as abandoned are actually abandoned.
 - 5. Remove abandoned pipe, ducts, conduits, and equipment, where shown, including those above accessible ceilings. Remove back to source of supply where possible otherwise cap stub and tag with identification. Patch holes left by the removal using materials specified for new construction.
- G. Clean existing systems and equipment that become unclean due to the work.
- H. Remove demolition debris and abandoned items from work area and dispose of off-site.

END OF SECTION 017329

SECTION 017419 - CONSTRUCTION WASTE RECYCLING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes recycling goals for construction and demolition work on Port property.
- B. The Contractor shall salvage, reuse, recycle, compost, mulch, or use for energy recovery as many construction, demolition, and yard waste materials as is feasible and cost-effective. The Contractor shall coordinate all salvaging and recycling operations.
- C. Unless specified elsewhere in this contract, salvaged and/or recycled material shall be removed from Port property in accordance with local, state, and federal regulations.

1.2 PROJECT-SPECIFIC RECYCLING

- A. Items to be recycled on this project may include, but are not limited to:
 - 1. Concrete.
 - 2. Metals (ferrous and non-ferrous).
 - 3. Wood.
 - 4. Corrugated cardboard.
 - 5. Plastics.
 - 6. Electronics and electrical components.
 - 7. Paper.
 - 8. Drywall board.
 - 9. Carpet.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 024119, Selective Interior Demolition

1.4 SUBMITTALS

- A. Initial Pre-Construction Estimate:
 - 1. Before site work begins, submit a completed site waste recycling form for work performed on this project.
 - 2. Use the form attached at the end of this section.
 - 3. The initial form submitted shall identify the types of construction or demolition materials that are expected to be recycled, salvaged, or disposed of over the duration of the work and the destination of the material.

- B. Monthly Reports: Submit updated site waste recycling forms on a monthly basis. The updates shall include the actual amounts of construction and demolition materials recycled, salvaged, or disposed of during the previous period.
 - 1. Report quantities of materials in tons, based on weight slips, bills of lading, etc. If actual quantity of material is unknown, provide an estimate calculated to the nearest 0.5 ton.
 - 2. Use the form attached at the end of this section.
- C. Closeout Project Summary: Prior to contract closeout, submit a final site waste recycling form that records the total amount of construction or demolition materials recycled, salvaged, or disposed of during the duration of the project. Use the form attached at the end of this section. Attach the following information to the form:
 - 1. Summary statement identifying and explaining any discrepancies between the amounts originally estimated and the actual amounts.
 - 2. Copies of receipts, weight slips, bills of lading, etc. for all materials.

1.5 QUALITY ASSURANCE

- A. Comply with applicable regulations pertaining to collection, management, hauling, and disposal of waste or recyclable materials.
- B. Use facilities properly permitted by appropriate jurisdictions.

1.6 RECYCLING PROCESSORS AND FACILITIES

- A. Contact Metro (503-234-3000) for a comprehensive list of recyclable materials and recycling facilities in the Portland area.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide handling, containers, storage, signage, transportation, and other items as required to facilitate the recycling process during the duration of the work.
- B. Designate a “waste coordinator” who shall be responsible for coordinating the Contractor’s recycling measures and verifying the accuracy of the recycling information submitted.
- C. Train employees, subcontractors, and suppliers on proper recycling procedures, as appropriate for the work.
- D. Conduct recycling operations to ensure minimum interference with roads, streets, walkways, and other adjacent occupied and used facilities.

- E. Do not sell or distribute recycled or salvaged items to the public from Port property.

3.2 ON-SITE MATERIALS SORTING

- A. Coordinate with recycling and salvage vendors to determine if materials targeted for recycling will be source-separated or co-mingled on site. Space or other site-specific factors shall be considered.
- B. Separate recyclables from non-recyclable waste materials, trash, and debris.
- C. Provide one or more appropriately marked containers or bins for collecting and managing recyclable waste until it is removed from the work site.
 - 1. Post list of acceptable and unacceptable materials at each container and bin.
 - 2. Inspect containers and bins for contamination and remove contaminated materials if found.

END OF SECTION 017419

SITE WASTE RECYCLING

CONTRACTOR: _____
PROJECT TITLE: _____
PROJECT NO: _____
LOCATION: _____

☐ Initial Pre-Construction Estimate ☐ Monthly Report (from: _____ to _____, 20____) ☐ Closeout Project Summary*

RECYCLED MATERIAL	Not generated at this site	Collected for offsite recycling (tons)	Collected for salvage/reuse (tons)	Collected for disposal (tons)	Destination (facility name and location)	Comments
Concrete						
Asphalt						
Metals (ferrous)						
Metals (non-ferrous)						
Land-Clearing Debris						
Wood						
Corrugated Cardboard						
Plastics						
Electronics and Electrical Components						
Other (specify)						
Other (specify)						

* For closeout project summary, include copies of documentation (receipts, bills of lading, etc.) with this report.

Signature of Waste Coordination Certifying
Accuracy of this Report

Title

Date

Print Name

Contact Telephone Number

See reverse for instructions and additional information.

Submit with Contractor's Monthly Request for Payment to Construction Contract Manager.

INSTRUCTIONS FOR COMPLETING SITE WASTE RECYCLE FORM

This form is to be used multiple times throughout the project as shown in the examples below.

MATERIAL SUMMARY

☒ Initial Pre-Construction Estimate

RECYCLED MATERIAL	Not generated at this site	Collected for offsite recycling (tons)	Collected for salvage/ reuse (tons)	Collected for disposal (tons)
Concrete		X		
Asphalt	X			
Metals (ferrous)	X			
Metals (non-ferrous)	X			
Land-Clearing Debris		X		
Wood			X	
Corrugated Cardboard	X			
Plastics		X		
Electronics and Electrical Components	X			
Other (specify)				X

Pre-Construction Estimate: Prior to beginning work at the site, submit a completed form that indicates the TYPES (not amounts) of site materials expected to be recycled, salvaged, or disposed of. Do this by marking the appropriate columns for each material as shown.

MATERIAL SUMMARY

☒ Monthly Report (from: 4/1 to 4/30 , 2005)

RECYCLED MATERIAL	Not generated at this site	Collected for offsite recycling (tons)	Collected for salvage/ reuse (tons)	Collected for disposal (tons)
Concrete		35		
Asphalt	X			
Metals (ferrous)	X			
Metals (non-ferrous)	X			
Land-Clearing Debris		15		
Wood			1.5	
Corrugated Cardboard	X			
Plastics				
Electronics and Electrical Components	X			
Other (specify)				X

Monthly Report: Each month, submit a completed form that indicates both the TYPES and QUANTITIES (to the nearest 0.5 ton) of site materials that were actually recycled, salvaged, or disposed of during the monthly reporting period. Do this by marking the appropriate columns for each material as shown.

MATERIAL SUMMARY

☒ Closeout Project Summary

RECYCLED MATERIAL	Not generated at this site	Collected for offsite recycling (tons)	Collected for salvage/ reuse (tons)	Collected for disposal (tons)
Concrete		35		
Asphalt	X			
Metals (ferrous)	X			
Metals (non-ferrous)	X			
Land-Clearing Debris		65		
Wood			4.5	
Corrugated Cardboard	X			
Plastics		.5		
Electronics and Electrical Components	X			
Other (specify)				6.5

Closeout Summary: After all site work is completed, submit a completed form that indicates both the TYPES and QUANTITIES (to the nearest 0.5 ton) of site materials that were actually recycled, salvaged, or disposed of during the monthly reporting period. Do this by marking the appropriate columns for each material as shown.

IN ADDITION, include documentation (weight receipts, bills of lading, etc.) that support the numbers reported.

- Forms shall be filled out completely and legibly. All amounts shall be reported in tons.

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 REDLINE DRAWINGS

- A. Upon completion of the work, and as a requirement of final acceptance, submit to the Port a drawing set showing all as-constructed changes and information.
- B. See Section 013300, Submittal Procedures, for requirements.

1.2 OPERATION AND MAINTENANCE MANUALS

- A. See Section 013300, Submittal Procedures, for requirements.

1.3 MAINTENANCE INSTRUCTION

- A. Instruct Port maintenance personnel in the operation, adjustment, and preventive maintenance procedures for the system/equipment.
- B. Schedule instruction through the Port.

1.4 TRAINING

- A. Train Port personnel in the operation of the system/equipment.
- B. Schedule training through the Port.

1.5 CONSTRUCTION STAKE AND MARKINGS REMOVAL

- A. Remove stakes and painted markings used in construction layout.

1.6 CLEANUP

- A. Remove debris from the staging and work area(s).
- B. Thoroughly sweep paved areas prior to final acceptance.
- C. Areas to be opened for aircraft operations shall be thoroughly swept clean and approved by the Port prior to opening.

1.7 CERTIFICATES OF FINAL APPROVAL

- A. Submit originals or clearly readable copies of certificates of approval from the inspection authority prior to application for final payment.

1.8 CERTIFICATES OF OCCUPANCY

- A. Obtain Certificate of Occupancy from the City of Portland Bureau of Development Review and submit to the Port. Certificate of Occupancy is required as a condition of substantial completion.

1.9 RETURN OF SECURITY IDENTIFICATION BADGES

- A. Prior to final acceptance of the work, return all Port security identification badges to the Port badging office and obtain a receipt for their return. Submit a copy of the receipt to the Port's Construction Contract Manager.

END OF SECTION 017700

SECTION 024119 – SELECTIVE INTERIOR DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the following:
 - 1. Demolition and removal of selected interior portions of building or structure.
 - 2. Demolition and removal of existing floor coverings.
 - 3. Salvage of existing items to be reused.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 017329, Cutting and Patching: For requirements applicable to demolition work.
- B. Section 090561, Common Work Results for Flooring Preparation: For additional demolition requirements for floor coverings.

1.3 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI/ A10.6-2006: Safety Requirements for Demolition Operations
- B. CRI: Carpet and Rug Institute
- C. NFPA: National Fire Protection Association
 - 1. NFPA 241-00: Standard for Safeguarding Construction, Alteration, and Demolition Operations
- D. RFCI: Resilient Floor Covering Institute

1.4 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
 - 1. Detailed sequence of selective demolition 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. Coordination of continuing occupancy of portions of existing building and of partial occupancy of completed work so that operations continue uninterrupted.
 - 7. Means of protection for items to remain and items in path of waste removal from building.

- B. Existing Conditions Report, Flooring Areas: Inspection report of all areas where floor coverings and base are scheduled for removal. Include the following:
 - 1. Labeled photos of subfloor areas.
 - 2. Summary of conditions encountered including any areas of subfloor damage or signs of moisture, mold, or mildew.
- C. Flooring Removal Equipment Plan: Verify the proposed flooring removal equipment can be used in locations. Include the following:
 - 1. Floor plan showing path to floor areas requiring equipment use.
 - 2. Weight and weight distributions.
 - 3. Footprint size and support points.
 - 4. Engine or motor type.
- D. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.
- E. Pre-Demolition Photographs or Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before work begins.

1.5 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this project.
- B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Pre-Demolition Meeting: Conduct meeting at project site to review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition 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 selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.6 PROJECT CONDITIONS

- A. The areas of selective demolition are within an existing building with ongoing occupant activities. Conduct selective demolition so ongoing operations will not be disrupted.

- B. Conditions existing at time of inspection for bidding purpose will be maintained by the building occupants as far as practical.
- C. Provide notification of discrepancies between existing conditions and drawings before proceeding with selective demolition.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.
- F. Flooring Removal Equipment Restrictions:
 - 1. General: No combustion engines allowed.
 - 2. Maximum Equipment Weight:
 - a. Deplaning level: 3,000 lbs.
 - b. Enplaning level: 2,600 lbs.
 - 1) Minimum equipment footprint of 2 feet by 5 feet.
 - 2) Operate a minimum of 5 feet clear from other equipment and construction loads including but not limited to similar units and stacked carpet rolls.
 - 3) Unit shall have a minimum of three support points with maximum of 40 percent weight distribution to any single support point.
 - 4) Maintain 1 foot minimum clearance from floor openings larger than 12 inches square.
 - c. Mezzanine and other levels above enplaning level: 600 lbs.

1.7 PROTECTION OF EXISTING WARRANTIES

- A. Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.
 - 1. Roof modifications is work of Section 070152, Modified Bituminous Sheet Roofing System Modifications.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plywood flooring substrate for loading: Marine-grade plywood in thickness indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.

- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. Examine existing floor covering for adhesion, water damage, alkaline deposits, and other defects.
 - 1. Document defects for Port's review for determinant factors for required remediation.
- E. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report.
- F. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- G. Perform surveys as the work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. The Port will arrange to shut off indicated services/systems when requested by the Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. See Sections 220500, Common Work Results for Plumbing; 230500, Common Work Results for HVAC; and 260500, Common Work Results for Electrical, for services/systems demolition requirements.

3.4 PREPARATION

- A. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent areas to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified elsewhere.
- B. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
- C. Temporary Protection: Provide protection to finishes and construction to remain to prevent damage. Comply with Division 01 requirements.

3.5 GENERAL SELECTIVE DEMOLITION

- A. Comply with Section 017329.
- B. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition 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 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. See Division 1 for fire suppression requirements and for welding, cutting, and burning permit.
 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.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition 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. Comply with requirements in Division 1 regarding solid waste management and construction waste management.

- C. Reuse of Building Elements: Do not demolish building elements beyond what is indicated on drawings without approval.
- D. Removed and Salvaged Items:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to the Port.
 - 4. Transport items to the Port's storage area.
 - 5. Protect items from damage during transport and storage.
- E. Removed and Reinstalled Items:
 - 1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 - 3. Protect items from damage during transport and storage.
 - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted, items may be removed to a suitable, protected storage location during selective demolition, cleaned, and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Existing post tension slab is to be left undisturbed during construction. Existing utility penetrations to be reused as needed. Existing penetrations shall not be modified without written approval from Port, project architect and structural engineer.
- B. Concrete:
 - 1. Remove slab on grade and other concrete assemblies in a manner to minimize damage to underslab vapor retarders and blind-side or concealed waterproofing.
 - a. Review methods of cutting and removal prior to work.
 - b. After removal, patch and repair membranes according to manufacturer's written instructions and as acceptable to Port and Port's envelope consultant.
 - 2. Demolish in small sections. Cut concrete to a depth of at least 3/4 inch at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.
 - 3. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove. Do not cut full-depth of slab.
- C. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.7 REMOVAL OF EXISTING FLOOR COVERINGS

- A. Floor Coverings:

1. Remove floor coverings and adhesive according to recommendations in CRI, RFCI-WP, and the RFCI-WP Addendum.
 2. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by CRI and RFCI.
- B. Avoid loading or driving construction equipment over terrazzo areas. Where required for access to parts of construction, protect terrazzo from damage.
1. Place 1-inch minimum plywood panel over 1/8-inch minimum thickness foam padded membrane. Adjacent panels shall be interlocked to prevent shifting during transporting of equipment over terrazzo.
 2. Extend protection panels a minimum of 2'-0" beyond the path width required to move equipment.
 3. Limit equipment loads to values indicated in Part 2.
- C. Remove existing floor covering and adhesive. Comply with local, state, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings and CRI 105 for carpet, and for terrazzo flooring removal, National Terrazzo & Mosaic Association's and International Concrete Repair Institute, ICRI 310.2 recommendations.
- D. Dispose of removed materials in accordance with local, state, and federal regulations and as specified in the Construction Waste Management Plan and Section 017419, Construction Waste Recycling.
- E. Carpet Removal:
1. All carpet:
 - a. Neatly cut edges of carpet to remain in straight lines.
 - b. Remove carpet.
 - c. Remove loose fibers from edges of remaining carpet.
 - d. Remove carpet tiles.
 - e. Remove adhesive following recommendations of ICRI, floor covering manufacturer, and adhesive manufacturer.
 - f. Do not use sweeping compounds.
 - g. Sweep and vacuum floor and adjacent carpet areas.
- F. Preparation of removed carpet for recycling:
1. If damp or wet, dry carpet thoroughly.
 2. Tightly roll pile side out in 6 feet wide or small rolls. Do not cut carpet into small narrow pieces.
 3. Carpet rolls and container shall be free of contamination as noted and shall not contain any knife blades, cardboard, plastic, food, or debris of any kind.
 - a. Carpet backing shall be reasonably free of direct glue down adhesive to meet requirements of recycling company.
 - b. Carpet backing shall be reasonably free of concrete or floor fill material to meet requirements of recycling company.
 - c. Carpet shall be tied off with carpet strips. Do not use tape or plastic ties.
 4. Use effective packing techniques to maximize amount of material in container.
- G. Exposed subfloor areas: Limit the amount of subfloor exposed to the public at any one time to only what is required to meet the critical path of the construction schedule.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. Except for items or materials indicated to be recycled, reused, salvaged, or reinstalled, remove demolished materials from project site and legally dispose of them in an EPA-approved landfill.
 - 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.

3.9 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 054000 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior non-load-bearing wall framing 33 mil and thicker.
- B. Related Requirements:
 - 1. Section 055000 “Metal Fabrications” for steel shapes used for cold-formed metal wall framing.
 - 2. Section 061053 “Miscellaneous Rough Carpentry” for concealed wood blocking.
 - 3. Section 078100 “Applied Fireproofing.”
 - 4. Section 092216 “Non-Structural Metal Framing” for interior wall framing less than 33 mil thickness and suspension systems.

1.2 SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings: For walls, showing required reinforcement, blocking, clips required for head-of-wall supports to be embedded in applied fireproofing and deck closures.
 - 1. Show interfaces with existing structure.
 - 2. Locate all penetrations and supports for other work to be concealed in framing cavities.
 - 3. Show required field modifications, reference attachment of other work and its requirements affecting cold-formed metal framing design or installation.
 - 4. Indicate reinforcing channels, final opening dimensions, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Welding Certificates.
- D. Product Certificates: For each type of code-compliance certification for studs and tracks.
- E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips.
 - 7. Miscellaneous structural clips and accessories.
- F. Qualification Data: To show compliance with "Quality Assurance" Article.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code-Steel," and AWS D1.3, "Structural Welding Code-Sheet Steel."
- D. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- E. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide products by the following:
 - 1. SCAFCO Corporation.
 - 2. Clark Steel Framing.
 - 3. Dietrich Metal Framing; a Worthington Industries Company.
 - 4. Steeler, Inc.
 - 5. United Metal Products, Inc.
 - 6. Or equal.

2.2 PERFORMANCE REQUIREMENTS

- A. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S220.
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: As indicated.
 2. Coating: G60 or equal.
- B. Steel Sheet for Clips: ASTM A 653, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: As Indicated.
 - a. Coating: G60 or equal.
- C. Recycled Content of Steel Products: Postconsumer recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

2.4 NON-LOAD-BEARING WALL FRAMING

- A. General: Material strengths, stud size, gauge and spacing are as shown on the drawings.
- B. Cold Formed Metal Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.
- C. Steel Track (cold formed metal track): Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Flange Width: 1 1/2 inches unless indicated otherwise in drawings.
- D. Deflection Tracks: Manufacturer's punched, U-shaped steel tracks, with unstiffened flanges, slotted openings for framing deflection and drift.
- E. Cold-Formed Angle: ASTM C 645. Size and thickness indicated.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Depth: 7/8 inch and 1-1/2 inches as indicated on drawings.

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration.
 1. Deck plates.
 2. Z-clips.
 3. Angles.
 4. Backer plates.
 5. Supplementary framing.

6. Bracing, bridging, and solid blocking.
 7. Web stiffeners.
 8. Stud kickers and knee braces.
 9. Hole-reinforcing plates.
- C. Steel Shapes, Zees, Clips and Plates: Provided under Section 055000 "Metal Fabrications."
1. ASTM A 36/A 36M, shop primed unless indicated to be galvanized.

2.6 ANCHORS AND FASTENERS

- A. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- B. Post-Installed Anchors: As indicated on Drawings.
- C. Power-Actuated Anchors: Comply with Section 017000 "Execution Requirements".
1. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- D. Mechanical Fasteners: Products indicated on Drawings. No substitutions.
1. Head Type: Hex washer head, undercut flathead, custom head styles as noted on drawings.
- E. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780.
- B. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- C. Sill Seal: Closed cell polyethylene foam sill gasket, minimum 1/4 inch thick, minimum 1 lb/cu.ft. density.

2.8 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this section.
1. Fabricate framing assemblies using jigs or templates.
 2. Cut framing members by sawing or shearing; do not torch cut.
 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

- a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to shop drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
- 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to shop drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, clips, or tracks to structural members indicated to receive sprayed fire-resistive materials.
 - 1. Attach deck closures and plates, opening covers and supports for grouting above.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install sill sealer gasket at the underside of wall bottom track at curbs and against exterior wall framing.

3.3 GENERAL INSTALLATION

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

- B. Install cold-formed steel framing according to AISI S220 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to shop drawings, and complying with requirements for spacing, edge distances, and screw penetration.
 - c. Install fasteners such that fastener heads are flush and in complete contact with framing member.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was engineered. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation where shown in built-up framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as indicated.

- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.
- D. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- E. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install deflection tracks and anchor to building structure.
- F. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
- G. Powder Actuated fasteners (PAF):
 - 1. See Section 017000 "Execution Requirements".
 - 2. PAFs with silencers will be allowed for anchoring non-structural light gage cold formed steel framing to structure.
 - 3. Where allowed, PAFs may only be used during night work hours when the public and tenants are not present and during the day in areas where the public and tenants are well separated from the sound. Coordinate with the Port prior to performing the work.
- H. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

- A. Testing: Port will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Port.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at the Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensure that cold-formed steel framing is without damage or deterioration at time of substantial completion.

END OF SECTION 054000

SECTION 055000 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes items made from iron and steel shapes, plates, bars, strips, tubes, pipes, and castings which are not a part of structural steel or other metal systems specified elsewhere.
 - 1. Miscellaneous framing and supports.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Steel profiles for cold-formed metal framing.
 - 2. Perimeter angle support for synthetic turf.
 - 3. Steel and strut supports required and designed in other Sections.
- C. Related Requirements:
 - 1. Section 054000 “Cold-Formed Metal Blocking” for gauge deck closure plates and assemblies receiving work of this section.
 - 2. Section 057000 “Decorative Metal” for decorative metal fabrications.
 - 3. Section 066116 “Solid Surfacing Fabrications.”
 - 4. Section 096253 “Synthetic Turf Flooring” for installation of perimeter angles.
 - 5. Section 102116 “Toilet Compartments.”

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in other work. Deliver such items to Project site in time for installation.

1.3 SUBMITTALS

- A. Product Data: Manufacturer’s specifications, anchor details, and installation instructions for products to be used in the fabrication of metalwork, including paint products and grout.
- B. Shop drawings: Show fabrication and erection of metal fabrications. Include drawings, elevations, and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation under other sections.
- C. Where design of members and connections is specified as part of the work of this section, submit structural analysis showing loadings and stresses, stamped and signed by a structural engineer registered in Oregon with shop drawings showing these items, similarly stamped and signed.

- D. For site welding work, submit a detailed plan of safety procedures that includes fume control and shielding.

1.4 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the provisions of the following codes, standards and specifications, except where more stringent requirements are shown or specified:
 - 1. AISC, "Specifications for Structural Steel Buildings," including the "Commentary on the AISC Specifications."
 - 2. AWS D1.1, "Structural Welding Code – Steel."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.5 FIELD CONDITIONS

- A. Take field measurements prior to preparation of shop drawings and fabrication, where required for installation. Do not delay job progress; allow for trimming and fitting wherever taking field measurements before fabrication might delay work.
- B. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

- A. For fabrication of metalwork which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, and roughness.
- B. Fabricate metal fabrications from ASTM A36 steel, or as recommended by fabricator for the specific application and approved by Port; except where material is specifically identified.
 - 1. See Structural Drawings.
- C. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches minimum and as required for application.
 - 2. Cold-Rolled Steel: ASTM A1008/A1008M, structural steel, Grade 33; 0.0966-inch minimum thickness; shop primed.
- D. Anchors and Fasteners: Select fasteners of the type, grade, and class required unless otherwise indicated.
 - 1. Post-Installed Anchors: See Structural Drawings.
 - 2. Provide zinc-coated fasteners for exterior use or where built into exterior walls.
- E. Metal Primer Paint:
 - 1. Zinc-Coated Steel: Acceptable Manufacturers and Products: Tnemec Series 115 or Series 1028 for non-overhead applications; Rustoleum System, or equal.

2. Uncoated Steel: Acceptable Manufacturers and Products: Prime: Tnemec Series 115 or Series V10 Primer; Rustoleum System, or equal.
3. Verify compatibility with the required finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified elsewhere.

2.2 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Workmanship:
 1. Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.
 2. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- C. Weld corners and seams continuously, complying with AWS recommendations. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.
- D. Form exposed connection with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, socket type flathead (countersunk) screws or bolts. Provide sufficient backing at screw locations to cover at least three threads.
- E. Provide for anchorage of type suitable for use with supporting structure. Fabricate and space anchoring devices as shown and as required to provide adequate support for intended use.
- F. Cut, reinforce, drill, and tap metal fabrications as required to receive finish hardware and similar items.
- G. Galvanizing: Provide a zinc coating for those items shown or specified to be galvanized, as follows:
 1. ASTM A123 for galvanizing iron and steel products.
 2. ASTM A153 for galvanizing iron and steel hardware.
 3. ASTM F2329 for galvanizing fasteners.
- H. Shop Painting:
 1. Shop paint metal fabrications (after galvanizing where a zinc coating is specified), except members or portions of members to be embedded in concrete or masonry, unless otherwise specified.
 2. Remove scale, rust and other deleterious materials before applying shop coat.
 3. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions and at a rate to provide uniform dry film thickness of 1.0 mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges and exposed surfaces.

4. Apply one shop coat to fabricated metal items, except apply two coats of paint to surfaces inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.
5. Omit shop primer on items being embedded in applied fireproofing unless permitted by UL fire-resistance assemblies.

2.3 METAL FABRICATIONS

A. Fabrications, General:

1. Provide miscellaneous steel framing and supports as indicated as required to complete work.
2. Fabricate miscellaneous units to sizes, shapes, and profiles shown or, if not shown, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware and similar items.
3. Shop prime except for locations embedded in concrete or in applied fireproofing unless otherwise allowed by UL designations.
 - a. Coordinate with Section 078100 for requirements.
4. Galvanize items at exterior and in exterior walls.

B. Miscellaneous Framing and Supports:

1. Supplemental Steel Framing and Supports: See Structural Drawings:
 - a. Deck supports.
 - b. Signage supports.
 - c. As indicated.
2. Provide 6-inch-square (minimum) 1/4-inch-thick steel plates and extending 1-inch minimum beyond equipment anchors:
 - a. At each point of support of toilet compartments and urinal screens. Attach to metal blocking.
 - b. Where required.
3. Steel Counter Supports: Provide angles to support counters as shown. Drill holes to receive screws for attachment to metal studs.

C. Perimeter Support Angles for Synthetic Turf: Provide angles to support terminating edges of turf.

1. Coordinate attachment holes with backup support and with requirements of Section 096253.
2. Fabricate from Type 316 stainless steel ASTM A276 angles or formed bents from ASTM A240 or ASTM A666 sheet.
 - a. Size: 1-1/2 inches by 1-1/2 inches legs, 1/8-inch thick.
 - b. Length: Single stick, full length each side.
 - c. Corner: Butted, with continuous horizontal leg.
 - d. Bend horizontal leg to 2-degree slope downward towards drain, 88 degree angle.
3. Mounting: Drill 1/4-inch diameter holes to receive screws for attachment to concrete.
 - a. Spacing: 1/2-inch minimum and 4 inches maximum from ends and maximum 16 inches o.c.
4. Screw Anchors: Provided under Section 096253.

- D. Rough Hardware:
 - 1. Furnish required bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other steel and iron shapes.
 - 2. Manufacture or fabricate items of sizes, shapes, and required dimensions.
- E. Loose Bearing Plates: Provide loose bearing plates for steel items bearing on concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required.
 - 1. Galvanize exterior items after fabrication.
 - 2. Shop prime interior bearing plates after fabrication.
- F. Provide other miscellaneous steel items. Work of this section is not limited to the items listed above.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which metal fabrications are to be installed. Correct conditions which are detrimental to the proper and timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection.
- B. Removal of existing applied fireproofing to comply with Section 017329 "Cutting and Patching."

3.3 INSTALLATION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
 - 1. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- B. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction including threaded fasteners for concrete inserts, toggle bolts, through-bolts, and other connectors as required.
- C. Cutting, Fitting and Placement:
 - 1. Perform cutting, drilling, and fitting required for installation of metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels with lines visually parallel. Provide temporary bracing or anchors in framework for items which are to be built into concrete or masonry of similar construction.

2. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop-welded because of shipping size limitations. Grind joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.
1. Fume Control: Provide welding fume control to protect personnel and the public from exposure to heavy metals.
 2. Shielding: Provide shielding for arc welding operations to protect personnel and the public that may have visual or other access during the work.
- E. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 1.0 mils.

END OF SECTION 055000

SECTION 057000 - DECORATIVE METAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes decorative metal (DM#):
 - 1. DM1: Steel plates.
 - 2. DM2: Interior metal wall base.
 - 3. DM3: Wainscot and wall paneling, with base.
 - 4. Factory fabricated interior column covers.
 - 5. Sheet metal trim.
- B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" and Section 092216 "Non-Structural Metal Framing" for blocking backup supporting decorative metal.
 - 2. Section 061053 "Miscellaneous Rough Carpentry".
 - 3. Section 092713 "Glass-Fiber-Reinforced Gypsum Fabrications" for GFRG column covers with matching seams of column covers in this Section.

1.2 COORDINATION

- A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in other work. Deliver items to Project site in time for installation.
- B. Coordinate installation of decorative metal with adjacent construction to ensure that wall assemblies, flashings, trim, and joint sealants, are protected against damage from the effects of exposure, age, corrosion, and other causes of deterioration.
- C. Coordinate column covers with GFRG column covers.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data including description of materials, components, finishes, fabrication details, anchors, and accessories.
- B. Shop Drawings: For each assembly or product, submit elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, welded connections, transitions, and terminations.
- C. Qualification Data: For fabricator-installer.
- D. Delegated-Design and Deferred Permit Submittal: For decorative metal elements required to have portions of the design delegated to the contractor, submit design information including

analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- E. Samples: Submit samples for each type of exposed finish and product item below for each type and condition shown.
 - 1. Column Cover: 6 inch by 6 inch sample of each type of cladding, illustrating finish.
 - 2. Shop finished metals, in each finish indicated.
 - 3. Stainless steel.
- F. Evaluation Reports: For fasteners and post-installed anchors, from ICC-ES.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: Submit maintenance and repair information to include in maintenance manuals for each type of exposed finish and exposed coating.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units, with no less than 5 years' experience.
- B. Installer Qualifications: Fabricator of products.
- C. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings, of type indicated, to aluminum extrusions and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
 - 4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."
 - 5. AWS D9.1, "Sheet Metal Welding Code."

1.6 MOCKUPS

- A. Mockups: Build mockups to verify matching, to demonstrate aesthetic effects, and to set quality standards for materials and execution; and to assist in constructability coordination.
 - 1. Build mockups of each decorative metal type.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect strippable protective covering on decorative metal and trim from exposure to sunlight and high humidity, except to extent necessary for period of decorative metal and trim installation.
- B. Deliver materials in factory provided protective coverings and packaging.
- C. Protect materials against damage during transit, delivery, storage, and installation at site.
- D. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.
- E. Prior to installation, store materials and components under cover, in a dry location.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on shop drawings.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. For decorative metal items, obtain each color, grade, finish, type, and variety of metal from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design column covers, its support framing, and attachment to building construction.
 - 1. Design support framing required for attachments, independent of or attached to building structure, using any materials in Sections 054000, 055000, and 092216 for framing, and FRT plywood for shear strength.
 - 2. Design structural column offset support attachments to maintain required fireproofing thickness on structure and to providing access for fireproofing repair and installation.
- B. Structural Performance of Column Covers: Withstand the effects of horizontal loading and stresses within limits for exposure and conditions.
 - 1. Loads: Uniform 5 psf horizontally.
 - a. 15 pounds point load applied concurrently at any point in any direction.
 - 2. Resist impact loads from airport activities.
- C. Seismic Performance: Applicable decorative metal fabrications shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

- D. Metal Standard for Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" and NAAMM requirements for dimensions and profiles shown unless more stringent requirements are indicated.

2.3 DECORATIVE METAL FABRICATORS

- A. Fabricator: Subject to compliance with requirements, provide products by one of the following:
 - 1. Hanset Metal Fabricators.
 - 2. Or pre-bid approved equal.

2.4 METALS, GENERAL

- A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.5 MATERIALS

- A. Aluminum: Fabricate products from alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
 - 1. Bars and Shapes: ASTM B221, Alloy 6063-T5/T52.
 - 2. Sheet: Flat, tension leveled, ASTM B209, Alloy 5005-H32.
- B. Galvanized-Steel Sheet: ASTM A653/A653M, G90 coating, either commercial steel or forming steel.
- C. Stainless Steel:
 - 1. Plate and Sheet: ASTM A666, Type 304, stretcher leveled.
 - 2. Flat Bar: ASTM A666, Type 304.
 - 3. Bars and Shapes: ASTM A276, Type 304.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
 - 1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.7 FASTENERS

- A. Fastener Material: Unless otherwise indicated, provide the following:
 - 1. Aluminum Items: Type 304 stainless steel fasteners.
 - 2. Stainless Steel Items: Type 304 stainless steel fasteners.
 - 3. Galvanized-Steel Items: Type 316 stainless steel fasteners.
 - 4. Dissimilar Metals: Type 316 stainless steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.
- C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless otherwise indicated to be face fastened or fasteners are shown.

2.8 DECORATIVE METAL FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items to greatest extent possible. Minimize field splices and field assembly. Disassemble only as necessary for transportation and handling. Mark items clearly for assembly and installation.
- B. Coordination: Match dimensions and attachment of decorative metal items to adjacent construction. Produce integrated assemblies. Closely fit joints; align edges and flat surfaces unless indicated otherwise.
- C. Forming: Provide profiles indicated. Maximize lengths. Provide crisp edges that minimize gap or discontinuity at joints and provide an eased edge where the public can come in contact with the edge.
- D. Reinforcement: Increase metal thickness; use concealed stiffeners, backing materials or both. Provide stretcher leveled standard of flatness and stiffness required to maintain flatness and hold adjacent items in flush alignment.
- E. Anchors: Straps, plates and anchors as required to support and anchor items to adjacent construction.
- F. Supports: Miscellaneous framing, mounting, clips, sleeves, fasteners and accessories required for installation.
- G. Welding and Brazing: Weld or braze joints continuously. Grind, fill or dress to produce smooth, flush, exposed surfaces. Do not discolor metal. Grind smooth, polish, and restore damaged finishes to required condition.
 - 1. Ease exposed edges 1/32" to small uniform radius.
 - 2. Welded Joints:
 - a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
 - b. Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.
 - c. Sheet Metal: Perform welding in accordance with applicable AWS standards and AWS D9.1.

- H. Finishing Welded Joints: Grind and detail welds at exposed to view stainless steel fabricated items to remove all evidence of welded joint. Polish item to provide consistent grain direction and appearance.
- I. For decorative metal column covers, orient seams to match existing column covers indicated.

2.9 INTERIOR DECORATIVE METAL FABRICATIONS

- A. Decorative Metal, Match Existing: Where indicated to match existing, field verify materials and finish prior to fabrication and finishing.
- B. Type (DM1): 3/8-inch stainless steel plates.
 - 1. Finish: No. 4 directional finish.
 - 2. Mounting:
 - a. Where screws are indicated, provide countersunk stainless screws with head type acceptable to tamper- heads or head type to match existing conditions
 - b. Concealed Anchors: Where no fasteners are shown. Attach to plates without visible face distortion.
 - 1) Strap Anchors: Spaced 2-inches from ends and 16-inches o.c. each side of unit. 1-inch wide.
 - a) Welded to back of plate minimum 12 gauge stainless steel. Punch or slot straps and plug weld to back of plate.
 - b) Back screw from framing cavities.
 - c) Blind rivet in 1/4-inch holes with 18 gauge straps.
 - 2) CD stud weld threaded studs for clips.
 - 3) For supporting glazing, provide 12 gauge straps. Confirm in delegated design under Section 084326 "All-Glass Storefronts."
- C. Type (DM2): Metal wall base, stainless steel, adhered to wall substrates.
 - 1. Form from minimum 16 gauge stainless steel.
 - a. Back-route at bends to minimize corner radius for tight arris.
 - 2. Finish: No. 4 directional finish.
 - 3. Substrate: As indicated.
 - 4. Provide upturn for back of reveal or integrate L-with upturned leg and concealed horizontal leg under top of base return at back of reveal.
- D. Type (DM3): Stainless steel wainscot and wall panels, with wall base.
 - 1. Fabricate from 1/8-inch stainless steel on backing.
 - a. Back-route at bends to minimize corner radius for tight arris.
 - b. Backing: Minimum 5/8-inch MDO, MDF or DOC PS 1 Exterior B-C plywood; fire-retardant treated in Section 061053, with panel z-clips for field installation.
 - c. Panel Z-Clips: Selected for reveal lift-off dimension indicated.
 - 2. Base is separate but may be attached to top wainscot with strapping for single installation where floor finishes and conditions permit, otherwise fabricate in 2 profiles with top having downturn back of reveal finish behind base.
 - a. Base metal thickness to match panel above.
 - b. Where base is abutting standalone base in lesser metal thickness and coplanar, adjust for aligning thicknesses in substrate or installation to achieve all alignments.
 - 3. Designed for sequential installation.

- E. Column Covers: Factory fabricated and finished metal sheet column covers, mechanically fastened to structural support.
 - 1. Metal: Stainless steel Type 304, match existing exposed finishes.
 - a. Finish: No. 4 directional.
 - b. Thickness: 14 gauge minimum.
 - 2. Bands: Concealed mounted to column covers.
 - a. Stainless steel bar stock, matching existing dimensions, thickness, attachment, and finish.
 - 3. Support joints with concealed stiffener gusset plates as needed to hold exposed faces of adjoining sheets in flush alignment.
 - 4. Fasteners: Concealed, self drilling; manufacturer's standard stainless steel or cadmium-plated.
Configurations: Round, custom.
 - a. Provide continuous pieces unless otherwise indicated, with separate section between joint types indicated.
 - 5. Joint Type: Varies; match existing, adjacent column indicated.
 - a. Locate joints as indicated.
 - b. Fabricate column covers with hairline horizontal butt joints produced by concealed backer plate matching exposed finishes. Finish returns.
 - c. Fabricate column covers with reveals at horizontal joints produced by offset backer matching plate with inset gasketing.
 - d. Fabricate bottom of column at floor surfaces by forming returns on mating ends of column cover sections.
 - 6. Manufacturers and Fabricators:
 - a. Hanset Metal Fabricators.
 - b. Gordon, Inc.
 - c. Forms + Surfaces.
 - d. Or pre-bid approved equal.
 - 7. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends.
 - 8. Coordinate dimensions and attachment methods of column covers with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.
 - 9. Coordinate with GFRG column covers in Section 092713, mounted above metal column cover base.
- F. Sheet Metal Trim: Formed trim in profiles indicated.
 - 1. Hem exposed edges or finish to match faces.
 - 2. Metal:
 - a. Stainless steel, Type 304, 24 gauge.
 - b. Prefinished or shop-painted:
 - 1) Galvanized steel, 24 gauge.
 - 2) Aluminum, 0.040 inch.

2.10 ACCESSORIES

- A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.

- B. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 - 1. For anchorage to concrete, provide inserts to be cast into concrete for bolting anchors.
 - 2. For anchorage to masonry, provide brackets to be embedded in masonry for bolting anchors.
 - 3. For anchorage to stud walls, provide backing plates for bolting anchors.
 - 4. Exposed Fasteners: No exposed bolts or screws.
- C. Carbon Steel Bolts and Nuts: ASTM A307.

2.11 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.12 FINISHES

- A. Stainless Steel: Provide finish indicated.
 - 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 - 2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 3. Run grain of directional finishes with long dimension of each piece.
 - 4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Prefinished and Sho-Painted: Steel and Aluminum Sheet and Extrusions:
 - 1. Prefinished: Coil coated with two-coat 70 percent PVDF resin in weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
 - 2. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3. Powder-Coat Finish: AAMA 2604. Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils. Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
- C. Refer to Section 099100, Painting for coating systems used on items not receiving high performance coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate and site conditions are acceptable and ready to receive work.
- B. Verify field dimensions of locations and areas to receive work.
- C. Notify Port immediately of conditions that would prevent satisfactory installation.
- D. Do not proceed with work until detrimental conditions have been corrected.
- E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates and supports for attachment of anchors.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's drawings and written instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects and with tight joints, except where necessary for expansion.
- C. Anchor securely to structure.
- D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- E. Isolate dissimilar materials with bituminous coating, bushings, grommets or washers to prevent electrolytic corrosion.
- F. Metal base: Shim base assembly as required to accommodate protruding fasteners in stud framing. Install metal base assembly using no exposed fasteners.
- G. Wainscot: Shim backup as required to maintain coplanar installation, with joints level and plumb without noticeable variance.
- H. Tolerances:
 - 1. Aligning with adjacent: Without variance at flush joints, 1/64-inch at 1/2-inch joints.
 - 2. For horizontal running finishes, maintain alignments of horizontal datums.
 - 3. Column Covers: Horizontal datum 1/8-inch plus/minus where independent and located more than 16 feet away.

3.3 CLEANING AND PROTECTION

- A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.
- C. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.
- D. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057000

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood blocking.
 - 2. Plywood, for backing panels and used as sheathing.
 - 3. Furring strips and requirements.
- B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" for metal blocking and metal framing anchors used to retain wood blocking.
 - 2. Section 102800 "Toilet Accessories" for grab bar and other wall-mounted accessories with blocking.

1.2 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.
 - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Fire-retardant-treated wood.
 - 2. Fasteners.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- B. Store and handle treated wood products according to manufacturer's written instructions.
 - 1. Do not stack on or store profiles wood caps in a manner that would result in warping.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Plywood: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for the work.
- B. Factory mark each piece of lumber with grade stamp of grading agency.
- C. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- D. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.3 WOOD BLOCKING AND MISCELLANEOUS LUMBER

- A. Wood Blocking, General: Provide fire-retardant treated, kiln-dried blocking of species and grade indicated on Structural Drawings and no less than No. 2 Douglas fir.
 - 1. All blocking on Project to be same species and grade unless otherwise indicated.
 - 2. Selected to eliminate or cut to remove defects that will interfere with its attachment, purpose, and performance.
- B. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Furring.
 - 2. Grounds for screeding.
 - a. Untreated, species and grade selected by installer.
- C. Where furring strips for installing plywood backers is indicated, select boards with no knots capable of producing bent-over nails and damage to paneling.
- D. Furring Strips: For voids in concealed cavities between wood panels and gypsum substrates:

1. Use 1-1/2-inches wide strips for fireblocking cavities.
2. Match depth of cavity or use compressible materials.
3. Materials:
 - a. Wood: No. 3 Grade boards with no knots, shakes or splits.
 - b. Mineral wool board.
 - c. Mineral fiber board.
4. Use high-tack firestop sealants in Section 078400 for adhering.

2.4 PLYWOOD

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, in not less than 3/4-inch nominal thickness.
 1. Backprime if gypsum board is not painted where installed directly in contact and over gypsum board.
- B. Plywood, DOC PS 1, Exterior, B-C, in not less than 5/8-inch nominal thickness.

2.5 FASTENERS AND ANCHORS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. Treated Blocking: Use fasteners with corrosion coating of no less than 800 hours of salt spray exposure without red rust forming according to ASTM B117 or use stainless steel or hot-dipped galvanized fasteners as recommended by treatment manufacturer.
 2. Roof Curbs: Where installed outside the roof vapor retarder, use stainless steel or corrosion coating with no red rust after 1,000 hours.
- B. Screws for Fastening to Metal Framing: ASTM C954, length as recommended by screw manufacturer for material being fastened.
- C. Metal Framing Anchors: Provided under Section 054000 "Cold-Formed Metal Framing."

2.6 MISCELLANEOUS MATERIALS

- A. Materials, General: Use materials complying with Section 016116 "VOC Content Restrictions".
- B. Adhesives for Gluing Furring: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
- C. Separator: Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spun-bonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

3.2 INSTALLATION, GENERAL

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, blocking, and similar supports to comply with requirements for attaching other construction.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Install plywood for sheathing backup by fastening to studs.
 - 1. Screw to cold-formed metal framing.
 - 2. Space panels 1/8 inch apart at edges and ends.
- F. Separate treated wood and metal with flexible flashing.
- G. Install separators in accordance with manufacturer's written instructions.
- H. Install separator at all locations of fire-treated wood in contact with metal framing where recommended by wood treatment manufacturer.
- I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. As indicated.
 - 2. Table 2304.10.2, "Fastening Schedule," in OSSC.
 - 3. ICC-ES evaluation report for fastener.

3.3 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess anchors, bolts and nuts flush with surfaces unless otherwise indicated.

3.4 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Provide fire blocking in furred spaces, concealed cavities between partitions and wall cavities as indicated and as follows:
 - 1. Fire block furred spaces so no cavity is more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.

END OF SECTION 061053

SECTION 066116 - SOLID SURFACING FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid Surfacing Fabrications:
 - a. Countertops and undercounter panel faces.
 - b. Wall cladding with built-in shelving.
 - c. Cabinets.
 - d. As indicated.
2. Solid surfacing materials (SSM#).
3. Hardware and accessories.
4. Miscellaneous materials.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for metal supports and reinforcements in or for supporting fabrications.
2. Section 057000 "Decorative Metal" for interfacing decorative metal.
3. Section 061053 "Miscellaneous Rough Carpentry" for furring requirements for voids behind paneling; for plywood sheathing substrates.
4. Section 092900 "Gypsum Board" for cement board substrates for adhered solid surface materials backing.
5. Section 093000 "Tiling" for joint treatment in cement backer boards.
6. Section 096623 "Resinous Matrix Terrazzo Flooring."
7. Section 102800 "Toilet Accessories" for accessories mounted in or on fabrications.
8. Divisions 22 and 26 for utility supply connections in fabrications.

1.2 REFERENCES

- A. AWS: Architectural Woodwork Standards, current edition; AWI Architectural Woodwork Institute, AWMAC Architectural Woodwork Manufacturers Association of Canada and WI Woodwork Institute.
- B. Fabrications means solid surfacing fabrications unless otherwise indicated.

1.3 COORDINATION

- A. Equipment Coordination: Coordinate operational clearances of equipment installed in fabrications. Provide fabricator product data of all equipment and appliances specified in other sections or scheduled on Drawings, prior to fabrication and shop drawing production.
- B. Coordinate sizes and locations of support, framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded fabrications.
 1. Coordinate supports shown and supports recommended by manufacturer.

- C. Coordinate locations of openings and utilities that will penetrate or are routed through fabrications.
- D. Coordinate installation of fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages and items with integral anchors, that are to be embedded in other work. Deliver such items to Project site in time for installation.
- E. Coordinate required expansion spaces at corners and abutting other construction.

1.4 SUBMITTALS

- A. Pre-Bid Qualification Submittal: Submit under requirements of pre-bid approved equal the qualification data for fabricators showing compliance with requirements.
 - 1. List projects' name, location, date and all materials occurring. Include contact information of owner, contractor, and architect.
 - 2. Include in project examples, photographs, drawings, project data and other information applicable to qualifications.
- B. Product Data: For each product.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
 - 2. Include manufacturer's fabrication and installation instructions for the fabrication types specified.
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show large-scale details.
 - 3. Indicate details at corners, edges, joints, openings, seams, end- and back-splashes, aprons, and profiles being fabricated. Show build-up required for forming profiles to dimensions indicated.
 - 4. Indicate relationship of fabrications to adjacent materials.
 - 5. Show proposed seam and joint types on all fabrications: Sealant-filled, hard-seamed, shop- and field-jointed, for approval.
 - 6. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 7. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 8. Show locations and sizes of cutouts and holes for items installed in fabrications.
 - 9. Show attachment methods.
- D. Samples for Verification: For the following:
 - 1. Solid Surface Material: Manufacturer's standard sample size but not less than 3 by 3 inches, for each type, color, pattern, and surface finish required.
 - 2. Exposed Hardware and Accessories: One full-size unit for each type and finish.
- E. Fabrication Samples: For each of the following, made from actual materials showing, joints, seams, edge profiles of the assembly, prior to fabrication:

1. Seam Sample: For each color, finish, and type of solid surface material, fabricate a minimum 10 by 10 inch sample with a seam in the center. Seams shall match design reference seam sample.
 2. Corner Pieces: For each type of solid surface. Fabrication corner assembly with required joints, exposed end and edge pieces, 12 inches high by 12 inches wide by 6 inches deep of each countertop and shelf unit; simulate end-/ back-splashes and apron.
- F. Product Certificates: For the following:
1. Solid surfacing material, for each different product.
 2. Solid Composite wood products.
 3. Adhesives.
- G. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.
- H. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of solid surface material to include in maintenance manuals.
1. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.
 2. List cleaning products recommended and products not for use that are detrimental to finishes.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate fabrications made of solid surfacing materials similar in size, scope, and applications to that required for this Project, including wall-adhered panels, and whose products have a record of successful in-service performance and having been in continuous operation for 5 years of documented experience and having successful in-service fabrications on a minimum of 5 projects.
1. Company with at least one project with similar fabrications in the past 3 years with value of within 20 percent of and not less than 80 percent the total cost of solid surface fabrications required for this Project.
 2. Fabricator shall be manufacturer approved.
- B. Installer Qualifications: Fabricator of solid surfacing fabrications.
- C. Design Reference Seam Sample: Sample of approved solid surfacing seam for each type of solid surface material, preapproved by Port.
1. Available on-site for reference and use for comparison of fabricator's seams.
- D. Comply with all solid surface manufacturer's technical bulletins and publications applicable to the Work, including but not limited to storage, shipping and handling of materials, required and provided supports, and the modifications, fabrication, and installation of solid surfacing fabrications.

1.7 MOCKUPS

- A. Mockups: Build mockups to demonstrate aesthetic effects, and to set quality standards for materials, fabrication, and execution.
 - 1. Build mockups of each type of typical fabrication as shown on Drawings.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Port specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver fabrications until painting and other finish operations that might damage fabrications have been completed in installation areas. Store fabrications in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels recommended by AWS and planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where fabrications are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 FABRICATORS

- A. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work are limited to those qualified and reviewed and approved under pre-bid approved equal requirements.

2.2 SOLID SURFACING FABRICATIONS, GENERAL

A. Solid Surfacing Fabrication, General:

1. Provide materials with smooth surfaces, without fabrication marks, cracks, stains, discolorations, or blemishes.
2. Provide backing recommended by solid surface manufacturer and fabricator for type of use and finish indicated, and with supports for strength and durability required for intended in-service use of each fabrication.
3. Fabrications are considered Architectural Woodwork for standards in fabrication and installation.
4. All seams shall match the Port's design reference seam sample; be seamless in appearance and touch.
5. Select sheet size to minimize joints and field seaming.

B. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

C. Architectural Woodwork Standards Grade: Premium.

D. Supports: Provide steel supports not showing and required for installation complying with Section 055000.

2.3 SOLID SURFACING FABRICATIONS

A. Countertops:

1. With 3/4-inch plywood subtops. Edge seal all openings and penetrations with epoxy coating. Prime surfaces to remain exposed (underside of counter).
2. Attach back- and end splashes to counters with color matching adhesive, with splashing held off substrate 1/8-inch.
3. Mounted to Section 055000 steel supports.

B. Wall Cladding: Adhered and panel mounted assembly, as indicated.

1. Panel: Mounted to 1/2-inch minimum exterior type plywood or MDO substrate.
 - a. Seal all edges of wood panels and backprime.
2. Wall: Adhered to cement backer boards.
 - a. Prime cement backer boards where recommended by adhesive manufacturer for application.
3. Joints and Seams in Field: Hard seamed.
4. Corners, Inside-Outside: With color-match sealant, 1/8-inch.

C. Cabinet: For trash receptacle. Fabricate from 1/2-inch minimum solid surface material.

1. Provide fully adhered joints and corner and hinge reinforcing.
 - a. Reinforce with stainless steel or solid surface blocking.
2. Thicknesses as scheduled for sides and access panel.
3. Corners: Seamless, miter or butt.

4. Hardware: Cabinet lock.

2.4 SOLID SURFACING MATERIALS

- A. Obtain solid surfacing materials of each type and color from single source from single manufacturer.
 1. Seaming adhesive shall be provided by and manufactured by solid surface manufacturer.
 2. Material shall be provided manufacturer's regional distributor for the Project location.
- B. Obtain each type of solid surfacing fabrication from single source from single fabricator unless otherwise indicated.
- C. Solid Surface Material: Solid sheets of homogeneous-filled plastic resin complying with ISFA 2-01 or quartz aggregates bound together with a matrix of polymers, resins, and pigment and complying with ISFA 3-01.
 1. Size: Maximize size and minimize panel joints.
 2. Provide the following types or pre-bid approved equals.
- D. Type (SSM1) Solid Surfacing: Quartz.
 1. Product: Corian Quartz.
 - a. Color: Cloud White.
 - b. Finish: Polished.
 2. Thickness: 2 cm.
- E. Type (SSM2) Solid Surfacing: Resin body.
 1. Product: Corian Solid Surface.
 - a. Color: Pearl Gray.
 - b. Finish: Matte.
 2. Thickness:
 - a. Vertical: 1/4 inch.
 - b. Horizontal Applications: 1/2 inch.
- F. Type (SSM7) Solid Surfacing: Resin body, self-supporting over structural members or over high-modulus flexible sealant.
 1. Product: Corian Solid Surface.
 - a. Color: Glacier White.
 - b. Finish: Matte.
 2. Thickness: 1/2 inch.
 - a. 1/4 inch for vertical applications is acceptable, subject to minimum panel size availability and demonstration of field seaming prior to procurement.
 3. Panel Size, Vertical: 4 by 9 feet, minimum.
 - a. Horizontal: Minimize joints.
 - b. Use material size which result in the least number of required joints and seams.
 4. Seaming and Joints:
 - a. Seam panel joints in field of wall applications with joints at perimeters and expansion space at ends of walls at butt joints.
 - b. Provide space for expansion of other materials at perimeter and ends of and penetrations in solid surfacing.

2.5 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood Products:
 - 1. Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated. Class A faces or fire retardant treated in Section 061053.
 - a. MDO: DOC PS 1, medium-density overlay. Grade B-B.
 - b. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade B-C Plugged, touch sanded.
 - 2. Prime faces in contact with adhesives, with primer in Section 099100 for wood.

2.6 HARDWARE AND ACCESSORIES

- A. Grommets: For trash openings. See Section 102800.
- B. Hinge: Stainless steel, continuous, for screw or undercut riveting.
 - 1. Attach with anchors and supplemented with epoxy for solid through-body attachment.
- C. Cabinet Lock: Schlage, CL777R.
 - 1. Provide one 1.125-inch mortise cylinder keyed lock per access door, Schlage FSIC Mortise Cylinder Housing 30-032 with Schlage 20-030-ICX Construction Core, or pre-bid approved equal. Provide two keys per lock and key locks alike.
 - 2. Strike: Angle, 16 gauge stainless steel, 1/2-by 1-inch, mount 1-inch to inside face of solid surface.
 - a. Do not mortise solid surface. Offset cabinet lock for engagement of strike.
 - 3. Coordinate keying with Port for matching existing.

2.7 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
 - 1. See Section 061053 for requirements where installed in cavities between panels and partitions.
- B. Steel Reinforcement: See Section 055000 "Metal Fabrications."
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use coated steel or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- D. Adhesives: Product recommended by solid surface material manufacturer:
 - 1. Seam: Manufacturer's seaming adhesive. No substitutions.
 - a. Product: Color-matching DuPont Corian Joint Adhesive.
 - 2. Mounting: 100-percent silicone sealant.

- a. Dowsil 795, Tremco Spectrem 2 or manufacturer's equal.
- E. Sealant for Joints: Comply with applicable requirements in Section 079200 "Joint Sealants."
 - 1. Color Match: As selected by Port.
 - a. SS7: White or precast white.
 - 2. Products:
 - a. Dowsil 795.
 - b. Tremco Spectrem 2.
 - c. Select using grout-color-matching, products in Section 093000.
 - d. Products recommended and manufactured by solid surface manufacturer and acceptable to Port.
- F. Panel Z-Clips: Extruded aluminum, two-part cleat mounting hardware, 6005A T5 aluminum; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.
- G. Epoxy Coating: See Section 099100 "Painting."
 - 1. The coating manufacturer's equal precatalyzed epoxy or urethane-based product is acceptable in lieu of Section 099100 product.
 - 2. Primer not required unless recommended by coating manufacturer.

2.8 FABRICATION

- A. Provide anchors, brackets, fasteners, set screws, spacers, filler materials, adhesive, and other accessories compatible with material in contact, as indicated or required for complete installations.
 - 1. Where standard anchors and brackets do not suit conditions, provide custom anchors and brackets as required.
- B. Fabricate and assemble according to solid surface material manufacturer's written instructions and to the specified AWI/AWMAC/WT's "Architectural Woodwork Standards" grade.
 - 1. Fabricate to accommodate the required and manufacturer's recommended supports.
- C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation.
 - 1. Notify Port seven days in advance of the dates and times fabrications will be complete.
 - 2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
 - 3. Clearly mark units for reassembly and coordinated installation.
 - 4. Use connections that maintain structural value of joined pieces.
 - 5. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting. Site fitting to be marked on Shop Drawings and be approved by Port prior to fabrication.
- D. Fabricate to dimensions, profiles, and details indicated.
 - 1. Form work true to line and level with accurate angles and surfaces.

2. Cut, drill, and machine materials cleanly and accurately.
 3. For fabrications scheduled to receive electrified items, provide raceway and wiring to accommodate specified item.
 4. Provide returns at visible ends fabrications using same materials unless otherwise indicated.
 5. Coordinate measurements of hardware and related mortises in to verify dimensions and alignment before shop machining.
 6. Reinforce to support indicated to receive hardware, screws, and similar items.
 7. Field measure conditions affecting installation. Scribe edges and surface for site conditions. Provide site-made templates including for shop machining to required profiles and for site fitting.
- E. Brackets, Supports, and Anchors: Provide wall and floor brackets, miscellaneous fittings, and anchors to interconnect fabrication members to other Work unless otherwise indicated.
1. Provide separate base for boxed fabrications with required supports and for fabrication attachment.
 2. At penetrating supports through plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.
 3. Provide inserts and other anchorage devices for connecting fabrications to concrete or masonry Work or embedded in other construction.
 4. Fabricate anchorage devices capable of withstanding loads imposed by fabrications.
 5. Coordinate anchorage devices with supporting structure.
- F. Joints:
1. Fabricate exposed faces without visible joints.
 2. Fabricate panelized assemblies in sections for joining in field, with joints at locations indicated.
 - a. Joint Locations: At changes in counter heights, and where approved in Shop Drawing submittals.
 - b. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints where indicated and approved. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.
 - c. Prepare seam joints for field adhering solid surfacing.
 3. Accommodate for expansion recommended by manufacturer for wall applications. Account for movement at inside corners. Mark on shop drawings dimensions for review.
- G. Cutouts and Holes: Shop-cut and machine openings and recesses to maximum extent possible to receive hardware, equipment and appliances, utilities and electrical work, and similar items. Locate openings and recesses accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings.
1. Remove sharp or rough areas on exposed surfaces.
 2. Sand edges of cutouts smooth; to remove splinters and burrs of wood and metal.
 3. Undercounter Equipment: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 4. Fittings: Drill countertops in shop for fittings, undercounter items, and similar items.
- H. Wood Subtops:

1. Comply with Section 061053 "Miscellaneous Rough Carpentry."
 2. Oversize openings in wood for items penetrating solid surface.
 3. Coat openings and extending 6-inches from opening edges on both sides, with two-coats epoxy coating. Saturate surfaces with first coat and let dry. Sand and apply second coat.
- I. Fabricate tops with shop-applied fronts, end and back splashes without visible seams, unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - J. Secure solid surfacing to subtops and substrates with mounting adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match solid surfacing, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - K. Base Boards: Where indicated on Drawings, provide recesses toe base provided by others around fabrication. Fabricate to dimensions and details indicated.
 - L. Decorative Metal: Attach decorative metal to comply with Section 057500 "Decorative Formed Metal."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface fabrication and conditions under which fabrications will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
 1. Verify adequate and required supports are installed and within required levelness and plumb for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before installation, condition fabrications to humidity conditions in installation areas for not less than 72 hours and as specified in "Field Conditions" Article.

3.3 INSTALLATION

- A. Install fabrication to comply with AWS quality standard grade of item to be installed and to comply with manufacturer's written instructions.
 1. Corian Solid Surface, technical bulletin "Interior Vertical Cladding" for wall cladding adhered to substrates.
 2. Do not shim solid surfaces in horizontal applications at any point using shims or other materials. Provide solid, continuous supports without shims in contact with solid surface.
- B. Complete fabrication at Project site to extent that it was not completed in the shop.

- C. Install fabrications level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims. Do not exceed 1/64-inch difference between planes of adjacent units.
 - 1. Install without distortion so operable components function and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
- D. Field Adjusting: Where approved by Port.
 - 1. Complete cutouts not finished in shop.
 - 2. Scribe and cut to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 3. Mask areas of fabrications adjacent to cuts and cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance.
 - 4. Ease edges slightly to prevent snipping.
 - 5. Seal edges of cutouts in wood backing by saturating with varnish.
- E. Anchor fabrications to anchors or blocking built in or directly attached to substrates. Secure with approved anchors or fasteners.
 - 1. Fasten by screwing through corner blocks of base units into underside of fabrication box or countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Shim as needed to align subtops in a level plane.
- F. Bond joints with adhesive and draw tight as units are set. Mask areas of surfacing adjacent to joints to prevent adhesive smears.
 - 1. Install metal splines in kerfs in joining edges at joints where indicated and approved. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- G. Apply sealant to gaps at walls and where indicated, at material transitions; comply with Section 079200 "Joint Sealants."
 - 1. 1/8-inch to 1/4-inch wide joints: Provide 1:1 joint width to depth. Use backer or bond breaker tape for sealant depth to match width. Do not install deeper than joint width.
 - 2. Prime all surfaces.

3.4 FIELD QUALITY CONTROL

- A. Inspections:
 - 1. Provide inspection of installed Work in accordance with AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
 - 2. Port to inspect installed Work and joint-seams for matching design reference seam sample.
- B. Inspection entity is to prepare and submit report of inspection.

- C. Fabrication-installations will be considered defective if they do not pass inspections and if they do not comply with requirements.
 - 1. Seams that are visible when fabrication is viewed from 2 feet away are considered defective.

3.5 ADJUSTING AND CLEANING

- A. Repair damaged and defective fabrications, where possible, to eliminate functional and visual defects. Where not possible to repair, replace units. Adjust joinery for uniform appearance. Adjust seams until no longer visible.
- B. Clean, lubricate, and adjust hardware.
- C. Clean all surfaces.

END OF SECTION 066116

SECTION 078100 – APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes concealed sprayed fire-resistive materials (SFRM), applied to surfaces that are concealed from view behind other construction when the work is completed.
 - 1. Repair to connections at existing structure with removed SFRM for work.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 017329, Cutting and Patching: for requirements of cutting and patching repair applicable to this Section.
- B. Section 024119, Selective Interior Demolition: for removal of existing SFRM.

1.3 REFERENCES

- A. ASTM: American Society for Testing and Materials
 - 1. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials
 - 2. ASTM E119: Standard Test Methods for Fire Tests of Building Construction and Materials
 - 3. ASTM E136: Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
 - 4. ASTM E605: Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
 - 5. ASTM E736: Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
 - 6. ASTM E759: Standard Test Method for Effect of Deflection on Sprayed Fire-Resistive Material Applied to Structural Members
 - 7. ASTM E760: Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members
 - 8. ASTM E761: Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members
 - 9. ASTM E859: Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials (SFRMs) Applied to Structural Members
 - 10. ASTM E937: Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
 - 11. ASTM G21: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- B. AWCI: Association of the Wall and Ceiling Industry
 - 1. AWCI Technical Manual 12-A: Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials

- C. CFR: Code of Federal Regulations
 - 1. 40 CFR 763: Asbestos
- D. UL: Underwriters Laboratories, Inc.

1.4 SUBMITTALS

- A. Submit product data for each type of product indicated.
- B. Shop Drawings: Submit structural framing plans indicating the following:
 - 1. Locations and types of surface preparations required before applying sprayed fire-resistive material.
 - 2. Extent of sprayed fire-resistive material for each construction and fire-resistance rating, including the following:
 - a. Show repair requirements of SFRM providing continuous fire resistance at transitions of repaired and new interfacing with existing SFRM.
 - b. Applicable fire-resistance design designations of a qualified testing agency.
 - c. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
 - d. Designation of restrained and unrestrained conditions based on definitions in ASTM E119, Appendix X3 or as determined by a qualified professional engineer.
- C. Submit product certificates for each type of sprayed fire-resistive material, signed by product manufacturer.
- D. Submit qualification data for installer, manufacturer, professional engineer, and manufacturer's qualified testing agency.
- E. Submit compatibility and adhesion test reports from sprayed fire-resistive material manufacturer indicating the following:
 - 1. Materials have been tested for bond with substrates, including existing SFRM.
 - 2. Materials have been verified by sprayed fire-resistive material manufacturer to be compatible with substrate primers and coatings, and existing SFRM.
 - 3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- F. Submit product test reports based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed sprayed fire-resistive materials.
- G. Submit research/evaluation reports for sprayed fire-resistive materials.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall be certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its sprayed fire-resistive materials to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer.

1. Installer's responsibilities include providing professional engineering services needed to assume engineering responsibility for designation of restrained and unrestrained conditions.
- B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.
- C. Source Limitations: Obtain sprayed fire-resistive materials through one source from a single manufacturer.
- D. Port-Provided Testing and Inspecting Agency: The Port will hire a testing and inspecting agency who will test for compliance with specified requirements for performance by doing the following:
 1. Sprayed Fire-Resistive Materials Testing:
 - a. Sprayed fire-resistive materials will be randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Only test specimens of sprayed fire-resistive materials that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
 - b. Only test specimens whose application the testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a description of preparation and conditioning of laboratory test specimens.
 2. Adhesion Testing: Test for bond per ASTM E736 and requirements in UL's "Fire Resistance Directory" for coating materials.
- E. Compatibility: Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with sprayed fire-resistive material.
- F. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another qualified testing agency. Identify bags containing sprayed fire-resistive materials with appropriate markings of applicable testing agency.
 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency for sprayed fire-resistive material serving as direct-applied protection tested per ASTM E119.
 2. Surface-Burning Characteristics: ASTM E84.
- G. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."
- H. Preinstallation Meeting: Conduct preinstallation meeting at work site. Review methods and procedures related to sprayed fire-resistive materials including, but not limited to, the following:
 1. Review and finalize construction schedule and verify sequencing and coordination requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to work site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to work.
- B. Use materials with limited shelf life within period indicated. Remove from work site and discard materials whose shelf life has expired.
- C. Store materials inside, under cover, aboveground, and kept dry until ready for use. Remove from work site and discard wet or deteriorated materials.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply sprayed fire-resistive material when ambient or substrate temperature is 40°F or lower unless temporary protection and heat is provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of sprayed fire-resistive material. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

PART 2 - PRODUCTS

2.1 CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

- A. General: For concealed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.
- B. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 - 1. Mixed at Pump:
 - a. Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of gypsum or portland cement binders and lightweight mineral or synthetic aggregates mixed with water at work site to form a slurry or mortar for conveyance and application.
 - b. Dry Density: 15 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 - c. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E605:

- 1) Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
- 2) Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
- 3) No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft.
- d. Bond Strength: 150 lbf/sq. ft. minimum per ASTM E736 under the following conditions:
 - 1) Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - 2) If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. minimum per ASTM E736.
 - 3) Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.
- e. Compressive Strength: 5.21 lbf/sq. in. as determined in the laboratory per ASTM E761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 15 lb/cu. ft.
- f. Corrosion Resistance: No evidence of corrosion per ASTM E937.
- g. Deflection: No cracking, spalling, or delamination per ASTM E759.
- h. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E760.
- i. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch, maximum dry density is 15 lb/cu. ft., test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
- j. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E84 by UL or another qualified testing and inspecting agency:
 - 1) Flame-Spread Index: 10 or less
 - 2) Smoke-Developed Index: 0
- k. Fungal Resistance: No observed growth on specimens per ASTM G21.
2. Mixed at Nozzle:
 - a. Sprayed-Fiber Fire-Resistive Material: Factory-mixed, dry formulation of inorganic binders, mineral fibers, fillers, and additives conveyed in a dry state by pneumatic equipment and mixed with water at spray nozzle to form a damp, as-applied product, complying with the following requirements:
 - b. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method," but with an average density of not less than 22 lb/cu. ft.

- c. Bond Strength: 434 lbf/sq. ft. minimum per ASTM E736.
- d. Compressive Strength: 51 lbf/sq. in. per ASTM E761.
- e. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method," but with an average density of not less than 39 lb/cu. ft.
- f. Bond Strength: 1000 lbf/sq. ft. minimum per ASTM E736.
- g. Compressive Strength: 300 lbf/sq. in. per ASTM E761.
- h. Corrosion Resistance: No evidence of corrosion per ASTM E937.
- i. Deflection: No cracking, spalling, or delamination per ASTM E759.
- j. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E760.
- k. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. per ASTM E859.
- l. Combustion Characteristics: Passes ASTM E136.
- m. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the following surface-burning characteristics as determined by testing identical products per ASTM E84 by UL or another qualified testing and inspecting agency:
 - 1) Flame-Spread Index: 10 or less
 - 2) Smoke-Developed Index: 0
- n. Fungal Resistance: No observed growth on specimens per ASTM G21.
- o. For exterior applications of sprayed fire-resistive material, provide formulation approved for surfaces exposed to exterior.

2.2 AUXILIARY FIRE-RESISTIVE MATERIALS

- A. Provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials and substrates and are approved by UL or another qualified testing and inspecting agency for use in fire-resistance designs indicated.

2.3 PATCHING AND REPAIR MATERIALS

- A. Provide material for patching and repairs. Material shall match existing or be compatible with existing fireproofing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:
 - 1. Substrates comply with requirements in the section where the substrate and related materials and construction are specified.
 - 2. Substrates are free of oil, grease, rolling compounds, incompatible primers, loose mill scale, dirt, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.

3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.
- B. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of oil, rolling compounds, and other substances capable of interfering with bond.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SEQUENCING AND COORDINATION

- A. Sequence and coordinate application of sprayed fire-resistive materials with related work specified in other sections to comply with the following requirements:
1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
 2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
 3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
 4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
 5. Do not apply fire resistive material to metal floor deck substrates until concrete topping has been completed.
 6. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
 8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

3.3 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.
- B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, loose mill scale, and incompatible primers, paints, and encapsulants.

3.4 INSTALLATION

- A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- B. Apply sprayed fire-resistive material that is identical to products tested as specified in Part 1 "Quality Assurance" article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.
- C. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by sprayed fire-resistive material manufacturer, install body of fire-resistive covering in a single course.
- D. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

3.5 INSTALLATION, CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

- A. Apply concealed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 2 "Concealed Sprayed Fire-Resistive Materials" article.

3.6 FIELD QUALITY CONTROL

- A. Port-Provided Testing and Inspecting Agency: The Port will hire a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Testing and Inspecting Services: Testing and inspecting of completed applications of sprayed fire-resistive material will take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of sprayed fire-resistive material for the next area until test results for previously completed applications of sprayed fire-resistive material show compliance with requirements. Tested values shall equal or exceed values indicated and required for approved fire-resistance design.
 - 1. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-square foot area, or partial area, on each floor, from the average of 4 measurements from a 144-square inch sample area, with sample width of not less than 6 inches per ASTM E605.
 - 2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E605.

3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 4. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000-square foot area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E736.
 5. If testing finds applications of sprayed fire-resistive material are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.
- C. Remove and replace applications of sprayed fire-resistive material where test results indicate that it does not comply with specified requirements for cohesion and adhesion, for density, or for both.
 - D. Apply additional sprayed fire-resistive material per manufacturer's written instructions where test results indicate that thickness does not comply with specified requirements.
 - E. Additional testing and inspecting, at Contractor's expense, may be performed to determine compliance of replaced or additional work with specified requirements.

3.7 CLEANING, PROTECTING, AND REPAIR

- A. Cleaning: Immediately after completing spraying operations in each containable area of work, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect sprayed fire-resistive material, according to advice of product manufacturer and installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of substantial completion.
- C. Coordinate application of sprayed fire-resistive material with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect sprayed fire-resistive material and patch any damaged or removed areas.
- D. Repair or replace work that has not been successfully protected.

END OF SECTION 078100

SECTION 078400 - FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes Contractor-designed firestopping using UL designs selected by the Contractor.
 - 1. Provide through-penetration fire blocks as defined by the Oregon Structural Specialty Code at all fire-rated and smoke-rated partitions and floor-ceiling assemblies.
 - 2. Provide where penetrations go through rated walls and floor-ceiling assemblies that require sealing in accordance with NFPA 101.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Other sections that relate directly to work of this section include, but are not limited to: concrete, expansion control and seismic joints, thermal and moisture protection, gypsum wallboard systems, mechanical, electrical, lighting, power, alarms, and communication.

1.3 REFERENCES

- A. ASTM: American Society for Testing and Materials.
 - 1. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials
 - 2. ASTM E814: Standard Test Method for Fire Tests of Penetration Firestop Systems
- B. NFPA: National Fire Protection Association.
 - 1. NFPA 101: Life Safety Code
- C. UL: Underwriters Laboratories, Inc.
 - 1. UL 1479: Intermediate Metal Conduit

1.4 SUBMITTALS

- A. Submit the following:
 - 1. Locations proposed for each system, identifying each product.
 - 2. Product data for each product intended to be used. Where more than one type of product is proposed, confirm compatibility at areas of contact.
 - 3. UL drawings, certificates, and ICC-ES evaluation reports indicating firestopping material conforms to specified requirements.
 - 4. Shop drawings. Complete construction details showing proposed material, reinforcement, anchorage, fastenings, and methods of installation.
 - 5. Qualification data for installation firms and employees which demonstrates their capabilities and experience. Include list of completed projects with project names, addresses, names of engineers, architects and owners, and other information specified.

- B. Submit system design listings, including illustrations from a qualified testing and inspection agency that is applicable to each firestop configuration.
 - 1. Where there is no specific third-party-tested and classified firestop system available for a particular firestop configuration, obtain from the firestop manufacturer an engineering judgment (EJ) or equivalent fire resistance rated assembly (EFRRA) for submittal.

1.5 QUALITY ASSURANCE

- A. Provide manufacturer's standard firestopping systems, with accessory materials, indicating fire-resistance ratings as established by testing identical assemblies per ASTM E814 by UL, other testing laboratory, or quality control agency having a current ICC-ES report.
- B. The Port may employ and pay a qualified inspection agency to check installed firestopping systems for compliance with requirements.
 - 1. Firestopping tests will be performed by a qualified testing and inspecting agency such as UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems.
 - 2. The Port will pay the cost to repair or replace a fire system that has been chosen for testing and successfully meets UL's installation requirements.
 - 3. The Contractor shall pay for all fire systems that were destroyed in testing if UL's installation procedures were not followed.
 - 4. Through-penetration firestop systems are identical to those tested per ASTM E814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly.
- C. Fire Resistance and Hose Stream Tests: Rate firestopping materials "F" and "T" in accordance with ASTM E814 or UL 1479. Rating periods: Same as the floor or wall assembly penetrated.
- D. Sealing characteristics: Does not require a rise in temperature to install or to activate seal.
- E. Installer Qualifications: Engage an experienced installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer qualification on the buyer.
- F. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.
- G. Provide firestopping products containing no detectable asbestos.
- H. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed in accordance with specified requirements.
- I. Pre-Installation Meeting: Conduct pre-installation meeting at the project site and submit meeting records.

1. Before installing firestopping, meet with the Port, consultants, independent testing agency, firestopping manufacturer, and other concerned entities.
2. Notify participants at least 3 business days before the meeting.
3. Distribute meeting notes recording decisions reached.

1.6 DELIVERY AND STORAGE

- A. Deliver materials in their original unopened containers; store in a location providing protection from damage and exposure to the elements.
- B. Remove damaged or deteriorated materials from the site.

1.7 SEQUENCING AND SCHEDULING

- A. Submit notification at least 1 week in advance of firestopping installations; confirm dates and times on days preceding each series of installations.
- B. Do not cover up firestopping installations that will be concealed behind other construction until the inspection agency, if required, has examined each installation.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide firestopping systems that are produced and installed to resist the spread of fire and the passage of smoke and other gases, with ratings equal to the surface penetrated. Provide complete firestopping systems that have been tested and approved by third-party testing agency.
- B. Provide through-penetration firestop systems with F ratings indicated, as determined by ASTM E814, but not less than that equaling the fire-resistance rating of the constructions penetrated.
- C. Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined by ASTM E814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas.
- D. For exposed firestopping, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined by ASTM E84.

2.2 MATERIALS

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as recommended by the firestopping manufacturer.
- B. Accessory Materials for Fire-Stops: Provide forming, joint-fillers, packing and other accessory materials required for installation of firestops as applicable to installation conditions encountered.

- C. Endothermic, Latex Compound Sealant: Single-component formulation. The following are acceptable products and manufacturers.
1. Fyre-Sil by Tremco Inc.
 2. Flame-Safe FS500/600 Series or FS900/FST900, International Protective Coatings Corp.
 3. Cafco TPS Type C, Isolatek International.
 4. Or pre-bid approved equal.
- D. Intumescent, Latex Sealant: Single-component formulation. The following are acceptable products and manufacturers.
1. Metacaulk 950 or 1000, The RectorSeal Corporation.
 2. FS-One, Hilti Construction Chemicals, Inc.
 3. Fire Barrier CP 25WB Caulk, 3M Fire Protection Products.
 4. SpecSeal SSS100 Series Sealant, Specified Technologies, Inc.
 5. Cafco TPS Type I, Isolatek International.
 6. Or pre-bid approved equal.
- E. Intumescent Putty: Non-hardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds. The following are acceptable products and manufacturers.
1. Flame-Safe FSP1000 Putty, International Protective Coatings Corp.
 2. Fire Barrier Moldable Putty, 3M Fire Protection Products.
 3. SpecSeal Firestop Putty, Specified Technologies, Inc.
 4. Cafco TPS Types P and EP, Isolatek International.
 5. CP 618, Hilti Construction Chemicals, Inc.
 6. Or pre-bid approved equal.
- F. Intumescent Wrap Strips: Single-component, elastomeric sheet with or without aluminum foil on one side, (foil as tested). The following are acceptable products and manufacturers.
1. Fire Stop Intumescent Wrap Strip 2002, 3M Fire Protection Products.
 2. CS2420 Intumescent Wrap, Hilti Construction Chemicals, Inc.
 3. Fire Barrier FS-195 Wrap/Strip, 3M Fire Protection Products.
 4. SpecSeal Intumescent Wrap Strip, Specified Technologies, Inc.
 5. Or pre-bid approved equal.
- G. Intumescent, Latex Spray Mastic: Single-component formulation (for use at head of walls against metal deck). The following are acceptable products and manufacturers.
1. Metacaulk 1100, The RectorSeal Corporation.
 2. CP 672, Hilti Construction Chemicals, Inc.
 3. FireDam Spray, 3M Fire Protection Products.
 4. Or pre-bid approved equal.
- H. Intumescent Pillows: Single component, plastic encased. The following are acceptable products and manufacturers.
1. Series SSB, Specified Technologies, Inc.
 2. Fire barrier pillows, 3M Fire Protection Products.
 3. Or pre-bid approved equal.
- I. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at work site to form a non-shrinking, homogenous mortar. The following are acceptable products and manufacturers.
1. Novasit K-10 Firestop Mortar, Bio Fireshield, Inc.

2. FS 635 Mortar, Hilti Construction Chemicals, Inc.
 3. KBS-Mortar Seal, International Protective Coatings Corp.
 4. SpecSeal Firestop Mortar, Specified Technologies, Inc.
 5. Cafco TPS Mortar, Isolatek International.
 6. Or pre-bid approved equal.
- J. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant. The following are acceptable products and manufacturers.
1. Firestop Sealant 2000 or SL 2003, 3M Fire Protection Products.
 2. CFS-S SIL GG Elastomeric Silicone Firestop Sealant, Hilti Construction Chemicals, Inc.
 3. Pensil 100 Firestop Sealant, Specified Technologies, Inc.
 4. Metacaulk 835 or 880, The RectorSeal Corporation.
 5. Fyre-Sil or Fyre-Sil S/L, Tremco Inc.
 6. Or pre-bid approved equal.
- K. Solvent-Release-Curing Intumescent Sealant: Single-component, synthetic-polymer-based sealant of grade indicated below. The following are acceptable products and manufacturers.
1. Fire Barrier CP 25N/S or CP 25S/L Caulk, 3M Fire Protection Products.
 2. Or pre-bid approved equal.
- L. Fire-Rated Pathway Device.
1. Requirements:
 - a. The fire-rated pathway shall contain a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated.
 - b. The self-contained sealing system shall automatically adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall firestop materials.
 - c. The pathway shall be UL classified and/or FM Global systems-approved and tested to the requirements of ASTM E814 (UL1479).
 2. Acceptable Products and Manufacturers:
 - a. E-Z Path, Specified Technologies Inc.
 - b. Or pre-bid approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive firestopping prior to submitting product data. Base selections and submittals on the findings of the Contractor's examination.
- B. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify that system components are clean, dry, and ready for installation.
- D. Verify that field dimensions are as shown on the drawings and as recommended by the manufacturer.

3.2 GENERAL

- A. Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond. Do not allow spillage and migration onto exposed surfaces.
- B. Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work. Remove tape as soon as it is possible to do so without disturbing the firestopping seal with substrates.

3.3 INSTALLATION OF THROUGH-PENETRATION FIRESTOPS

- A. Comply with the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications required.
- B. Install forming/damming materials and other accessories of types required to support and position fill materials during their application. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
 - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after work is completed, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 INSTALLING FIRESTOP JOINT SYSTEMS

- A. General: Comply with the firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install joint fillers to support and position firestop materials during application.
- C. Install systems by proven techniques that result in firestop materials:
 - 1. Directly contacting and fully wetting joint substrates.
 - 2. Completely filling recesses provided for each joint configuration.
 - 3. Providing uniform, cross-sectional shapes and depths relative to joint width that optimize movement capability.
- D. Tool non-sag firestop materials immediately after their application and prior to the time skinning begins. Form smooth, uniform beads of configuration indicated or required to:
 - 1. Produce fire-resistance rating.
 - 2. Eliminate air pockets.
 - 3. Ensure contact and adhesion with sides of joint.

3.5 INSTALLING PERIMETER FIRE BARRIER SYSTEMS

- A. Comply with the firestop manufacturer's installation and drawings pertaining to products and applications indicated.
- B. Install metal framing, curtain wall insulation, mechanical attachments, safing materials, and firestop materials as applicable within the system design.

3.6 FIELD QUALITY CONTROL

- A. The Port, or its inspecting agency, will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.
- B. The Port, or its inspecting agency, will report observations promptly and in writing to the Contractor.
- C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.
- D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.7 CLEANING

- A. Clean off excess fill materials adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- B. Protect firestopping 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 substantial completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION 078400

SECTION 079200 – JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes sealant at interior joints in vertical and horizontal surfaces.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 071800 “Traffic Coatings” for sealants used in traffic coating assemblies.
- B. Section 078400, Firestopping: For sealants installed in fire-resistant rated assemblies.
- C. Section 092900, Gypsum Board: For acoustical joint sealant.
- D. Section 096623, Resinous Matrix Terrazzo Flooring: For joint sealants in terrazzo floors.

1.3 REFERENCES

- A. ASTM: American Society of Testing and Materials
 - 1. ASTM C794: Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
 - 2. ASTM C834: Standard Specification for Latex Sealants
 - 3. ASTM C920: Standard Specification for Elastomeric Joint Sealants

1.4 SUBMITTALS

- A. Submit the following.
 - 1. Product data from manufacturers for each joint sealer product required with color cards, including instructions for joint preparation and joint sealer application.
 - 2. Samples for Initial Selection Purposes: Manufacturer’s standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.
 - 3. Samples for verification purposes of each type and color of joint sealer required. Install joint sealer samples in 1/2 inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealers.
- B. Certificates from manufacturers of joint sealers attesting that their products comply with specification requirements and are suitable for the use indicated.
- C. Qualification data complying with requirements specified in “Quality Assurance” article. Include list of completed projects with project name, addresses, names of architects and owners, plus other specified information.

- D. Compatibility and adhesion test reports from elastomeric sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
- E. Product test reports for each type of joint sealers indicated, evidencing compliance with requirements specified.
- F. Preconstruction field test reports indicating which products and joint preparation methods demonstrated acceptable adhesion to joint substrates.

1.5 QUALITY ASSURANCE

- A. Obtain elastomeric materials only from manufacturers who will, if required, send a qualified technical representative to project site, for the purpose of advising the installer of proper procedures and precautions for the use of the materials.
- B. Installer Qualifications: Engage an installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to this project.
- C. Field-Constructed Mock-Ups: Prior to installation of joint sealers, apply elastomeric sealants to the following selected building joints as indicated below for further verification of colors selected from sample submittals and to represent completed work for qualities of appearance, materials and application:
 - 1. Joints in field-constructed mock-ups of assemblies specified in other sections which are indicated to receive elastomeric joint sealants in this section.
 - 2. Retain mock-ups during construction as standard for judging completed construction.

1.6 SYSTEM PERFORMANCE

- A. Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to project site in original unopened containers or bundles with labels containing information 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 materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.8 PROJECT CONDITIONS

- A. Pre-Installation Meeting:
 - 1. Meet with installer, the Port, sealant manufacturer's technical representative, and other trades involved in coordination with sealant work at the project site to review the procedures and time schedule proposed for installation of sealants and coordination with other work.
 - 2. Review each major sealant application required on the project.
- B. Conditions of Other Work:
 - 1. Examine the joint surfaces, backing, and anchorage of units forming sealant rabbet, and the conditions under which the sealant work is to be performed. Correct conditions detrimental to the proper and timely completion of the work and performance of the sealants.
 - 2. Do not proceed with the sealant work until unsatisfactory conditions have been corrected.
- C. Weather Conditions:
 - 1. Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.
 - 2. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength.
 - 3. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures.
 - 4. Coordinate time schedule to avoid delays.

1.9 WARRANTY

- A. Extend period during which installer of work of this section is required to return to job to make corrections for four additional years beyond the one-year warranty period.
- B. Repair or replace sealants which fail to perform as air-tight and water-tight joints; or fail in joint adhesion, cohesion or abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in another manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Colors: For exposed materials, provide color as indicated, or if not indicated, as selected by the Port from manufacturer's standard colors. For concealed materials, provide the natural color which has the best overall performance characteristics.
- B. Hardness: As recommended by manufacturer for application shown, unless otherwise indicated.

- C. Modulus of Elasticity: Provide the lowest available modulus of elasticity which is consistent with exposure to weathering, indentation, vandalism, abrasion, support of loading, and other requirements.
- D. Compatibility: Before purchase of each required material, confirm its compatibility with each other material it will be exposed to in the joint system.
- E. Size and Shape: As shown or, if not shown, as recommended by the manufacturer for the type and condition of joint, and for the indicated joint performance or movement.
- F. Grade of Sealant: For each application, provide the grade of sealant (non-sag, self-leveling, no-track, knife grade, preformed, etc.) as recommended by the manufacturer for the particular condition of installation (locations, joint shape, ambient temperature, and similar conditions), to achieve the best possible overall performance. Grades specified herein are for normal conditions for installation.

2.2 SEALANT AND CALKING MATERIALS

- A. Elastomeric Sealant, Interior:
 - 1. Acrylic Latex Joint Sealants:
 - a. Provide one-part, non-sag, mildew-resistant, sealant complying with ASTM C834, formulated to be paintable and recommended for exposed interior applications involving joint movement of not more than 7.5 percent from installed dimension.
 - b. Acceptable Manufacturers and Products:
 - 1) Bosti-Flex Plus by Bostik.
 - 2) Tremco Tremflex 834 Silconized Acrylic Latex Sealant by Tremco.
 - 3) Sikacryl NP 520 by Sika.
 - 4) Or equal.
 - 2. At joints around plumbing fixtures, at wet tile areas and where indicated to be mildew-resistant silicone; provide mildew-resistant, silicone, one-part, non-sag, elastomeric sealant, complying with ASTM C920 Type S, Grade NS, Class 25, Use NT; recommended for interior joint surfaces shown.
 - a. Acceptable products and manufacturers:
 - 1) 898 by Percora Corporation.
 - 2) 786 by Dowsil.
 - 3) Tremsil 200 by Tremco.
 - 4) SCS1700 Sanitary Sealant by Momentive Performance Materials, Inc.
 - 5) Or equal.

2.3 MISCELLANEOUS MATERIALS

- A. Joint Cleaner: Provide the type of joint cleaning compound recommended by the sealant or calking compound manufacturer, for the joint surfaces to be cleaned.
- B. Joint Primer/Sealer: Provide the type of joint primer/sealer recommended by the sealant manufacturer, for the joint surfaces to be primed or sealed.

- C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by the sealant manufacturer, to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.
- D. Sealant Back-Up Rod: Compressible rod stock of polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended for compatibility with sealant by the sealant manufacturer. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backing to minimize the possibility of sealant extrusion when joint is compressed.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or calking compound.
- B. For elastomeric sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with ASTM C794 has successfully demonstrated that sealant bond is not impaired by coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.
- C. Etch masonry and stonework joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5 percent solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.
- D. Roughen joint surfaces on vitreous coated and similar non-porous materials, where sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive to produce a dull sheen.

3.2 INSTALLATION

- A. Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.
- B. Prime or seal the joint surfaces wherever shown or recommended by the sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.
- C. Install sealant backup rod for elastomeric sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.

- D. Clean joint surfaces as recommended by sealant manufacturer. Provide bond-breaker or separator between sealant and joint filler, wherever recommended by manufacturer and wherever sealant is not compatible with joint filler.
- E. Install bond breaker tape where shown and where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.
- F. Employ only proven installation techniques which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides.
 - 1. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces.
 - 2. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
- G. Install sealants to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead.
 - 1. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but neither more than 1/2 inch deep nor less than 1/4 inch deep.
 - 2. For joints sealed with non-elastomeric sealants and calking compounds, fill joints to a depth in the range of 75 percent to 125 percent of joint width.
- H. Spillage:
 - 1. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces including exposed aggregate panels and similar rough textures. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either primer/sealer or the sealant/calcing compound.
 - 2. Remove excess and spillage of compounds promptly as work progresses. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
- I. Where exposed, install with surface profile within plus or minus 1/16 inch from dimension shown except over 8 feet above floor plus or minus 1/8 inch, with surface uniformly smooth and free of wrinkles.

3.3 CURE AND PROTECTION

- A. Cure sealants and calking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Do not cure in a manner which would significantly alter material's modulus of elasticity or other characteristics.
- B. Follow manufacturer's procedures required for curing and protection of sealants and calking compounds during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of completion.

3.4 TESTS FOR PERFORMANCE

- A. After nominal cure of exterior joint sealants which are exposed to weather, test for water leaks. Flood joint exposure with water directed from a 3/4-inch garden hose held perpendicular to wall face, 2'-0" from joint, connected to a water system with 30 psi minimum static water pressure at the nozzle. Move stream of water along joint at an approximate rate of 20 feet per minute.
- B. Test approximately 5 percent of total joint system in locations which are typical of every joint condition, and which can be inspected easily for leakage on opposite face. Conduct test in presence of the Port who will determine actual percentage of joints to be tested and actual period of exposure to water from hose, based upon extent of observed leakage, or lack thereof. Repair sealant installation at leaks or, if leakage is excessive, replace sealant installation as directed.
- C. Where nature of observed leakage indicates possibility of inadequate joint bond strength, the Port will direct that additional testing be performed at a time when joints have been fully cured, followed by natural exposure through both extreme temperatures, and returned to lowest range of temperature in which it is feasible to conduct testing. Repair or replace work as required. Perform testing at a reasonable time within 24 months of installation date, as directed.

END OF SECTION 079200

SECTION 081100 - METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section Includes the Following:
 - 1. Hollow metal doors.
 - 2. Hollow metal door frames.
- B. Related Sections Include the Following:
 - 1. Section 087100, Door hardware.
 - 2. Section 099100, Painting.

1.2 REFERENCES

- A. Definitions
 - 1. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.
 - 2. OEESC – Oregon Energy Efficiency Specialty Code – Current Edition.
 - 3. Exposed to View: Readily apparent to the public in normal use of the structure. A view distance of 20 feet is consistent with the intent of this definition.
 - 4. SDI: Steel Door Institute.

1.3 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 SUBMITTALS

- A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, fire-resistance ratings, thermal performance (U-value) and finishes.
- B. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.6 QUALITY ASSURANCE

- A. Hollow Metal Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to the Port. Remove and replace damaged items that cannot be repaired as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366, Commercial Steel (CS), or ASTM A 620, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Metallic-Coated Steel Sheets: ASTM A 653, Commercial Steel (CS), Type B, with minimum G60 A60 zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

2.2 DOORS

- A. General: Provide doors of sizes, thicknesses, and designs indicated.
- B. Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

2.3 FRAMES

- A. Frames, General: Provide steel frames for doors that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
 - 1. Configuration: Typical frame shall be plus 1-inch greater than gypsum finished partitions.

- a. Provide overall width to match finishes other than gypsum as indicated.
 - 2. Verify every condition requirements in field.
 - 3. Coordinate with framing and sheathing build-up.
- B. Frames: 0.053-inch- thick steel sheet.
- 1. Construction: Face welded.
 - 2. Finish: Primed.

2.4 ACCESSORIES

- A. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.
- B. Plaster Guards: 0.016-inch- thick, steel sheet plaster guards to close off interior of openings; place at back of hardware cutouts where plaster or other materials might obstruct hardware operation.
- C. Supports and Anchors: Formed from same material as frames, minimum thickness of 0.042 inch , and as follows:
 - 1. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 - a. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
 - 2. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
- D. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Provide zinc-coated items for items built in exterior walls, comply with ASTM A 153, Class C or D as applicable.

2.5 FABRICATION

- A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Fit and assemble units in manufacturer's plant.
- B. Interior Door Faces: Fabricate exposed faces of doors and panels from uncoated cold-rolled steel sheet.
- C. Core Construction: Manufacturer's standard core construction that produces doors complying with SDI standards.
- D. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.
- E. Single-Acting, Door-Edge Profile: Beveled edge.
- F. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

- G. Fabricate concealed stiffeners, reinforcement, edge channels from either cold- or hot-rolled steel sheet.
- H. Exposed Fasteners: Not permitted.
- I. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
 - 1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.
- J. Frame Construction: Fabricate frames to profiles indicated.
 - 1. Fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
 - 2. Provide welded frames with temporary spreader bars.
- K. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- L. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

2.6 FINISHES

- A. Apply manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.
 - 1. Interior door and frame final color and gloss: Per Section 099100 Painting Schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine adjacent construction and supports.
- B. Verify that openings are within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface.
- C. Correct other conditions detrimental to the proper or timely completion of this work before proceeding with installation.

3.2 INSTALLATION

- A. General: Install hollow metal doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as indicated and specified.
- B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.

After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Place frames before construction of enclosing walls and ceilings, unless otherwise acceptable to the Port.
2. In metal-stud partitions, provide at least 3 wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with 2 screws per anchor to prevent rotation.
3. For openings 90 inches or more in height, install an additional anchor at hinge and strike jambs.

- C. Door Installation: Comply with ANSI A250.8. Fit doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

3.3 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. Prime-Coat Touchup: Immediately after installation, sand smooth rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

END OF SECTION 081100

SECTION 083100 – ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes general requirements for access doors.
- B. Provide doors where required for access to work of other divisions and other locations required. Provide fire-rated door assemblies in fire-rated wall assemblies.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 095100, Acoustical Ceilings: For access in acoustical ceiling systems.

1.3 REFERENCES

- A. NFPA: National Fire Protection Association
 - 1. NFPA 80: Standard for Fire Doors and Other Opening Protectives

1.4 SUBMITTALS

- A. Submit product data. Include manufacturer's specifications and installation instructions.

1.5 QUALITY ASSURANCE

- A. Fire-Rated Door Assemblies: Units that comply with NFPA 80 and are labeled and listed by UL, Warnock Hersey, or other testing and inspecting organization acceptable to authorities having jurisdiction.
- B. Provide label from acceptable testing and inspecting organization on each fire-rated access door assembly.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

- A. Acceptable Manufacturers and Products: As listed below.
- B. General: Provide access doors manufactured as an integral unit, complete with all parts and ready for installation.
- C. Size: Access panels shall be 24 inches by 24 inches, unless indicated otherwise on the drawings.

- D. Steel and Stainless Steel Access Doors and Frames:
1. Steel Fire-Rated Units: Fabricate in a manner similar to steel access doors and frames, except provide manufacturer's standard insulated flush panel doors with self-closing mechanism.
 - a. Masonry and Concrete Walls: Exposed flange not over 1-inch wide will be allowed.
 - b. Veneer Plaster (and Gypsum Wallboard) Walls: Nystrom "APFR-WP" or equal with recessed "Drywall" beads, UL and WH listed. Exposed flanges will not be allowed.
 2. Stainless Steel Fire-Rated Units: Fabricate in a manner similar to stainless steel access doors and frames, except provide manufacturer's standard insulated flush panel doors with self-closing mechanism.
 - a. Veneer Plaster (and Gypsum Wallboard) Walls: Nystrom "APFR-WP" or equal with recessed "Drywall" beads, UL and WH listed. Exposed flange will not be allowed.
 3. Fabricate units of continuous welded steel construction, unless otherwise shown on the drawings. Grind welds smooth and flush with adjacent surfaces.
 4. Provide attachment devices and fasteners of the type required to secure access doors to the types of supports encountered.
 5. Non-Rated Frames: Fabricate from 16-gage steel (stainless steel at stainless steel door).
 - a. Where installed in masonry or concrete, provide frame with exposed flange not less than 1 inch wide around perimeter of frame, Milcor Style M, Nystrom TM, or equal; except where fire rated type is required.
 - b. Where installed in gypsum wallboard surfaces, provide drywall trim, similar to Milcor Style DW, Nystrom Style WB, or equal.
 - c. Where installed in decorative finishes, provide concealed channel frame attached to blocking with inset door panel for accommodating finish assemblies for concealing.
 6. Steel Non-Rated Flush Doors: Fabricate from 14-gage steel with concealed spring hinges or concealed continuous hinge, set to open to 175 degrees.
 7. Stainless Steel Non-Rated Flush Doors: Fabricate from 16-gage stainless steel with concealed spring hinges or concealed continuous hinge, set to open to 175 degrees.
 8. Finish steel with manufacturer's factory-applied baked enamel prime coat applied over phosphate protective coating on steel. Finish stainless steel with a #4 finish.
 9. Locking Devices:
 - a. Public Areas: Provide one 1.125-inch mortise cylinder keyed lock per access door, Schlage FSIC Mortise Cylinder Housing 30-032 with Schlage 20-030-ICX Construction Core, or pre-bid approved equal. Provide two keys per lock and key locks alike.
 - b. Non-Public Areas:
 - 1) Rated Doors: Provide knurled-knob locks of the number required to hold door in flush, smooth plane when closed.
 - 2) Non-Rated Doors: Provide flush, screwdriver-operated cam locks of the number required to hold door in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's instructions for installation. Coordinate installation with work of other trades.
- B. Set frames accurately in position and securely attach to supports with face panels plumb in relation to adjacent finish surfaces; and horizontal surfaces level.

3.2 ADJUST AND CLEAN

- A. Adjust hardware and panels after installation for proper operation.

END OF SECTION 083100

SECTION 084326 - ALL-GLASS STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes all-glass storefront (sidelite) systems.
- B. Related Requirements:
 - 1. Section 057000 "Decorative Metal " for support substrates for all-glass storefronts.
 - 2. Section 088000 "Glazing" for glazing installed in all-glass systems and designed under cover of this Section; for wall-adhered glazing components.

1.2 SUBMITTALS

- A. Glazing types specified in Section 088000 and installed in this Section may be submitted in this Section submittals.
 - 1. Include reference on 088000 submittals where under this section.
- B. Product Data: For each product.
 - 1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for all-glass system.
- C. Shop Drawings: For all-glass storefront systems.
 - 1. Plans, elevations, and sections.
 - 2. Details of fittings and glazing, including isometric drawings of fittings.
- D. Samples: Sample of each exposed finish in manufacturers' standard size but not less than 3 by 2 inches.
- E. Fabrication Sample: Rail fittings where ends will be exposed, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. End finish
 - 2. Joinery.
 - 3. Anchorage.
- F. Delegated Design Submittals: For items indicated, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. At Port's discretion and approved prior to bid, in lieu of professional engineering, submit manufacturer's qualified installation instructions showing compliance with requirements, as pre-engineered systems for Port approval.
- G. Qualification Statements: For Installer.
- H. Delegated Design Engineer Qualifications: For all-glass storefront systems.
- I. Sample Warranties: For all-glass storefront systems.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For all-glass storefront systems.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Fabricator of products.
 - 2. Entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 3. Authorized representative who is trained and approved by manufacturer.
- B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Port, except with Port's approval. If changes are proposed, submit comprehensive explanatory data to Port for review.

1.5 MOCKUPS

- A. Build mockups to demonstrate aesthetic effects and to set quality standards for materials, fabrication, and execution.
 - 1. Build mockup of typical all-glass sidelite.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Port specifically approves such deviations by Change Order.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace components of exterior all-glass entrance and storefront systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal exposure.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain all components of exterior all-glass entrance and storefront systems, including framing and accessories, from single manufacturer.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include the following:
 - 1. Assa Abloy.
 - 2. CR Laurence Co., Inc.
 - 3. PRL Glass Inc.
 - 4. Or equal.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design all-glass storefront system attachments and restraints to supporting construction.
 - 1. Delegated design is not required where manufacturer's standard installation details include anchors types and spacing meeting requirements as determined during submittal review.
 - 2. Design glazing channel attachment to and support attachment of decorative stainless steel plates in Section 057000 "Decorative Metal".
- B. General Performance: Comply with performance requirements specified, as determined by testing of all-glass storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- C. Structural Loads:
 - 1. Design Loads: 5 psf/ horizontal.
 - 2. Impact Loads: Design to CPSC 16 CFR 1201 (Category II) and ANSI Z97.1 (Class A).
 - 3. Deflection Limits: Deflection normal to glazing plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller.
- D. Seismic Performance: All-glass storefront systems to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

2.3 ALL-GLASS STOREFRONT SYSTEMS

- A. Fitting Configuration:
 - 1. All-Glass Storefronts: Glazing U-channel at top and continuous rail fitting at bottom; as indicated.
 - 2. Cladding: Stainless steel.
- B. Rail Fittings:
 - 1. Top U-Channel: As indicated and sufficient for glass lift type install and retaining; with cladding.
 - a. Product: Eagle Aluminum; Aluminum channel GHU-469, 2-5/8-inch high by 1-1/4-inch wide outer dimensions, 1/8-inch thickness.

- b. Height: Cut to indicated and accommodating cladding return over flange ends.
 - 2. Bottom Rail:
 - a. Base shoe with 1-inch wide channel, for 1/2-inch glazing, as U-channel for 1-inch channel used for 13/16-inch laminated glass; with cladding.
 - 1) Product: CRL, 8B Series.
 - 2) Wet seal if gaskets are not available at top gasket race.
 - 3) Shim tight with Teflon shims each side of glazing to center glazing.
 - b. Profile: Square.
 - 3. End Caps: Manufacturer's standard precision-fit end caps for rail fittings.
 - a. Custom form end caps welded, with returns of 4-inches and concealed backers butt joints with cladding at base shoes with cladding.
 - b. At base shoe, omit glass profile to assist in installation of glazing, where approved in shop drawings.
- C. Anchors and Fastenings: Concealed.
- D. Materials:
 - 1. Aluminum: ASTM B221, with strength and durability characteristics of not less than Alloy 6063-T5.
 - 2. Stainless Steel Cladding: ASTM A240/A240M or ASTM A666, Type 304.
 - a. Finish: ASTM A480/480M No. 4 directional satin finish.
 - b. Thickness: 0.035 inch.

2.4 GLASS

- A. Glass: See Section 088000 "Glazing" for types indicated.
 - 1. Exposed Edges: Machine ground and flat polished.
 - 2. Butt Edges: Flat ground.
 - a. Joint Width: 1/4-inch.
 - b. Treatment: Clear sealant or open, as indicated.

2.5 SEALANTS

- A. Comply with Section 079200 "Joint Sealants."
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. GE Construction Sealants; Momentive Performance Materials Inc.
 - 2. Pecora Corporation.
 - 3. Tremco Incorporated.
 - 4. Dowsil.
- C. Butt Joint Sealant: Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, for Uses NT, G, and A.
 - 1.
 - 2. Color: As indicated or as selected by Port for each application.

- D. Adhesive Sealants and Accessories: For attachment of cladding. Type recommended by manufacturer. Two rows each surface, primed. For overhead, use adhesive.
 - 1. Single-component, nonsag, neutral-curing silicone joint sealant, ASTM C920, Type S, Grade NS, Class 25, for Uses NT, G, and A.
 - a. Products: Dowsil 795, Tremco Spectrem 2, or equal.
 - 2. Modified Polymer Adhesive: Soudal Fix ALL High Tack, Bostik Grabber, or Titebond WeatherMaster Ultimate MP.
 - 3. Tape not permitted.

2.6 FABRICATION

- A. Provide all required components, including but not limited to anchors, brackets, fasteners, set screws, spacers, filler materials, adhesive, and other accessories compatible with material in contact, as indicated or required for complete installations.
 - 1. Where standard anchors and brackets do not suit conditions, provide custom anchors and brackets as required.
- B. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.
 - 1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.
- C. Factory assemble components and factory install hardware and fittings to greatest extent possible.
- D. Form metal cladding and finish components to comply with Section 057000.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALL-GLASS STOREFRONT SYSTEMS

- A. Install all-glass storefront systems and associated components according to manufacturer's written instructions.
- B. Set units level, plumb, and true to line, with uniform joints.
- C. Maintain uniform clearances between adjacent components.
- D. Lubricate hardware and other moving parts in accordance with manufacturer's written instructions.

- E. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.
- F. Install butt-joint sealants according to manufacturer's written instructions and as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

3.3 CLEANING

- A. Remove excess sealant and glazing compounds and dirt from surfaces.
- B. Protect glass and finishes from damage.

END OF SECTION 084326

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes items known commercially as finish or door hardware that are required for swinging doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.
- B. This section includes the following:
 - 1. Hinges.
 - 2. Lock cylinders and keys.
 - 3. Lock and latch sets.
 - 4. Door trim units.
 - 5. Kick plates.
 - 6. Seals.
 - 7. Stops.
 - 8. Closers.
 - 9. Pivots.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 081100, Metal Doors and Frames.
- B. Section 079200, Joint Sealants.
- C. Section 102113, Toilet Compartments.

1.3 REFERENCES

- A. ADA: Americans with Disabilities Act; ICC A117.1.
- B. ANSI/ BHMA: American National Standards Institute/Builders Hardware Manufacturers Association
 - 1. ANSI/ BHMA A156.18: American National Standard for Materials and Finishes
 - 2. ANSI A117.1: Accessible and Usable Buildings and Facilities
- C. NFPA: National Fire Protection Association
 - 1. NFPA 101: Life Safety Code

1.4 COORDINATION

- A. Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.5 SUBMITTALS

- A. Product Data: Submit product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
- B. Hardware Schedule: Coordinate hardware schedule with doors, frames and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into hardware sets indicating complete designations of every item required for each door or opening. Include the following information:
 - a. Type, style, function, size and finish of each hardware item.
 - b. Name and manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of each hardware set cross-referenced to indications on drawings both on floor plans and in door and frame schedule.
 - e. Explanation of all abbreviations, symbols, codes, etc. contained in schedule.
 - f. Mounting locations for hardware.
 - g. Door and frame sizes and materials.
 - h. Keying information.
 - 2. Submittal Sequence: Submit final schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.
 - 3. Samples of Finish Hardware: Submit minimum 2-by-4-inch plate samples of each type of finish required, except primed finish. Samples will be returned to the supplier. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated in the work, within limitations of keying coordination requirements.
 - 4. Templates: For doors, frames and other work to be factory-prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.6 MAINTENANCE

- A. Furnish a complete set of specialized tools and maintenance instructions as needed for the Port's continued adjustment, maintenance, and removal and replacement of door hardware.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed 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.
- B. Supplier Qualifications: Door hardware supplier with warehousing facilities in project's vicinity and who is or employs an experienced hardware consultant, available during the course of the work to consult with the Contractor and the Port about door hardware and keying.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- D. Regulatory Requirements: Comply with provisions of the following:
 - 1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1, FED-STD-795, "Uniform Federal Accessibility Standards," as follows:
 - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 - b. Thresholds: Not more than 1/2 inch. Bevel raised thresholds with a slope of not more than 1:2.
 - 2. NFPA 101: Comply with the following for means of egress doors:
 - a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
 - b. Thresholds: Not more than 1/2 inch high.
- E. Preinstallation Conference: Conduct conference at project site. Review methods and procedures related to electrified door hardware including, but not limited to, the following:
 - 1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
 - 2. Review sequence of operation for each type of electrified door hardware.
 - 3. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review required testing, inspecting, and certifying procedures.

1.8 PRODUCT HANDLING

- A. Tag each item or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.
- B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage it in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packaged in same container.
- C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer unit until each is satisfied that count is correct.

- D. Deliver individually package door hardware items promptly to place of installation (shop or work site).
- E. Provide secure lock-up for door hardware delivered to the project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.9 WARRANTY

- A. Warranty Period: Five years from date of substantial completion, unless otherwise indicated.
- B. Special Warranty: Submit written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of operators and door hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

PART 2 - PRODUCTS

2.1 PORT-FURNISHED PRODUCTS

- A. Final replacement cores and keys will be furnished and installed by the Port.

2.2 MANUFACTURERS

- A. Manufacturers shall be the following or pre-bid approved equal unless noted as no substitution.
 - 1. Hinges: Stanley, McKinney, Hager.
 - 2. Cylinders: Schlage, no substitution.
 - 3. Lock and Latches: Schlage, no substitution.
 - 4. Kick Plates, Stops and Miscellaneous: Ives, Trimco, Rockwood, Glynn-Johnson.
 - 5. Closers: LCN, no substitution.
 - 6. Seals, Door Bottoms, Thresholds, Gasketing: Pemko, Reese, Zero.

2.3 SCHEDULED HARDWARE

- A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware are indicated in the Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following:
 - 1. Manufacturer's Product Designations: The product designation and name of one manufacturer is listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Manufacturers article above for each hardware type, the comparable product of one of the other manufacturers that comply with requirements.

2.4 MATERIALS AND FABRICATION

- A. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standard for each type hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish optional materials or forming methods for those indicated, except as otherwise specified.
- B. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
- C. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible.
- D. Provide concealed fasteners for hardware units that are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.5 HINGES, BUTTS, AND PIVOTS

- A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Screws: Provide Phillips flat-head screws complying with the following requirements.
 - 1. For metal doors and frames install machine screws into drilled and tapped holes.
 - 2. Finish screw heads to match surface of hinges or pivots.
- C. Hinges Pins: Except as otherwise indicated, provide hinge pins as follows:
 - 1. Out-Swing Doors with Locks: Nonremovable pins.
 - 2. Tips: Flat button and matching plug, finished to match leaves.
- D. Number of Hinges: Provide number of hinges indicated but not less than three hinges for door leaf for doors 90 inches or less in height and one additional hinge for each 30 inches of additional height.

2.6 LOCK CYLINDERS AND KEYING

- A. Equip locks with cylinders with full size interchangeable core pin tumbler inserts. Furnish only temporary inserts for the construction period. Permanent inserts will be furnished and installed by the Port.
- B. Metals: Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.

2.7 LOCKS, LATCHES, AND BOLTS

- A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.
 - 1. Provide flat lip strikes for locks with three-piece, antifriction latch bolts as recommended by manufacturer.
- B. Security: Provide BHMA Grade 1 Security listed locksets with fully reversible lock case which does not require removal of lock case cover to re-hand. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.
 - 1. Provide 1/2-inch minimum throw of latch for other bored and preassembled types of locks and 3/4-inch minimum throw of latch for mortise locks. Provide 1-inch minimum throw for all dead bolts.

2.8 DOOR TRIM UNITS

- A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.
- B. Fabricate protection plates not more than 1-1/2 inch less than door width on hinge side and not more than 1/2 inch less than door width on pull side by height indicated.
 - 1. Metal Plates: Stainless steel, 0.050 inch (U.S. 18 gauge).

2.9 WEATHERSTRIPPING AND SEALS

- A. Provide continuous sound seals on interior doors. Provide non-corrosive fasteners.

2.10 THRESHOLDS

- A. Except as otherwise indicated, provide standard metal threshold unit of type, size, and profile as shown or scheduled.

2.11 HARDWARE FINISHES

- A. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/ BHMA A156.18 "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.
 - 1. USP 600 primed for painting.
 - 2. US28 628 satin aluminum.
 - 3. US32D 630 satin stainless steel.
 - 4. ALUM. 689 aluminum painted.
 - 5. US26D (BHMA No. 626) dull chrome plated.

PART 3 - PRODUCTS

3.1 INSTALLATION

- A. Mount hardware units at heights indicated in “Recommended Locations for Builders Hardware for Standard Steel Doors and Frames” by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by the Port.
- B. Install each hardware item in compliance with the manufacturer’s instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protection with finishing work specified in the Division 9 sections. Do not install surface-mounted items until finishes have been completed on the substrate involved.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Set thresholds in full bed of butyl rubber or polyisobutylene mastic sealant complying with requirements specified in Section 079200, Joint Sealants.
- F. Weatherstripping and Seals: Comply with manufacturer’s instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING AND TRAINING

- A. Adjust and check each are operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units, which cannot be adjusted to operate freely and smoothly as intended for the application made.
 - 1. Where door hardware is installed more than one month prior to acceptance or occupancy of space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
 - 2. Clean adjacent surfaces soiled by hardware installation.
 - 3. Instruct the Port’s personnel in proper adjustment and maintenance of door hardware and hardware finishes.

3.3 HARDWARE SCHEDULE

- A. Provide hardware for each door to comply with hardware set numbers indicated in the hardware schedule below. Hardware sets indicate quantity, item, manufacturer and product designation, size, and finish or color, as applicable.
- B. Hardware may be provided under work of other Sections where indicated.

HW SET # 050

Each door or doors to have:

QTY	EA	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080T 03A	626AM	SCH
1	EA	TEMP CORE	23-030ICC	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	GASKETING	488BK PSA	BK	ZER

Notes: Provide 3 hinges up to 7'-6" doors and 4 hinges for doors larger up to 9'-0" tall.

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior glass (GL#).
 - 2. Glazing sealants, compounds and accessories.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for sealants other than glazing purposes.
 - 2. Section 084326 "All-Glass Storefronts."

1.2 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.
- B. Coordinate surface preparation for wall-adhered glazing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: Submit samples 12 by 12 inch in size for each type of laminated glass and glazing film.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.
- E. Product Certificates: For glass.

- F. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- G. Preconstruction adhesion and compatibility test report.
- H. Sample Warranties: For special warranties.
- I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Port's name and registered with manufacturer.
- J. Qualification Data: For Installer and manufacturers of fabricated glass units.

1.5 QUALITY ASSURANCE

- A. Delegated Design: Engage a qualified professional engineer, licensed in the State of Oregon, to design glazing.
- B. Perform work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.
 - 2. Maintain minimum ambient temperature before, during, and 24 hours after installation of glazing compounds.

1.7 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 5 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Structural Glazing Sealant: Provide a twenty year manufacturer warranty to include coverage for structural adhesion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide type and thickness of glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure and seismic loads acting normal to plane of glass.
 - 1. See structural drawings for design loads.
 - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - a. Limit center of glass deflection for exterior insulated glass units to 1 inch maximum.
 - b. Limit center of glass deflection for laminated canopy glass to 1/8 inch under self-weight of glass.
 - 3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 4. Glass thicknesses listed are minimum.
 - a. Minimum glass thickness at laminated canopy glass shall be as required to comply with applicable code structural performance and indicated deflection limits.
 - 5. Installed glazing systems shall withstand normal exposure without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Safety Glazing: Where safety glazing is required or indicated, provide glazing that complies with 16 CFR 1201, Category II or ANSI Z79.1 as appropriate, as well as complying with the rest of the requirements of the type of glass or unit.
 - 1. Subject to compliance with requirements, obtain safety glazing product permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
- C. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

- D. Structural-Sealant Glazing, Wall Adhered: Designed to carry gravity loads of glazing.
- E. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, wall-applied glazing systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant to occur before adhesive failure.
 - 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 - 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 MANUFACTURERS

- A. Source Limitations for Glass: Obtain glass from single source from single manufacturer.
- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.3 MANUFACTURERS

- A. Glass Manufacturers:
 - 1. Manufacturers: As indicated in Glass Schedule.
 - 2. Or pre-bid approved equal.
- B. Float Glass: Provide float glass based glazing unless otherwise indicated. ASTM C1048, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear), Quality-Q3.
 - 1. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 category II criteria for safety glazing used in hazardous locations.
 - a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - 2. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - 3. Impact Resistant Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria; Class A/Category II.
 - 4. Provide low-iron glass where scheduled.
- C. Laminated Glass: Float glass in thickness indicated, laminated in accordance with ASTM C1172.
 - 1. Provide low iron glass.
 - 2. Provide fully tempered and heat strengthened glass where indicated.
 - 3. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category II impact test requirements.
 - a. Ionoplast Interlayer: Opaque for custom printing.
 - 1) Thickness: 0.060 inch or as scheduled.
 - 2) Product: Kuraray; SentryGlas Xtra.

- a) Or pre-bid approved equal.
 - b. PVB Interlayer: For wall-mounted glazing. Opaque, for custom printing.
 - 1) Thickness as scheduled.
 - 2) Product: Kuraray; Trosifol UltraClear.
 - a) Or equal.
- 4. Digital Files for Custom Graphics: The Port will furnish the following:
 - a. Production ready artwork will be provided in vector (outline) files saved in either EPS or Adobe Illustrator (AI) format. All fonts (text) will be converted to curves or outlines.
- D. Ceramic-Coated Glass: ASTM C1048, Condition C, Type I, Class 1 (clear) or substrate type as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in NGA's "Engineering Standards Manual."

2.4 GLAZING COMPOUNDS

- A. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- C. 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.
- D. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.5 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II, color black. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by 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 long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting back painted glazing and certified by both coating and mastic manufacturer as compatible with glass coating and substrates on which glazing will be installed.
- D. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl- based, 100 percent solids compound; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2.
 - a. Width: As required for application.
 - b. Thickness: As required for application.
 - c. Spacer Rod Diameter: As required for application.
 - d. Manufacturers:
 - 1) Pecora Corporation: www.pecora.com/#sle.
 - 2) Tremco Global Sealants: www.tremcosealants.com/#sle.
 - 3) Or equal.
 3. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - a. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 - b. AAMA 810.1, 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 I; color black.
- F. Glazing Clips: Manufacturer's standard type.
- G. Spacer Tape: Self-adhered, vapor permeable open cell polyurethane foam tape designed for use in structural silicone glazing assemblies in direct contact with silicone adhesive.
- H. Glazing Channels: Extruded aluminum, mill finish, intended to allow gasketed or wet sealed glazing.
- I. Panel Clips: Extruded aluminum, manufacturer recommended for structurally glazed application.
- J. Clips, Glazing Adhered to Wall: For structural-glazed to wall application (GL30), provide offset mirror z-clips at top of glass, with 1/4-inch bite, polished stainless steel or satin anodized aluminum. Provide two clips each lite.

2.6 GLAZING SEALANTS

- A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Port from manufacturer's full range of industry colors.
 - a. Clear.

- B. Structural Glazing Sealants: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes into contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in structural-sealant-glazed assembly indicated.
1. Structural glazing sealants shall be fabricated and tested in accordance with the following standards and specifications:
 - a. ASTM C1087.
 - b. ASTM C1135.
 - c. ASTM C1184.
 - d. ASTM C1265.
 - e. ASTM C1294.
 - f. ASTM C1369.
 2. Performance Characteristics:
 - a. Color: Black.
 - b. Minimum Short Term Load Working Normal and Shear Stress: 20 psi with minimum factor of safety of 5.
 - c. Minimum Long Term Load Working Normal and Shear Stress: 1 psi with minimum factor of safety of 5.
 - d. Minimum 15% extension under service loads.
 - e. Minimum 25% extension under seismic loads.
 3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dowsil.
 - b. Momentive Performance Materials.
 - c. Pecora.
 - d. Tremco.
 - e. Or equal.

2.7 FABRICATION

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.

- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), ASCE 7 and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.
- G. Setting Block Installation: Locate center of setting block within L/8 or 6 inches from ends of lite, whichever is greater, where "L" is width of glass lite being supported.

3.4 INSTALLATION OF GLAZING GASKET (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch 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. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.5 INSTALLATION – WET GLAZING METHOD

- 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 from 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 smooth. For exterior conditions, tool exposed surface of sealants to provide positive drainage.

3.6 INSTALLATION OF GLAZING SEALANT

- 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 from 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.

3.7 INSTALLATION – GLAZING FILMS

- A. Apply film to prepared glass surfaces in compliance with the manufacturer's written instructions and recommendations using manufacturer-recommended tools:
 - 1. Oversize and accurately cut and fit film to area to be covered. Double-cut film as required to ensure tightly-fitted seams and accurate alignment of film pattern.

2. Remove release liner from film and apply wetting solution to adhesive surface of film and glass.
3. Place and accurately position film on glass to required position.
4. Remove all bubbles and water from film without damage.
5. Accurately trim excess film from edges with sharp razor and straightedge.
6. Remove wrinkles and trapped air and wetting agent.
7. Allow film to completely dry and adhere to the glass.
8. When complete, film shall completely cover glass without gaps and shall be free from wrinkles and trapped air and wetting agent.

B. General:

1. Rigidly secure nonmovement joints.
2. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
3. Install structural glazing.
 - a. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
 - b. Set glazing with proper orientation, so that coatings face exterior or interior as specified.
 - c. Apply structural silicone sealant to completely fill cavity, in accordance with sealant manufacturers written instructions with the framing and glazing in a fully supported position.
 - d. Brace or stiffen framing and glazing in such a manner to prevent undue stresses on the glass edge seal and structural joints or movement of the glazing, until sealant is fully cured in accordance with manufacturer's recommendations.
4. Interior glazing installed as wall finish:
 - a. Where glass is mounted to substrate, adhere glazing to substrate using manufacturer recommended size and location of sealant bead.
 - b. Where glass is directly mounted to partition, directly adhere panel clip to glass.

3.8 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to date of substantial completion in accordance with glass manufacturer's written recommendations.

3.9 PROTECTION

- A. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- B. Remove and replace glass that is damaged during construction period.

3.10 GLASS SCHEDULE

- A. Type GL27: Laminated monolithic glass.
 - 1. Unit Makeup: 13/16" total thickness.
 - a. (2) equal layers, 3/8" heat strengthened low iron clear glass.
 - b. Interlayer: Ionoplast, custom printed.
 - c. Ceramic Frit: White opaque frit applied to surface and location indicated on drawings.
 - 2. Manufacturers:
 - a. McGrory Glass.
 - 1) Sample Reference: ZGFP-561.
 - b. Pulp Studio.
 - 1) Sample Reference: 5099-2.
 - c. Skyline Glass.
 - 1) Sample Reference: 535897-007.
 - d. Or equal.
 - 3. Application: All-glass storefront.
- B. Type GL29B: Laminated monolithic glass with printed interlayer; wall adhered.
 - 1. Unit Makeup: 1/2" total thickness.
 - a. Outer lite: 1/4" low iron heat strengthened clear glass.
 - b. Inner lite: 3/16" low iron heat strengthened clear glass.
 - c. Interlayer: PVB, custom printed.
 - 2. Manufacturers:
 - a. McGrory Glass.
 - b. Pulp Studio.
 - c. Skyline Glass.
 - d. Or equal.
 - 3. Application: Wall adhered.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Silvered flat glass mirrors (MI1).
- B. Related Requirements:
 - 1. Section 088000 "Glazing" for glazing requirements applicable to mirrors.
 - 2. Section 092900 "Gypsum Board" for cement board substrates for mirrors.
 - 3. Section 102800 "Toilet Accessories" for toilet accessories interfacing with mirrors.

1.2 COORDINATION

- A. Coordinate required backing to support mirrors to achieve alignments indicated and for specified installation requirements.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's printed data on structural, physical and environmental characteristics, size limitations, special handling, and installation requirements
 - 1. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
 - 2. Include manufacturer's written installation instructions.
 - 3. Include for each type of accessory showing compliance with requirements.
 - 4. For sealant, include a letter from the sealant manufacturer indicating that the sealant is compatible with both edge sealers, mirror coatings, and mirror mastic.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.
- C. Samples: Submit samples, 12 by 12 inches in size, illustrating mirror design and edging on two adjacent sides.
 - 1. Mirror Mounting: Mount on same substrate, 1/2-inch thick.
- D. Manufacturer's Certificate: Submit manufacturer's certification that mirrors meet or exceed specified requirements.
- E. Preconstruction Test Reports: Submit test reports from mirror manufacturer or testing agency indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.
 - 1. Materials of mirror assembly, mirror glass, adhesive-mastic, primer and substrate-backings have been tested for compatibility and adhesion.

2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
- F. Qualification Data:
1. Manufacturer: Submit documentation showing that manufacturer meets requirements.
 2. Installer: Submit documentation showing that installer meets requirements.
 3. Testing agency.
- G. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Executed Warranty: Furnish executed warranty with authorized signatures and endorsements; ensure that forms have been completed in Port's name and registered with manufacturer.
- B. Maintenance Data: Furnish manufacturer's written recommendations for the care and cleaning of mirrors for inclusion in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Source Limitations:
1. Obtain mirrors through a single source from a single manufacturer.
 2. Obtain each type of accessory from a single manufacturer.
- B. Manufacturer: Company member of GANA Mirror Division.
- C. Installer: Certified under the National Glass Association's "Certified Glass Installer Program".
- D. Testing Agency Qualifications: Qualified in accordance with ASTM E329 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Mirror Mastic Compatibility and Adhesion Testing:
1. Submit mirror mastic products to mirror manufacturer for laboratory testing to determine chemical compatibility and adhesion performance of mastic with both the mirror backing and the specified primed substrate.
 - a. Testing is not required if certified laboratory data are submitted based on previous testing of mirror mastic products, primer, and mirror backing matching the exact materials submitted for this Project.
 - b. Where mirror manufacturer does not provide testing, engage a qualified testing agency to conduct tests.
 - c. Test Specimen Size: As required by specified testing standards.
 - d. Engineering Performance Criteria: Test assemblies to destructive failure. The entire assembly (mirror glass, mastic, primer, and cement board substrate) must meet the following performance minimums after a standard 21-day cure cycle:
 - 1) Tensile Adhesion (Forward Pull) according to ASTM C1135:

- a) Minimum Ultimate Tensile Strength: Greater than or equal to 50 psi (0.35 MPa).
 - b) Acceptable Failure Mode: Greater than or equal to 75 percent cohesive failure within the mastic.
- 2) Lap Shear Strength (Downward Weight) according to ASTM C961:
 - a) Minimum Ultimate Shear Strength: Greater than or equal to the higher value of either 40 psi (0.28 MPa) or 5 times the actual calculated dead-load weight of the largest glass panel.
 - b) Acceptable Failure Mode: Greater than or equal to 75 percent cohesive failure within the mastic.
- 3) Adhesion-in-Peel Pull Strength according to ASTM C794:
 - a) Testing Scope: Conduct separate peel tests to isolate the mastic-to-mirror-glass interface and the mastic-to-primed-substrate interface.
 - b) Minimum Pull Strength: Not less than 5 lbs per lineal inch (9 N / 25mm width) for both interfaces.
 - c) Target Failure Mode: Achieve 100 percent cohesive failure of mastic on the mirror glass and greater than or equal to 75 percent cohesive failure of mastic on the primed substrate.
- 4) Unacceptable Performance: Visible peeling, stripping, or blistering of the mirror's protective silver coating, or complete delamination of the primer coating from the cement board substrate below the minimum strength thresholds, shall constitute an immediate test failure and system rejection.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings.
- C. Store mirrors indoors protected from moisture including condensation and to prevent deterioration of silvering, damage to edges, abrasion of glass surfaces and applied coatings, and other damage.
- D. Comply with additional requirements and precautions of the manufacturer and GANA "Mirrors - Handle with Extreme Care".

1.8 FIELD CONDITIONS

- A. Do not install mirrors when ambient temperature is less than 60 degrees F and as required by adhesive and sealant manufacturers.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of mirrors.
- C. Obtain accurate field dimensions prior to fabrication and show measurements on shop drawings.

1.9 WARRANTY

- A. Furnish to Port a five-year manufacturer warranty for defective coating on mirrors and replacement of same. Warranty period shall commence on substantial completion.
- B. Defects include those that develop from normal use attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning mirrors contrary to the mirror manufacturer's written instructions. Defects include, but are not limited to, discoloration, black spots, clouding of the silver film and other silver spoilage and blemishes exceeding those allowed by the mirror and glass reference standards.
- C. During warranty period furnish new mirrors to replace deteriorated mirrors at no additional cost to the Port.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

- A. Select materials and/or provide supports as required to limit mirror material deflection to 1/175, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.
- B. Temper mirrors where indicated and where required for application, according to OSSC and to comply with 16 CFR 1201, Category II.

2.2 MIRROR GLASS

- A. Type (M11): ASTM C1503 Q1 (high quality mirrors) silvering, protective coating, and quality requirements on ASTM C1036 Type 1 – Transparent Flat, Class 1 – Clear Quality glass. Fully tempered ASTM C1048.
 - 1. Thickness: 5/16-inch; thicker as required for performance and application.
 - 2. Sizes: As indicated in drawings.
 - 3. Mounting Method: Direct-adhered to cement board substrates.

2.3 GLAZING COMPOUNDS

- A. Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Uses NT, O and G; single component; neutral curing; non-bleeding, non-staining, cured Shore A hardness of 15 to 25. Sealant shall be compatible with edge sealer and mirror coatings.
 - 1. Color: Clear or color selected by the Port.

2.4 ACCESSORIES

- A. Anti-Graffiti Film: Provide at all mirror surfaces. Comply with Section 088000, Glazing.
 - 1. Product: 3M Scotchgard Multi-Layer Protective Film 1004 or equal.
 - 2. Shop- or Field- apply.

- B. Mirror Mastic, Adhesive: Chemically compatible with mirror coating and backing substrate.
 - 1. Volatile Organic Content (VOC): Compliant with indicated requirements.
 - 2. Manufacturers:
 - a. Palmer Products Corp; Superset Mirro-Mastic.
 - b. Or equal.
 - 3. Provide manufacturer's recommended primers for substrates.
- C. Mounting Tape: Double-sided mirror mounting tape, depth to match adhesive space.
- D. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness.
- E. Top J-Clip: For retaining top of mirror, supplemental to mastic.
 - 1. Stainless steel, with leg extending minimum 1/8-inch and maximum 1/4-inch over mirror.
 - 2. 1-inch wide.
 - 3. Finish: Satin.

2.5 FABRICATION

- A. Shop-fabricate mirrors in accordance with the accepted shop drawings and GANA "Proper Procedures for Fabrication of Flat Glass Mirrors".
- B. Cut mirrors to final sizes and shapes to suit job conditions. Furnish mirrors in single-cut sizes for each location required, unless otherwise indicated.
- C. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- D. Mirror Edge Treatment: Flat polished with edge sealer.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
 - 3. Double coat edges with sealer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
 - 1. Verify substrates are clean and dust free.
- C. Verify mirror backing is complete for alignments indicated.

- D. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are clean and dry.

3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.
 - 1. Prime all substrates. Prepare substrates for primer and apply according to primer and mastic manufacturer's written instructions.

3.3 INSTALLATION

- A. General Requirements:
 - 1. Install mirrors in accordance with GANA publications, mirrors manufacturer's written instructions, and accepted shop drawings.
 - 2. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
 - 3. Set Mirrors with edge clearance free of surrounding construction including countertops and splashes.
 - 4. Provide a minimum airspace of nominal 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
 - a. Do not apply mastic continuously preventing air circulation-exposure.
 - b. Apply mastic vertically.
 - c. Supplement mastic with vertical strips of mounting tape.
- B. Frameless Mirrors, Adhesive Method:
 - 1. Set clips at top of mirror panels at each panel corner, minimum 1/2-inch from vertical edge and distance in approved shop drawings.
 - 2. Set bottom of mirror above counter or splash.
 - 3. Install blocks, 4-inches long, at quarter points on support.
 - a. Support mirrors on shims or setting blocks of deeper depth until curing is complete, not less than 48 hours.
 - 4. Apply mirror adhesive in compliance with the adhesive manufacturer's written instructions. After mastic is applied, properly position and align mirrors and press in place while maintaining the minimum airspace between back of mirrors and mounting surfaces. Support mirrors until adhesive has set.
 - a. Replace bottom supports with setting blocks held 1/16-inch from mirror face to allow for sealant over top to conceal blocks.
 - 5. At lavatory and sink counters and other wet surfaces, apply a continuous bead of sealant between bottom and adjacent surface and tool smooth. Comply with requirements indicated in Section 079200, Joint Sealants.

3.4 CLEANING AND PROTECTION

- A. Remove mirror adhesive from finish surfaces without damage.
- B. Remove labels after installation is complete.

- C. Clean mirrors in accordance with written recommendations of the manufacturer and GANA "Proper Procedures for Cleaning Flat Glass Mirrors".
- D. Protect mirrors from breakage and contaminating substances resulting from construction operations.
 - 1. Do not permit edges of mirrors to be exposed to standing water.
 - 2. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

END OF SECTION 088300

SECTION 090561 – COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This section describes:
 - 1. Preparation for floor coverings.
 - 2. Moisture mitigation system for concrete floor slabs.
- B. This section applies to all floor coverings. Moisture mitigation system shall be applied to all prepared concrete surfaces scheduled for floor coverings of the following types:
 - 1. Resilient flooring.
 - 2. Resinous terrazzo flooring.
 - 3. Carpet.
- C. Do not install moisture mitigation:
 - 1. Under areas scheduled for sloped screeds and new curbs, in pet relief room.

1.2 RELATED REQUIREMENTS

- A. Section 024119, Selective Interior Demolition: For removal of existing floor coverings and protection of terrazzo flooring to remain.
- B. Section 033053, Miscellaneous Cast-in-Place Concrete: For sloped screeds as traffic coating substrates and leveling screed at roof deck.
- C. Section 096623, Resinous Matrix Terrazzo Flooring.
- D. Section 096500, Resilient Flooring.
- E. Section 096800, Broadloom Carpeting.

1.3 COORDINATION

- A. Coordinate preparation requirements of substrates for application of moisture mitigation system and floor coverings.

1.4 REFERENCES

- A. ASTM: American Society for Testing and Materials
 - 1. ASTM D1653: Standard Test Methods for Water Vapor Transmission of Organic Coating Films
 - 2. ASTM F710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

3. ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
4. ASTM F2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes

B. ICRI: International Concrete Repair Institute.

1.5 SUBMITTALS

- A. Existing Conditions Report: Inspection report of all areas where floor coverings and base are removed prior to preparation activities. Include the following:
1. Quantity of cementitious patching compound estimated to be needed.
 2. Quantity of leveling compound estimated to be needed. Coordinate with shop drawings.
 3. Subfloor Moisture Emission Report: Prior to installation of flooring moisture mitigation system, submit report by system representative of existing vapor transmission and alkalinity subfloor.
- B. Product Data: For all materials.
1. Floor covering and adhesive manufacturers' product literature for each specific combination of substrate, floor covering, and adhesive to be used showing:
 - a. Moisture, relative humidity, pH, porosity limits, and test methods.
 - b. Manufacturer's required bond/compatibility test procedure.
 2. Moisture Mitigation System: physical characteristics and product limitations of materials.
 - a. Manufacturer's installation instructions:
 - 1) Indicate procedures and conditions requiring special attention.
 - 2) Include information on mixing and application.
 - 3) Indicate type of floor drains required, details at floor drains, special procedures, and perimeter conditions requiring special attention.
 3. Cementitious Patching and Leveling Compounds:
 - a. Manufacturer's installation instructions.
- C. Shop Drawings: Indicate locations and material type and show the following:
1. Floor Plans.
 - a. Areas requiring remediation.
 - b. Extents of leveling compounds. Indicate final elevations and approximate depth of compound.
 - c. Locations and transitions where different manufacturers are providing different moisture mitigation systems for the project.
 2. Details of joints, expansion, isolation and control joints.
 - a. Include proposed detail of transition showing overlap of systems providing continuous protection with minimum 2 inch lap.
- D. Qualifications: From the manufacturer, applicator, and supervisor.
- E. Testing agency's report. Include the following:
1. Description of areas tested. Include floor plans and photographs if needed.
 2. Summary of conditions encountered.
 3. Copies of specified test methods.
 4. Include certification of accuracy by authorized official of testing agency.

- 5. Submit report not more than two business days after conclusion of testing, and at least two weeks prior to carpet installation.
- F. Test Results: Submit test results from any tests performed by the Contractor for moisture vapor emission rate, relative humidity, pH, and porosity.
- G. Adhesive bond test report.
- H. Product Test Reports: Showing compliance with requirements, tested by a qualified testing agency.
 - 1. Moisture mitigation system.
 - 2. Patching and leveling compounds.
- I. Letter of Compatibility: Written verification of compatibility with all materials scheduled to be placed over moisture mitigation system, provided by flooring manufacturers.
- J. Certification:
 - 1. Certify that products meet or exceed specified requirements.
 - 2. Upon completion of flooring moisture mitigation system installation, submit certification from system representative that the subfloor meets requirement for vapor transmission and alkalinity specified in this section.
- K. Sample Warranty: Copy manufacturer's warranty.
 - 1. Ensure that forms have been completed in the Port's name and registered with the manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Executed warranty.
- B. Maintenance Data: Include recommended procedures for re-flooring in the future.

1.7 QUALITY ASSURANCE

- A. Testing Agency Coordination:
 - 1. Coordinate activities with testing agency.
 - 2. Provide access and escort testing agents in secure areas if needed.
 - 3. Allow adequate time in project schedule for testing agency activities.
- B. Compatibility: Topping and underlayment materials shall be compatible with substrates and with subsequent materials placed over them, including floor coverings, sealers, and moisture mitigation system.
 - 1. Verify compatibility in writing prior to application.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum of 5 years of experience.
- D. Applicator Qualifications: Company specializing in performing work of this section with a minimum of 5 years of experience and approved by the manufacturer.

- E. Supervisor Qualifications: Trained by product manufacturer under direct full-time supervision of manufacturer's own foreman.
- F. Provide all materials of the system including but not limited to primers, resins, hardening agents, and finish or sealing coats from a single manufacturer.
- G. Verify in writing prior to application that moisture mitigation system is compatible with flooring adhesive and related primers, and cementitious patching compound.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store all materials under cover and elevated above grade.
- B. Store products in manufacturer's unopened packaging until ready for installation.
- C. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 70°F.

1.9 FIELD CONDITIONS

- A. Test to confirm if existing ambient conditions are within the following ranges:
 - 1. Ambient Temperature: Not less than 65 degrees F or more than 85 degrees F.
 - 2. Ambient Humidity: Not less than 40 percent or more than 60 percent.
 - 3. Notify the Port if existing conditions are outside of these ranges.
- B. Do not install system until floor penetrations and peripheral work are complete.
- C. During the curing process, ventilate spaces to remove excess moisture.

1.10 WARRANTY

- A. Special Warranty: For moisture mitigation system. Submit warranty on manufacturer's standard form in which manufacturer and applicator agree(s) to repair or replace materials that fail to control the existing vapor transmission rates down to a level as required in this section, within the specified warranty period.
- B. Warranty period shall be no less than 15 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MOISTURE MITIGATION SYSTEM MATERIALS

- A. System Main Component: Epoxy based materials. Materials vary with manufacturer.
- B. Moisture Mitigation Materials:

1. The system shall reduce the vapor emissions of the concrete. Manufacturer's certification shall show the system has been tested in accordance with ASTM D1653 and has a permanency rating of less than 0.05.
2. Manufacturer shall be UZIN or equal.
3. For existing concrete with:
 - a. A relative humidity value up to 90% and moisture vapor emissions level up to 7 lbs, maximum: UZIN PE 414.
 - b. A relative humidity value higher than 90% and moisture vapor emissions level over 7 lbs: UZIN PE 460.
4. Control Joints: Uzin KR 518 two-component joint filler.
5. Patching and Filling: Uzin NC 890 Hydropatch and Uzin XS 3.2.

2.2 PATCHING COMPOUND AND LEVELING MATERIALS

- A. Cementitious Patching Compound and Leveling Underlayment: 100 percent portland cement-based compound capable of providing adequate bond for subsequently applied floor adhesives; approved by remedial coating manufacturer, flooring manufacturer, and which meets industry standards. Self-leveling compounds to be compatible with flooring adhesives and primers and designed for application over moisture mitigation system.
 1. Products shall be UZIN or equal.
 - a. Provide floor covering manufacturer's leveling products, considered equal by Port, where required for warranty.
 2. Depending on thickness of installation, provide the following:
 - a. UZIN NC 182.
 - b. UZIN NC 886.
 - c. UZIN 170 Level Star (self-leveling).
 3. Primer/solidifier and adhesive residue primer.
 - a. UZIN PE 414 Turbo Primer.
 4. When using a moisture mitigation system, provide the following:
 - a. UZIN NC 170 Level Star (self-leveling).

2.3 MIXING

- A. Mix materials on site in accordance with manufacturer's instructions.
- B. Mix to self-leveling consistency without overwatering.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Port has performed or will perform tests to have an overview of the relative humidity in the concrete.
- B. Perform any additional tests required to meet floor finish manufacturers' requirements.

- C. Examine floor slabs and substrates. Coordinate with Section 024119 “Selective Interior Demolition” for existing conditions prior to and after floor covering removal.
- D. Notify the Port of conditions detrimental to proper or timely installation. Do not proceed until detrimental conditions have been corrected.
- E. If active water leaks or continuing moisture migration to surface of slab, notify the Port of this condition and do not proceed with work in this area until the condition has been corrected.
- F. Starting work constitutes acceptance of substrate conditions.
- G. Comply with requirements and recommendations of moisture mitigation system, floor covering and adhesive manufacturers.
 - 1. See floor covering sections for additional requirements.
- H. Conduct adhesion testing on each substrate, concrete and each subsequent coating material.
- I. If floor covering or adhesive manufacturers require use of a primer prior to adhesive application then use their recommended primer.
 - 1. Apply primer over moisture mitigation system for application of patching and leveling compounds.

3.2 PRELIMINARY CLEANING

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents, citrus or soy-based solvents, surfactants, or other chemicals for cleaning.

3.3 TESTING

- A. Adhesion Bond Testing: Perform a concrete pull test as described in ACI 548 for each type of substrate. Pull test should show a performance of 300 psi or better.
- B. General Testing Procedures: For moisture vapor emission, relative humidity, PH, and porosity testing.
 - 1. Where the floor covering manufacturer's requirements conflict with the test result, notify the Port and meet the manufacturer's requirements with additional testing. The additional testing shall be at no additional cost to the Port.
 - 2. In the event that test values from any additional Contractor testing exceed floor covering or adhesive manufacturers' recommended limits, perform remediation.
 - 3. Submit report(s) containing all Contractor test results.
- C. Moisture Vapor Emission Rate Testing:
 - 1. Calcium chloride test in accordance with ASTM F1869 and as follows.
 - 2. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

3. Perform remediation if test values exceed the manufacturer's recommended limit for 1,000 square feet per 24 hours.
- D. Relative Humidity Testing:
1. Test in accordance with ASTM F2170 and as follows.
 2. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
 3. Perform remediation if any test value exceeds the manufacturer's recommended limit for relative humidity.
- E. PH Testing: Test according to ASTM F710.
- F. Porosity Testing: Water absorption test in accordance with ICRI standards.
- G. The Port may elect to perform verification tests at all locations originally tested for moisture to confirm moisture mitigation products have been installed in the millage as required and in compliance with floor covering and adhesive manufacturer's requirements.

3.4 EXAMINATION

- A. Where available, review Port's previous testing of moisture vapor emission rate, relative humidity, pH, and porosity.
- B. If required by flooring manufacturer, perform moisture vapor emission rate, relative humidity, pH, and porosity tests.
- C. Exposed Existing Concrete Floors: For areas indicated to have exposed concrete floor as final finish, perform field survey with Port to designate locations requiring floor patching utilizing materials indicated in Part 2. Conditions requiring patching will be designated by the Port based on the intended use, to assure safety and efficient movement of occupants and wheeled equipment.
- D. Record condition of floor.
- E. Verify that required floor-mounted utilities are in correct location.
- F. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, and dry. Surfaces shall also be free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- G. Verify that substrates are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- H. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to substrate surfaces.

- I. Verify that concrete subfloor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F710. Obtain instructions if test results are not within limits recommended by resilient flooring and adhesive materials manufacturers.
 - 1. Do not install moisture mitigation system over concrete substrates with a moisture emission level of 20 lb or less at the time of testing when measured in accordance with ASTM F1869, or a relative humidity value of 95 percent or less when measured in accordance with ASTM F2170.
- J. Starting work constitutes Contractor's acceptance of substrate conditions.

3.5 PREPARATION

- A. Mask and protect adjacent wall and floor surfaces from damage.
 - 1. Protect existing terrazzo flooring to remain according to Section 024119 "Selective Interior Demolition."
- B. If flooring installed over existing uneven subfloor conditions would meet the following criteria, perform the required remediation.
 - 1. Criteria:
 - a. Detrimental to life of the flooring.
 - b. Noticeable to a person walking, rolling luggage, or pushing a cart.
 - c. Telegraph through the flooring and be visible at the flooring surface.
 - d. Uneven elevations between different floor coverings.
 - e. Exceeding tolerances allowed by floor covering manufacturer.
 - 2. Remediation:
 - a. Remove sub-floor ridges and bumps. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, minor or local low spots, cracks, joints, holes, irregularities, and other defects with cementitious patching compound. Verify that concrete subfloor complies with ASTM F710.
 - b. Grind metal protrusions flat and flush with adjacent surfaces.
 - c. Apply self-leveling compound to provide even floor elevations and transitions.
- C. Remediate existing uneven substrates.
 - 1. Comply with requirements specified in floor covering Sections.
- D. Maximum variation of ridges and valleys from perfect smoothness: 3/16 inch in 10 feet, non-cumulative.
 - 1. Use trowelable leveling and patching compounds, according to manufacturer's instructions, to fill cracks, holes, and depressions in substrates.
 - 2. Fill or level cracks and holes and depressions 1/8 inch in depth or deeper by 1/16 inch in width or wider.
 - 3. Grind flat protrusions more than 1/8 inch unless manufacturer has more stringent requirements.
- E. Do not fill expansion joints, isolation joints, or other movement joints except as otherwise required by and recommended by moisture mitigation manufacturer.

3.6 PREPARATION, MOISTURE MITIGATION SYSTEM

- A. The concrete shall be clean, and free of oil, grease, dirt, curing compounds, and any substance that might act as a bond breaker.
- B. Mechanically clean using shot blasting or other method to achieve a minimum surface profile of ICRI CSP #3.
- C. Repair all cracks in the subfloor to minimize telegraphing through the moisture mitigation system.
- D. Follow moisture mitigation manufacturer's recommended procedure for crack repair.
- E. Fill joints with compatible joint filler.
- F. Once the cracks and control joints have been properly filled, allow these areas to cure prior to proceeding with the installation of the system.
- G. Honor all expansion and isolation joints within floor areas.

3.7 INSTALLATION, MOISTURE MITIGATION SYSTEM

- A. Install moisture mitigation system in accordance with manufacturer's instructions over properly prepared concrete surfaces.
 - 1. Provide for expansion and isolation joint movement in system.
- B. Apply moisture mitigation system over entire floor areas receiving floor coverings.
- C. Where system stops, terminate under centerline of door and at wall edges.
- D. Where any additional testing by the Contractor results in values above the amount allowed by floor covering or adhesive manufacturers, for moisture vapor emission rate, relative humidity, pH, or porosity, remediate until testing is complying with requirements.

3.8 INSTALLATION, CEMENTITIOUS PATCHING AND LEVELING COMPOUNDS

- A. Apply, trowel, and float cementitious patching compound to achieve smooth, flat, hard surface according to the manufacturer's instructions. Prohibit traffic until cementitious patching compound is cured.
- B. Comply with requirements and recommendations of coating and floor covering manufacturers.
- C. Apply leveling compounds over primer over moisture mitigation system to elevations required for alignment of adjoining floor coverings.

3.9 INSTALLATION SURFACE PRIMER

- A. Comply with requirements and recommendations of coating and floor covering manufacturers.

- B. Apply to areas receiving patching and leveling compounds and as required by floor covering manufacturer.

3.10 CLEANING

- A. Remove excess materials and adhesives from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's instructions.

3.11 PROTECTION

- A. Safely cover exposed building expansion joints when exposed to foot and luggage cart traffic. Temporarily leave approximately 1-inch-wide portion of old carpet or other material under edges of expansion joint cover to prevent rocking or movement and protect edges.
- B. Protect cut edges of carpet and allow transition for traffic over edge without leaving tape or residue on new carpet or fraying cut edges.
- C. Plastic sheeting or plastic with adhesive is not acceptable.
- D. Non-durable coverings are not acceptable.

END OF SECTION 090561

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes non-structural metal framing systems:
 - 1. Partition framing, 30 mil and less.
 - 2. Suspended ceiling and soffit systems for gypsum veneer plastering.
- B. Related Requirements:
 - 1. Section 024119 "Selective Interior Demolition" for removal of existing spray fireproofing for preparation for attachments in this Section.
 - 2. Section 054000 "Cold-Formed Metal Framing" for interior framing greater than 30 mil thickness.
 - 3. Section 092613 "Gypsum Veneer Plastering" for ceilings and soffits, for shop drawings.
 - 4. Section 102113 Toilet Compartments for blocking requirements.
 - 5. Section 102800 Toilet Accessories for blocking requirements.

1.2 COORDINATION

- A. Coordinate requirements for finishes and panels attached to suspension systems.
- B. Coordinate transitions from acoustical exposed grid to concealed ceilings and soffit framing systems in this Section.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For suspended gypsum veneer plastered ceilings and soffits. Coordinate with Section 092613.
 - 1. Include reflected ceiling plans, sections, and details, drawn to scale, showing the following:
 - a. Ceiling suspension members.
 - b. Method of attaching hangers to building structure and locations of anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - c. Ceiling control joints for review and approval.
 - d. Ceiling-mounted items including, but not limited to, light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
 - e. Ceiling perimeter and penetrations through ceiling; trim and moldings.
- C. Delegated-Design Submittal: For items indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- D. Evaluation Reports: from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction for the following:
 - 1. For each ceiling suspension system.
 - 2. For post installed anchors.
- E. Coordination Drawings, Ceilings: See Section 095100 “Acoustical Ceilings.”
 - 1. Incorporate suspended soffits and ceilings in coordination drawings for Project.

1.4 QUALITY ASSURANCE

- A. Engineer Qualifications: Qualified professional engineer responsible for delegated design, licensed in the jurisdiction in which Project is located.
- B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association, the Certified Steel Stud Association or the Steel Framing Industry Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design the following:
 - 1. Ceiling and soffit systems, their suspension system and seismic restraint.
 - 2. Soffit supports to retain other work where not designed in drawings.
- B. Seismic Performance: Suspended ceilings and soffits shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- C. Horizontal Deflection: For vertical soffit fascia assemblies, limited to 1/240 of the height based on horizontal loading of 5 lbf/sq. ft.
- D. Vertical Deflection: For suspended ceilings and soffit framing systems, deflection limited to 1/360 of the span.
 - 1. Verify weight of all suspended ceiling and soffit types, and for all items being supported and attached to suspension systems.
 - a. Suspended ceiling and soffit finishes include the following:
 - 1) Gypsum veneer in Section 092613 “Gypsum Veneer Plastering.”
 - 2) As indicated.
 - 2. Vertical Loading: 6 lbf/sq. ft. for single layer gypsum board.
 - a. Exception: Provide 10 lbf/sq. ft. at ceilings indicated to have suspended items attached.
- E. Design suspension systems to maintain clearances at openings, to allow for construction tolerances and allow for building structure movement.
 - 1. Do not bridge finishes nor rigidly connect deflection- and movement joints in exterior walls or interior partitions with connections on both sides of joints.

2. Do not bridge finishes nor rigidly connect framing systems where bearing and suspended support conditions meet; differential movement between support types requires isolation.
 - a. At fascia and soffit assemblies where framing transitions from suspended to bearing support, provide slip joints to accommodate differential movement between support conditions.
 - b. Do not apply slip joints at continuous wall support angle for grid suspension systems, except as required by the grid system manufacturer.
- F. Spacing:
1. At ceilings scheduled for level 5 finishes, framing shall be 16 inches o.c. maximum.
 2. As required by substrate tolerances and finishes in other Sections.

2.2 MANUFACTURERS

- A. Source Limitations: Obtain framing and suspension systems of each type from a single manufacturer.
- B. Manufacturers: See Section 054000 "Cold-Formed Metal Framing."

2.3 NONSTRUCTURAL STEEL FRAMING

- A. General, Framing Members and Accessories: Comply with requirements in AISI S220 for conditions indicated.
 1. Protective Coating: ASTM A653/A653M, G40 coating or coating with equivalent corrosion resistance; G60 at "wet walls".
 - a. Galvannealed products are unacceptable.
 - b. Equivalent Corrosion-Resistant Coating: Other coating with demonstrated equivalent corrosion resistance to ASTM A653 is acceptable with authority having jurisdiction approval of equivalency evaluation report.
 2. Minimum Base-Steel Thickness: As indicated on Drawings.
 3. Minimum Yield Strength: 33 ksi.
- B. Studs and Track: Conventional members, roll-formed into standard C- and U-track shapes without surface deformations to stiffen framing members.
 1. Depth: As indicated on Drawings
 2. Flanges sized for support and installation requirements of panel products and attached items, minimum 1-1/4-inches.
 3. Punched for routing utilities and continuous channel bridging.
- C. Slip-Type Head Joints: Where indicated on Drawings, below structure, provide one of the following:

1. Slotted Deflection Track: Steel sheet top track manufactured with 2-1/2-inch- deep flanges that allow positive attachment to studs through long slots and prevent deflection of structure above from cracking finishes applied to framing; in base-steel thickness not less than that of studs and in width to accommodate depth of studs.
- D. U-Channel: For channel bridging and suspended-assembly furring. Cold-rolled steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.

2.4 SUSPENSION SYSTEMS

- A. Attachment Devices: Size for 5 times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated. Comply with seismic design requirements.
- B. Post-Installed Anchors: See Structural Drawings.
- C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency. Comply with Section 017000.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 1. Zinc-Coated Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at 3 times the hanger design load (ASTM C635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- E. Stabilizer Channels, Tees, and Bars: Manufacturer's standard components for stabilizing main carriers at regular intervals and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated; and factory finished with matte-black baked finish.
- F. Seismic Struts: Metal framing profiles.

2.5 GRID SUSPENSION SYSTEMS

- A. Grid Suspension Systems for Gypsum Board Ceilings: Heavy-duty classification according to ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock; self-spanning, wall-supported; with hanging, soffit, box, cove and transition profiles.
 1. Select products appropriate for conditions and applications within limitations for spans, support requirements of attached items within specified performance limits.
 2. Products: Subject to compliance with requirements, provide products named or equivalent products by one of the other manufacturers:
 - a. Products: Armstrong World Industries, Ceiling & Wall Solutions; Drywall Grid:
 - 1) Wall Supported: Shortspan Drwall Framing System.
 - 2) Frameall Drwall Grid Systems.
 - 3) Quikstix Drawll Grid for Soffits.

- 3. Other Manufacturers:
 - a. CertainTeed; SAINT-GOBAIN.
 - b. USG Corporation.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Install required blocking, bridging and clips attached to overhead framing.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Coordinate extents of spray fire-resistive materials are required to be removed.
 - 2. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 3. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

2. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 1. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 2. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 3. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLATION OF SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Comply with Section 095100 "Acoustical Ceilings" Part 3 for installation of suspension system components, for anchorage and hangers.

3.6 INSTALLATION OF GRID SUSPENSION SYSTEMS

- A. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.7 TOLERANCES

- A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes and to tolerances required for gypsum veneer plastering.

3.8 FIELD QUALITY CONTROL

- A. Inspect framing installation for compliance with requirements. Inspect with trades whose work is affected by framing, including wall and ceiling finishes.
- B. Correct or replace non-structural metal framing where out of compliance or where effect to other work exceeds tolerances and requirements for installation.
- C. Special Testing and Inspection: See Section 095100 "Acoustical Ceilings."

END OF SECTION 092216

SECTION 092613 - GYPSUM VENEER PLASTERING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes gypsum veneer plastering for ceilings and soffits:
 - 1. Gypsum veneer base and accessories.
 - 2. Gypsum veneer repair for existing ceilings and soffits.
- B. Related Requirements:
 - 1. Section 017329 "Cutting and Patching" for requirements applicable to transitions between existing and new gypsum veneer plastered finishes.
 - 2. Section 092216 "Non-Structural Metal Framing" for framing and suspension systems for gypsum veneer plastered assemblies.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Provide data on veneer plaster products.
- B. Shop Drawings: Submitted under Section 092216.
 - 1. Show locations, fabrication, and installation of control joints, reveals, and trim; include plans, sections, details of components, and attachments to other work.
 - 2. Show new to existing work, including transitioning areas.
- C. Samples: Submit two sample panels, 12 by 12 inch in size illustrating veneer finish and texture.

1.3 MOCKUPS

- A. Provide a full-thickness finish mockup for each type and finish of gypsum veneer plaster and substrate to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. The Port will select representative surfaces and conditions for application of each type of gypsum veneer plaster and substrate.
 - 2. Provide mockups of ceilings or partitions in sizes of at least 100 sq. ft..
 - 3. Provide mockup of two transitions between new and existing gypsum veneer finishes.
 - 4. Apply gypsum veneer plaster, according to requirements for the completed work, after permanent lighting and other environmental services have been activated.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.

- B. Store materials inside under cover, and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.
- C. Stack panels flat on leveled supports off floor or slab to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C843 requirements or gypsum veneer plaster manufacturer's written recommendations, whichever are more stringent.
- B. Do not apply veneer plaster when substrate or ambient air temperature is less than 50 degrees F nor more than 80 degrees F; for 24 hours prior to, during operations and after, until building heating system can maintain the above minimum temperature.
- C. Avoid conditions that result in gypsum veneer plaster drying too rapidly.
 - 1. Distribute heat evenly; prevent concentrated or uneven heat on veneer plaster.
 - 2. Maintain relative humidity levels, for prevailing ambient temperature, that produce normal drying conditions.
 - 3. Ventilate building spaces in a manner that prevents drafts of air from contacting surfaces during veneer plaster application until it is dry.
- D. Do not install panels that are wet, moisture damaged, mold damaged, or faded from overexposure to sunlight.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain gypsum veneer plaster products, including gypsum base for veneer plaster, joint reinforcing tape, and embedding material, from single manufacturer.

2.2 MANUFACTURERS

- A. Manufacturers:
 - 1. Georgia-Pacific Gypsum LLC.
 - 2. National Gypsum Company.
 - 3. USG.
 - 4. Or equal.

2.3 MATERIALS

- A. Gypsum Veneer Plaster: ASTM C587, mixed in accordance with manufacturer's instructions.
- B. Standard Gypsum Veneer Base: ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Thickness: 5/8 inch.

- C. Gypsum Veneer Trim Accessories: Zinc-coated steel, complying with ASTM C1047.
- D. Gypsum Board Accessories: Complying with ASTM C1047, GA-216, and GA-600.
- E. Joint Reinforcing for Gypsum Veneer Base: As specified in ASTM C587.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrates are ready to receive work.
- B. Verify gypsum plaster base is flat, smooth and surface is ready to receive work. Verify joint and surface perimeter accessories are in place.

3.2 INSTALLATION: GYPSUM VENEER PLASTER BASE

- A. Install gypsum base in accordance with ASTM C844
 - 1. Erection Tolerance: No more than 1/16-inch offsets between planes of gypsum base panels, and 1/8 inch in 8 feet noncumulative, for level, plumb, warp, and bow, and as required for gypsum veneer plastering.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not locate joints, other than control joints, at corners of framed openings.
- E. Attach panels to steel studs, so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- F. Attach panels to framing provided at openings and cutouts.
- G. Form control joints with space between edges of adjoining panels.
- H. Fit panels around openings, light fixtures, ducts, pipes, and conduits.
- I. Single-Layer Application:
 - 1. On ceilings, apply gypsum base panels before wall panels, to the greatest extent possible and at right angles to framing unless otherwise indicated.
- J. Use drywall screws to fasten gypsum base to framing substrate.

1. Fasteners: Drive fasteners flush with gypsum base surface. Do not overdrive fasteners or cause surface depressions.
- K. Install trim accessories. Install trim with back flanges intended for fasteners, and attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- L. Tape, fill, and sand filled joints, edges, corners, openings, and trim to produce surface ready to receive veneer finish.
 1. Reinforce interior angles and flat joints with joint tape and embedding material to comply with ASTM C843 and with gypsum veneer plaster manufacturer's written recommendations.
- M. Feather coats onto adjoining surfaces so that joint camber is maximum 1/32 inch.

3.3 APPLICATION OF GYPSUM VENEER PLASTER

- A. Gypsum Veneer Plaster Mixing: Mechanically mix gypsum veneer plaster materials to comply with ASTM C843 and with gypsum veneer plaster manufacturer's written recommendations.
- B. Do not apply veneer plaster to gypsum base if paper facing has degraded from exposure to sunlight. Before applying veneer plaster, use remedial methods to restore bonding capability to degraded paper facing according to manufacturer's written recommendations and as approved by Architect.
- C. Gypsum Veneer Plaster Application: Comply with ASTM C843 and with veneer plaster manufacturer's written recommendations.
 1. Two-Component Gypsum Veneer Plaster:
 - a. Base Coat: Hand trowel or machine apply base coat over substrate to a uniform thickness of 1/16 to 3/32 inch. Fill voids and imperfections.
 - b. Finish Coat: Trowel apply finish-coat plaster over base-coat plaster to a uniform thickness of 1/16 to 3/32 inch.
 - c. Finish surface to flat, smooth, hard trowel finish.

3.4 TOLERANCES, FINISHING

- A. Maximum Variation from Specified Thickness: Plus or minus 1/64 inch.

3.5 REPAIRING EXISTING GYPSUM VENEER AND TIE-IN

- A. Comply with Section 017329.
- B. Remove gypsum veneer plaster of sufficient depth to provide joint treatment and tie-in for feathering and repair to specified tolerances without visible joints telegraphed from existing to new work.
 1. Remove no less than 12-inches of plaster from joint and transition for feathering and as required for joint treatment between new and existing base.
 2. Apply veneer plaster in layers and sand between until joints are not visible.

3.6 PROTECTION

- A. Protect installed gypsum veneer plaster from damage from weather, condensation, construction, and other causes during remainder of the construction period.

END OF SECTION 092613

SECTION 092713 - GLASS-FIBER-REINFORCED GYPSUM FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Glass-fiber-reinforced gypsum (GFRG) fabrications:
 - 1. Column covers.
- B. Related Requirements:
 - 1. Section 057000 "Decorative Metal" for decorative metal column covers and supports provided under its cover for attachment and support of GFRG covers.

1.2 COORDINATION

- A. Coordinate metal and GFRG column covers and their required supports for attachment.
- B. Coordinate column layout, joints, and seams with sizes and locations of penetrations, joints and seams in adjacent materials.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, weights, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details, including locations of attachments to support framing.
 - 2. Detail fabrication and assembly of glass-fiber-reinforced gypsum fabrications.
 - 3. Structural members to which glass-fiber-reinforced gypsum fabrications will be attached and method of attachment.
 - 4. Indicate requirements for joint treatment.
 - 5. Indicate location of control joints.
 - 6. Items interfacing with column covers, including but not limited to ceilings, walls, floor and other construction.
 - 7. Perimeter moldings.
- C. Samples: For each exposed product and for each color and texture specified.
 - 1. Linear Moldings: 24-inch-long section with finished joint. Show complete pattern.

1.4 MOCKUPS

- A. Build mockups to set quality standards for fabrication and installation.
 - 1. Build mockup of each type of glass-fiber-reinforced gypsum fabrication.
 - 2. Paint mockups to match finish indicated and to comply with requirements specified in Section 099100 "Painting."
 - 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.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C1467/C1467M.

1.6 FIELD CONDITIONS

- A. Verify existing column covers indicated to match, prior to fabrication. Mark on shop drawings.
 - 1. Match items indicated, including but not limited to:
 - a. Size.
 - b. Configuration of joints.
 - c. Joint types.
 - d. Terminations.
 - e. Interfaces with other materials and construction.
 - f. Finish surfaces and finish type.
- B. Environmental Conditions:
 - 1. Comply with ASTM C1467/C1467M.
 - 2. Do not deliver or install glass-fiber-reinforced gypsum fabrications until building is enclosed, wet-work is complete, and HVAC system is operating and continuously maintaining temperature and relative humidity at levels intended for building occupants.
- C. Conditioning: Acclimatize glass-fiber-reinforced gypsum fabrications to ambient temperature and humidity of spaces in which they will be installed. Remove packaging and move units into installation spaces not less than 48 hours before installing them.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED GYPSUM FABRICATIONS

- A. GFRG Column Covers, General: Match existing in appearance, finish, jointing, and interfaces with other construction and as indicated.
 - 1. Design column covers to support loads for service exposure indicated. Reinforce faces to limit deformation for exposure to impact, abuse, and abrasion.

2. Performance Requirements in Section 057000 "Decorative Metal" applies to column covers.
- B. Fabrications: Molded, glass-fiber-reinforced gypsum units complying with ASTM C1381/C1381M.
- C. Embedments: As required for installation and to match existing conditions.
 1. Cold-rolled steel channels with ASTM A653/A653M, G60 hot-dip galvanized coating
 2. As standard with glass-fiber-reinforced gypsum fabrication manufacturer and as required for reinforcement and for anchorage to substrates and framing.
- D. Finish: Match existing.
 1. Smooth for paint finish.
 2. Smooth for gloss paint finish.

2.2 AUXILIARY MATERIALS

- A. Adhesives: As recommended in glass-fiber-reinforced gypsum fabrication manufacturer's written instructions.
- B. Steel Drill Screws: ASTM C1002, unless otherwise indicated.
 1. Screws complying with ASTM C954 for fastening glass-fiber-reinforced gypsum fabrications to steel members from 0.033 to 0.112 inch thick.
- C. Joint-Treatment Materials: ASTM C475/C475M.
- D. Control Joints: ASTM C1047, one-piece control joint with V-shaped slot and removable strip covering the slot opening.
 1. Material: Steel sheet zinc-coated by hot-dip process.

2.3 FABRICATION

- A. Fabricate glass-fiber-reinforced gypsum units in factory to comply with ASTM C1381/C1381M, with smooth-finished surfaces; repair hollows, voids, scratches, and other surface imperfections. Fabricate units in lengths and sizes that will minimize number of joints between abutting units.
- B. Embedments: Incorporate embedments into units to develop the full strength of glass-fiber-reinforced gypsum fabrications. Cover embedments with not less than 3/16-inch thickness of glass-fiber-reinforced gypsum composite.
- C. Connection Hardware: Designed and fabricated to support and connect glass-fiber-reinforced gypsum fabrications to hangers, support framing, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with ASTM C1467/C1467M.
- B. Install glass-fiber-reinforced gypsum fabrications level, plumb, true, and aligned with adjacent materials. Use concealed shims where required for alignment.
- C. Attach glass-fiber-reinforced gypsum fabrications to framing and substrates with steel drill screws unless otherwise indicated. Do not use pneumatic staple guns. Countersink screw heads below adjoining finished surface.
 - 1. Predrill fastener holes in units. Clean fastener holes to remove dirt and oil.
 - 2. Locate fasteners not less than 5/16 inch from edges or ends of units.
- D. Where glass-fiber-reinforced gypsum fabrications are joined to form composite units, join fabrications with adhesive. Band or brace units together until adhesive cures.
- E. Install control joints between glass-fiber-reinforced gypsum fabrications where indicated.
- F. Use joint-treatment materials to finish glass-fiber-reinforced gypsum fabrications to produce surfaces ready to receive primers and paint finishes specified in Section 099100 "Painting."
 - 1. Finish glass-fiber-reinforced gypsum fabrications according to ASTM C840 for Level 5 and to match surface texture of units without visible or tangible variance.
 - 2. Repair hollows, voids, scratches, and other surface imperfections on units.

END OF SECTION 092713

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gypsum board.
 - 2. Cement board backing panels, for tile, solid surface, and mirrors.
 - 3. Trim accessories.
 - 4. Joint treatment.
 - 5. Acoustical sealant.
- B. Related Requirements:
 - 1. Section 078400 "Firestopping" for fire-rated joint sealants and head of wall treatments applied over gypsum board.
 - 2. Section 079200 "Joint Sealants" for joint sealant requirements installed in gypsum board assemblies.
 - 3. Section 092216 "Non-Structural Metal Framing" for nonstructural steel framing and suspension systems that support gypsum board panels.
 - 4. Section 092613 "Gypsum Veneer Plastering" for gypsum ceiling and soffit assemblies and finishes.
 - 5. Section 093000 "Tiling" for joint treatment of cement board.

1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Locations and installation of control and expansion joints, including plans, elevations, sections, and attachment details.

1.3 MOCKUPS

- A. Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockups for the following:
 - a. Each level of gypsum board finish required for use in exposed locations.
 - 2. Apply or install final decoration required, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings in accordance with ASTM E90 and classified in accordance with ASTM E413; tested by a qualified testing agency.

2.3 GYPSUM BOARD, GENERAL

- A. Size: Provide panel products in maximum lengths and widths available that will minimize joints in each area and that correspond with support system specified or indicated on Drawings.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. CertainTeed; SAINT-GOBAIN.
 - c. Georgia-Pacific Gypsum LLC.

- d. Gold Bond Building Products, LLC provided by National Gypsum Company.
- e. PABCO Gypsum.
- f. USG Corporation.

2.4 INTERIOR GYPSUM BOARD

- A. Gypsum Board, General:
 - 1. All gypsum board for walls shall be 5/8-inch Type X unless otherwise indicated on Drawings.
 - a. Non-rated walls may use 5/8-inch gypsum without Type X designation where available. Lightweight panels are not permitted except where specified in Part 3.
 - 2. Panel Sizes: 48 inches wide by length required.
 - 3. Above 8'-0": Lightweight 5/8-inch may be used.
- B. Gypsum Board, 5/8": Type X, ASTM C1396/C1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
- C. MR, Mold-/ Moisture- Resistant Gypsum Board: ASTM C1396/C1396M; manufactured with moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch, Type X.
 - 2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.
 - 3. Long Edges: Square or tapered.

2.5 CEMENT BOARD BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
 - 1. Thickness: 1/2 inch.
 - a. Provide 3/8, 1/4, and 1/8 inch thicknesses as required for build-out of substrates for alignments indicated.
 - 2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.
 - 1. Material: Galvanized-steel sheet or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated on Drawings.
 - 1. Product: Subject to compliance with requirements, provide Fry Reglet Profiles or comparable product by one of the following:

- a. Brand X Metals, Inc
 - b. Flannery, Inc.
 - c. Gordon Inc.
 - d. Pittcon Industries
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M requirements.
 1. Mold-Resistant Joint Compound: Use mold-resistant formulations with mold-resistant panel products.
- B. Joint Tape:
 1. Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels: In Section 093000.

2.8 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended in writing by manufacturer for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C1002 unless otherwise specified or indicated on Drawings.
 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended in writing by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
 2. Select thicknesses to fill cavities completely.

- E. Acoustical Sealant: For partitions indicated to be sound partitions with STC rating.
 - 1. For partitions not indicated to be STC-rated, provide latex sealant in Section 079200 "Joint Sealants."
 - 2. Sealants demonstrated by testing representative assemblies in accordance with ASTM E90 to effectively reduce airborne sound transmission through perimeter joints and openings in building construction.
 - 3. Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
 - a. Products:
 - 1) USG Sheetrock Acoustical Sealant.
 - 2) Tremco Acoustical Curtainwall Sealant.
 - 3) Master Builders, MasterSeal NP1.
 - 4) Or equal.
 - 4. At Fire-Rated Assemblies: See Section 078400 "Firestopping".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Examine framing and other substrates receiving panel products. Reject framing that is not level, not plumb, not coplanar, or has other conditions affecting installation of panels including telegraphing into exposed finishes.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. For Acoustical Joint Sealant: Comply with Section 079200 and the following:
 - 1. Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
 - 2. Prime joint substrates where recommended by acoustical joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
 - 3. Mask and protect areas where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove masking immediately after tooling without disturbing joint seal.

3.3 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840 requirements.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 requirements and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound-attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.4 INSTALLATION OF GYPSUM BOARD

- A. Install gypsum board in the following locations:
 - 1. Gypsum Board, Type X: All vertical surfaces indicated as Gypsum Board 5/8" unless otherwise indicated.

2. MR, Mold-Resistant Gypsum Board: Behind mop-sinks if not indicated to be cement board.
 - a. In restrooms behind mirrors where cement board is not required by adjacent finishes.
 3. Cementitious Backers: At walls and partitions scheduled for tile (T#) and solid surface (SSM#) surfaces; where indicated.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated on Drawings.
 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise specified or indicated on Drawings or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated on Drawings or required by fire-resistance-rated assembly.
 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated on Drawings or required by fire-resistance-rated assembly.
 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over studs or furring members and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated on Drawings or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.5 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with Section 079200 and acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

- B. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
- D. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

3.6 INSTALLATION OF CEMENT BACKER PANELS

- A. Cementitious Backer Units: ANSI A108.11. Comply with requirements in Section 066116 "Solid Surfacing Fabrications", Section 088300 "Mirrors", and Section 093000 "Tiling."
 - 1. Install with 1/4-inch gap where panels abut other construction or penetrations.
 - 2. At inside corners, leave 1/4-inch gap at one edge with edge extending to framing.
 - 3. For multi-layer applications, second layer may be spot adhered where third layer is applied and screw-retained.
- B. Where cement backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- C. Inspection: Tile backing panels is subject to approval by installers of Section 066116, Section 088300, and Section 093000.
 - 1. Remove, repair or replace tile backer boards where installation do not comply with specified requirements.

3.7 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim in accordance with manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings and in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Install at outside corners unless otherwise specified or indicated on Drawings to receive other corner finishes.
 - a. Apply paper tape at outside corners receiving other finishes.
 - 2. LC-Bead: Install at exposed panel edges.
 - a. At each side of panels at joints where framing has differential bearing, such as at framed walls bearing on slab abutting framed headers suspended from above.
 - b. At each side of panels at movement joints.

3. L-Bead: Install where indicated on Drawings. Use at all exposed edges abutting other Work, where bead is applied after gypsum; where insufficient clearance for LC-bead
 4. U-Bead: Install at exposed panel edges.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.8 APPLICATION OF JOINT TREATMENT MATERIALS

- A. Finishing Panel Products: Treat joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare panel surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over panel joints, except for trim products specifically indicated as not intended to receive tape. Install at inside corners.
- D. Interior Gypsum Board: Finish panels to levels indicated below and in accordance with ASTM C840:
1. Level 1: Tape embed joints and interior angles in joint compound. Panel surfaces shall be free of excess joint compound. Tool marks and joint compound ridges are acceptable.
 - a. Locations: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Tape embed joints and interior angles in joint compound with one coat of joint compound applied over joints, angles, fastener heads and accessories. Panel surfaces shall be free of excess joint compound. Tool marks and joint compound ridges are acceptable.
 - a. Locations: Panels that are substrate for other fabricated panels, at mirrors.
 - 1) Behind wall-adhered glazing, unless wall is painted then provide level 5.
 3. Level 3: Tape embed joints and interior angles in joint compound with one coat of joint compound applied over joints, angles, fastener heads and accessories. Apply one additional separate coat of joint compound over the taped joints, angles, fastener heads and accessories. Panel surfaces shall be free of excess joint compound. Finish joint compound smooth and free of tool marks and joint compound ridges.
 - a. Locations: Walls scheduled to receive resilient sheet goods not indicated to be other panel types.
 - b. Primer and its application to surfaces are specified in Section 099100 "Painting."
 4. Level 4: Tape embed joints and interior angles in joint compound with one coat of joint compound applied over joints, angles, fastener heads and accessories. Apply two additional separate coats of joint compound over the taped joints. Apply one additional separate coat of joint compound over angles, fastener heads and accessories. Panel surfaces shall be free of excess joint compound. Finish joint compound smooth and free of tool marks and joint compound ridges.
 - a. Locations: At panel surfaces that will be exposed to view unless otherwise indicated.
 - b. Primer and its application to surfaces are specified in Section 099100 "Interior Painting."

5. Level 5: Tape embed joints and interior angles in joint compound with one coat of joint compound applied over joints, angles, fastener heads and accessories. Apply two additional separate coats of joint compound over the taped joints. Apply one additional separate coat of joint compound over angles, fastener heads and accessories. Apply an additional thin skim coat of joint compound or latex flat sealer to the entire surface. Panel surfaces shall be free of excess joint compound. Finish joint compound smooth and free of tool marks and joint compound ridges.
 - a. Provide finish without camber more than 1/32-inch in 4 feet and 1/16-inch in 6 feet.
 - b. Locations: Where scheduled.

E. Cementitious Backer Units: In Section 093000.

3.9 PROTECTION

- A. Protect adjacent surfaces from joint compound and promptly remove from floors and other non-gypsum board surfaces. Repair surfaces stained, marred, or otherwise damaged during gypsum board installation and finishing.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.
- D. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Tile (T1).
 - 2. Setting materials.
 - 3. Accessories.
 - 4. Joint treatment of tile backers installed in other Sections.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for requirements of sealing of movement joints in tile surfaces.
 - 2. Section 092900 "Gypsum Board" for cement board tile backing panels.
 - 3. Section 102800 "Toilet, Bath, and Laundry Accessories."

1.2 COORDINATION

- A. Coordination installation of items penetrating or attached to tile assemblies, including but not limited to:
 - 1. Toilet accessories.

1.3 DEFINITIONS

- A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Large Format Tile: Tile with at least one edge 15 inches or longer.
- D. Module Size: Actual tile size plus joint width indicated.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 SUBMITTALS

- A. Product Data: For each type of product.

- B. Shop Drawings: Show locations, plans, and elevations, of each type of tile and tile pattern. Show widths, details, and locations of movement joints in tile substrates and finished tile surfaces.
 - 1. Propose required movement joints.
 - 2. Show sealant joints.
 - 3. Show other work, items penetrating, inseting or interfacing and joint treatment.
- C. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 24 inches square, but not fewer than six tiles; cut ends on outside. Use grout of type and in color or colors approved for completed Work.
- D. Qualification Data: For Installer.
 - 1. Include a list of at least three completed projects, each with project's description, completion date, general contractor contact information, material list and images showing installation.
- E. Product Certificates: For each type of product, including product use classification.
- F. Product Test Reports:
 - 1. Tile-setting and -grouting products.
 - 2. Certified porcelain tile.
- G. Field Quality-Control Reports: Water test reports of membrane in wet areas.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall have not less than 5 years' documented and continuous experience with installation methods and materials as specified for this Project, on at least ten projects with similar scope resulting in successful in-service performance.

1.8 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockup of each type of wall tile installation.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.11 WARRANTY

- A. System Warranty: Manufacturer's non-prorated comprehensive warranty that agrees to repair and replace defective installation areas, material, and labor that fail under normal usage within specified warranty period.
 1. Warranty Period: 10 years from date of Product Purchase.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Tile: Obtain tile of each type from single source or producer.
 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Tiling System: Obtain system products from single manufacturer and each aggregate from single source or producer.
 1. Obtain setting and grouting materials, except for unmodified portland cement and aggregate, from single manufacturer.
 - a. Grout colors are for reference. Provide color specified by color matching acceptable to Architect, using basis-of-design grout materials.
 2. Obtain underlayment from manufacturer of setting and grouting materials.
 3. Obtain waterproof membrane, crack isolation, and other required membranes from manufacturer of setting and grouting materials.

- a. Provide setting material manufacturer's recommended crack isolation membrane where wall substrates exceed manufacturer's recommendations.
4. Obtain joint sealants from manufacturer of setting and grouting materials.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 1. Provide tile complying with Standard Grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE

- A. Tile Type (T1): Wall tile.
 1. Product: Tilebar, Basic White Ceramic Subway Wall Tile, or pre-bid approved equal
 2. Face Size: 12 by 24 inches.
 3. Thickness: 9.5 mm (nominal 3/8-inch).
 4. Color: White.
 5. Finish: Polished.
 6. Pattern: Stack bond, horizontal orientation, as indicated.
 7. Grout Color: Laticrete, Smoke Gray #89.
 8. Joint Width: 1/8-inch.

2.4 SETTING MATERIALS

- A. Products, Setting Materials: Subject to compliance with requirements, provide specified products by Laticrete or equal product by one of the following:
 1. ARDEX Americas.
 2. MAPEI Corporation.
- B. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15. Prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 1. Product: Laticrete 254 Platinum.
 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.15.
- C. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less and capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.
 1. Product: Laticrete SPECTRALOCK Pro.

- D. Sealant: Sealant: Silicone, mildew resistant, neutral curing; single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT, I, M and G. Backers recommend by manufacturer. Comply with Section 079200 "Joint Sealants".
1. Primer: Manufacturer's standard for sealant type.
 2. Product: Laticrete, Latasil.
 3. Color: Match grout.

2.5 MISCELLANEOUS MATERIALS

- A. Joint Tape: 10 by 10 alkali resistant fiberglass mesh; type compatible with cementitious backer and suitable for tile installation method.
- B. Metal Edge Trim: Profile designed for wall terminations and edge protection.
1. Product: Subject to compliance with requirements, provide Schluter Systems L.P. profiles indicated or comparable pre-bid approved equal products by one of the following:
 - a. Blanke Corporation
 - b. Profilitex Corp.
 - c. Progress Profiles America Inc.
 2. Profiles, Finish, and Applications: As indicated.
 - a. Wall Trim, L-shaped: Schluter, Jolly.
 - 1) Material and Finish: Stainless steel, satin finish.
- C. Temporary Protective Coating: Formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products and easily removable after grouting is completed without damaging grout or tile.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 2. Verify that concrete substrates for tile walls installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
 5. Verify tile backing panels installed in Section 092900 "Gypsum Board" are within tolerances required and installed in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to tile setting method and tile setting manufacturer's written instructions.
- B. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.
- C. Panel Joints, Cement Board: Fill and skim coat joints with mortar. Embed mesh tape in skim. After drying, sand ridges and protrusions affecting installation of tile.
 1. Install mesh in corners, over joint. Do not fill corner joints with mortar under or over mesh.
- D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- E. Substrate Flatness:
 1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.
 2. For large format tile, tile with at least one edge 15 inches or longer, confirm that structure or substrate is limited to 1/8 inch in 10 ft. from the required plane, and no more than 1/16 inch in 24 inches when measured from tile surface high points.
- F. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION OF TILE

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
 1. Add materials, water, and additives in accurate proportions.
 2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

- B. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.
1. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
 2. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
 3. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
 4. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
 5. Vary setting-bed thickness to achieve alignments and offsets in planes indicated.
 6. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - a. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets, so joints between sheets are not apparent in finished Work.
 - b. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - c. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
 7. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- C. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings and where recommended by TNCA and approved in shop drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- D. Install sealant joints in lieu of grout, at inside corners, at bottom joint of tile meeting floors. between trim and tile edges where materials are installed on different planes, where tile is abutting other materials, at penetrations, and like conditions.
- a. Do not install grout at joints of changes of plane change intersections.
- E. Metal Wall Trim: Install at locations indicated on Drawings.
1. Provide trim profiles at all visible boundaries of tile fields and openings where not otherwise captured or concealed by other work.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

- B. Cleaning: On completion of placement and grouting, clean all tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Wall Installations, Wood or Metal Studs or Furring: TCNA W244, Thinset mortar on cementitious backer board.
 - 1. Thinset Mortar: Improved modified dry-set mortar.
 - 2. Grout: Water-cleanable epoxy grout.
 - 3. Joint Width: As indicated in Part 2.
 - 4. Movement Joints: Do not grout tight to penetrating items, to abutting material, or other material inset in tile. Provide for sealant joint.
 - a. Tile edges abutting walls or other materials are considered movement joints.
 - b. At Corners: Butt joint unless otherwise indicated, with sealant.
 - 1) Inside: One side grout to inside backer corner, opposite side held joint width from inside tile face for sealant.
 - c. Depth of sealant to match width, 1:1, for joints less than 1/4-inch.

END OF SECTION 093000

SECTION 095100 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical ceilings, accessories and associated suspension system for interior ceilings, of the following types:
 - 1. Acoustical metal ceilings, perforated with concealed grid (AMC3 and AMC7).
 - 2. Linear wood ceiling panels, with concealed grid (LWC1).
- B. Related Requirements:
 - 1. Section 092216 "Non-Structural Metal Framing" for suspension systems for gypsum-finished ceilings and soffits.
 - 2. Section 102113 "Toilet Compartments."

1.2 COORDINATION

- A. Coordinate locations of required support for suspension systems concealed in ceiling plenum cavities and concealed by other work.
- B. Coordinate hangers and attachments for suspension systems with spray applied fireproofing of structure to provide adequate support attachments to structure.
- C. Coordinate required removal of spray applied fireproofing for anchorages where new anchors are required for installation.
- D. Coordinate layout and installation of ceilings and suspension systems with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- E. Coordinate penetrations in ceiling panels for any devices located on, or attached through, panels.

1.3 SUBMITTALS

- A. Product Data: For each type of product. Include procedure for cutting metal pans.
- B. Samples for Verification: Submit samples of each component indicated and for each exposed finish required, prepared on samples of size indicated below:
 - 1. Finish Samples: 12-inch-square samples of each ceiling panel type, finish, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, Fillers, and Trim: Set of 6-inch-long samples of each type, finish, and color.
 - 3. Sound Absorber: Sample of each type matching size of finish sample.
- C. Shop Drawings: For suspended ceilings.

1. Include reflected ceiling plans, sections, and details, drawn to scale, showing the following:
 - a. Ceiling patterns and joints.
 - b. Ceiling suspension members.
 - c. Method of attaching hangers to building structure and locations of cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - d. Ceiling-mounted items including, but not limited to, light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
 - e. Ceiling perimeter and penetrations through ceiling; trim and moldings.
 - f. For wood ceilings, indicate edge condition with coursing occurring between boundary walls for edges parallel to linear members.
 - D. Delegated Design Submittals: For design of seismic restraints and attachment devices. For installed products indicated to comply with design loads and other criteria, include structural analysis and other analytical data signed and sealed by the qualified professional engineer responsible for their preparation.
 - E. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Suspended ceiling components.
 2. Structural members to which suspension systems will be attached.
 3. Method of attaching hangers to building structure.
 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 5. Size and location of access modules for acoustical panels.
 6. Items bounding, interfacing or penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Perimeter moldings.
 - f. Access panels.
 - g. Emergency notification devices.
 7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
 - F. Qualification Data: For testing agency.
 - G. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.
 - H. Field quality-control reports.
- 1.4 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceilings: Full-size units of each type and finish, with sound absorber equal to 2 percent of quantity installed.
 - 2. Torsion Springs and Clips: Equal to 2 percent of quantity installed.

1.6 QUALITY ASSURANCE

- A. Design Engineer Qualifications: Design metal ceiling panel units, attachments, support systems, and seismic design under direct supervision of a professional structural engineer experienced in the work and licensed in the State of Oregon.
- B. Installer Qualifications: Minimum three years' experience with the system to be installed.
 - 1. The installer shall be approved by the manufacturer as qualified to perform work.
- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockup of each type of suspended ceiling as shown on Drawings.
 - a. Demonstrate treatment of edge trim, perimeter trim and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ceiling panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Handle acoustical ceiling panels, suspension-system components, and accessories carefully to avoid damaging units and finishes in any way.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical ceilings until wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Acclimatize wood products in the spaces where they will be installed for a minimum of 72 hours immediately before ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design attachments, supports, and seismic restraints for ceiling systems.
- B. Structural Performance:
 - 1. Classification; Conform to ASTM C635/C635M, Heavy Duty Classification.
 - 2. Code Compliance: Comply with applicable Building Code with edition dates per local authorities having jurisdiction.
 - a. Comply with requirements for independent support from structure above for light fixture and mechanical services installed into acoustical metal pan ceiling systems.
 - 3. Seismic Performance: Suspended ceilings to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7 and to resist seismic load by using practices specified in ASTM E580.
 - 4. Provide code minimum seismic separation joint dimension and spacing unless noted otherwise on drawings.
- C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Comply with ASTM E1264 for Class A materials.
 - 2. Smoke-Developed Index: 450 or less.
- D. Low Emitting Materials: All products and accessories used in installation shall meet applicable requirements of sustainability as detailed in Section 016116 "VOC Content Restrictions". The work of this section includes the following categories of applicable products:
 - a. Adhesives, sealants and caulks.
 - b. Paints and coatings.
 - c. Insulation.
 - d. Acoustical ceiling panels

2.2 ACOUSTICAL CEILINGS, GENERAL

- A. Source Limitations: Obtain each type of acoustical ceiling and suspension system from single source from single manufacturer.
- B. Provide all accessories required to provide a complete installation of ceilings shown in accordance with manufacturer's written installation instructions.
 - 1. Include required blocking and supports for other work attached to ceiling panels.
- C. Provide products indicated or pre-bid approved equal.
 - 1. AMC# subject to sample review in pre-bid submission.

2.3 ACOUSTICAL METAL CEILINGS

- A. Metal Ceilings, General:
 - 1. Sheet Metal Characteristics: For metal components exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, roughness, stains, or discolorations.
 - 2. Aluminum Sheet: Rolled aluminum sheet, complying with ASTM B209 (ASTM B209M); alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, stretcher leveled.
 - 3. Field cut edges shall be concealed using trim as indicated.
 - 4. Accessibility, Access: Full, downward.
 - 5. Provide factory formed panels to greatest extent possible.
 - 6. See Section 017329 "Cutting and Patching" for requirements applicable to existing linear metal ceilings.
- B. Acoustical Metal, Perforated, Concealed Grid Metal Pan Ceiling (AMC3 and AMC6):
 - 1. Product: USG Ceilings Plus, Illusions.
 - 2. Pan Material: 0.050 Aluminum, perforated.
 - 3. Perforation Patterns:
 - a. AMC3: CD05006 (SD-2), 0.05-inch diameter, 6.3% open, staggered 45-degrees, 0.177-inch diagonal centers.
 - b. AMC6 (TCORE APC7): CD11717 (A116), 0.1165-inch diameter, 17% open, staggered 45-degree.
 - 4. Install Type: Torsion spring.
 - 5. Color: Blanco Mat.
 - 6. Backing: White acoustibond with Ultrasorb 1-1/2", 1.5 lb. density.
 - 7. Size: As indicated.
 - 8. NRC: 0.70 panel.
- C. Suspension System: USG Celebration Torsion Spring Tee Grid, heavy duty 15/16" white.
 - 1. See Drawings for limitations for torsion spring mounting.
- D. Perimeter Trims:
 - 1. Open Edges: 4-1/2-inches face and as indicated; match panel finish; with hold down clips and concealed fastened to grid.
- E. Edge Molding, Wall Mounted: Profiles indicated, matching panel finish.
- F. Pan Fabrication: Manufacturer's standard units of size, profile, and edge treatment indicated, formed from metal indicated and finished to comply with requirements indicated.
 - 1. Torsion-Spring-Hinged Pans: Designed to be securely retained in preslotted, exposed suspension grid by torsion springs provided by manufacturer.
- G. Sound-Absorbent Fabric Layer: Provide fabric layer, sized to fit concealed surface of pan, and consisting nonwoven, nonflammable, sound-absorbent material with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing in accordance with ASTM E84.
 - 1. Bond fabric layer to panels in the factory with manufacturer's standard nonflammable adhesive.

- H. Sound-Absorbent Pads: Provide width and length to completely fill concealed surface of panel, with surface-burning characteristics for flame-spread index of 25 or less and smoke-developed index of 50 or less, as determined by testing in accordance with ASTM E84, and to comply with the following requirements:
 - 1. Unwrapped, Glass-Fiber Insulation: Black coated, unfaced, complying with ASTM C553, Type I, Type II, or Type III; treated to be nondusting; thickness indicated.
- I. Adhesive: Manufacturer's standard nonflammable adhesive for sound-absorbent fabric and pads.

2.4 LINEAR WOOD CEILINGS

- A. Wood Ceilings, General:
 - 1. Materials: Manufacturer's standard linear profiles fabricated from kiln-dried solid-wood planks and without finger joints, cracks, checks, or warp. Planks run parallel to panel length.
 - 2. Shop cut panels and finish ends, based on field measurements. Cut-to-length is prohibited in field unless sample provided with finished ends and approved by Port prior to work.
 - 3. Field-cut openings with cover plates or escutcheons are acceptable with prior approval.
- B. LWC1, Linear Wood Ceiling:
 - 1. Product: Rulon International, Panel Grille, PG 8-12-22, Style W.
 - 2. Wood and Finish: Solid ash, custom stain.
 - 3. Profile, Blades: 3/4-inch by 1-3/8-inches width by depth, 8 blades/ ft., 3/4-inch space between members.
 - a. Where parallel to blades boundary walls create gaps larger than 1-1/2 inches, or two equal 3/4-inch spaces, adjust spacing of blades, for 12-inches from boundary walls or gapped as selected by Port for each condition.
 - 4. Cross Piece: Woodbacker, white to match backing fabric.
 - 5. Backing: Fabric, Phifer, Infinity2 5%.
 - a. Color: PG1 Cotton.
 - 6. Acoustical Liner: Knauf, Atmosphere Duct Liner, 1.5" thick.
 - 7. Wood Trim: As indicated on Drawings; manufacturers standard solid wood finished to match planks; with trim connectors recommended in writing by ceiling and suspension-system manufacturers.
- C. Suspension System: Armstrong, Prelude XL 15/16".
 - 1. Color: White.
- D. Edge Molding: Armstrong wall angle, model 7800, 7/8-inch flanges.
- E. Access Panels: For access at locations indicated, provide door hinge assembly, retainer clip, and retainer bar, assembled with ceiling panels and carrier sections into access doors of required size, permitting downward opening and concealed within panels without visual impact and tight fitting joints, concealed retainers.

2.5 ACCESSORIES

- A. Adhesive: Manufacturer's standard nonflammable adhesive for sound-absorbent
 - 1. Verify adhesives have a VOC content of 70 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."
- B. Provide escutcheon trim for all penetrations or trim to conceal cut holes in finishes to match metal ceilings and stainless steel for acoustical panel and wood ceilings unless finish is otherwise selected by the Port.
 1. Match existing standards.
- C. Acoustic Infill Panels: Manufacturer's standard to provide NRC rating indicated Nonwoven mineral or glass fiber in thickness indicated, with flame-spread index of 25 or less and smoke-developed index of 50 or less as determined by testing in accordance with ASTM E84.

2.6 METAL SUSPENSION SYSTEMS, GENERAL

- A. Grid Suspension System: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C635/C635M requirements.
 1. Provide systems complete with carriers, runners, splice sections, connector clips, alignment clips, leveling clips, hangers, molding, trim, retention clips, load-resisting struts, and other suspension components required to support ceiling units and other ceiling-supported construction.
- B. Attachment Devices: Size for 5 times the design load indicated in ASTM C635/C635M, Table 1, Direct Hung, unless otherwise indicated. Comply with seismic design requirements.
- C. Post-Installed Anchors: See Structural Drawings.
- D. Power-Actuated Anchors: Comply with Section 017000.
 1. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 1. Zinc-Coated Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at 3 times the hanger design load (ASTM C635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.
- F. Stabilizer Channels, Tees, and Bars: Manufacturer's standard components for stabilizing main carriers at regular intervals and at light fixtures, air-distribution equipment, access doors, and other equipment; spaced as standard with manufacturer for use indicated; and factory finished with matte-black baked finish.
- G. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

- H. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical metal pans in place.
- I. Hold-Down Clips: Manufacturer's standard hold-down clips spaced to secure acoustical metal pans in place at each pan.
- J. Exposed Metal Edge Moldings and Trim: Fabricate using metal and finish matching acoustical metal pan ceiling units unless otherwise indicated, to conceal edges of and penetrations through ceiling, to conceal edges of pans and runners, for fixture trim and adapters, for fasciae at changes in ceiling height, and for other conditions; of metal and finish matching acoustical metal pan ceiling units unless otherwise indicated.
 - 1. Comply with seismic requirements of authorities having jurisdiction.
 - 2. Provide trim at field cut acoustical metal panels to conceal edges of and penetrations through panels, to conceal edges of pans and runners.
 - 3. Provide trim for fixtures and adapters, for fasciae at changes in ceiling height, and for other conditions.
 - 4. For Circular Penetrations of Ceiling: Fabricate edge moldings to diameter required to fit penetration exactly.

2.7 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.
- C. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.8 ALUMINUM FINISHES

- A. Color-Coated Finish: Manufacturer's standard powder-coat baked paint complying with coating manufacturer's written instructions for surface preparation, pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical ceilings.

- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical metal pans to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width pans at borders, and comply with layout shown on reflected ceiling plans and coordination drawings.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. General: Install acoustical ceiling assemblies to comply with ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling suspension members or carrying channels and to supports above with a minimum of four tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that do not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure supplemental framing supports, angle, channel, and rod hangers to ceiling suspension members or carrying channels and to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that does not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Fasten hangers at composite deck to structure framing or to deck using postinstalled mechanical anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members or carrying channels and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with postinstalled anchors.
- D. PAFs with silencers are allowed for suspended ceiling applications, in accordance with ASCE 7-10, Chapter 13, and as described in Section 017000, Execution Requirements.
- E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pans.
 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed directly to wall surfaces.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- F. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- G. Cut acoustical panel units for accurate fit at borders and at interruptions and penetrations by other work through ceilings.
 1. Stiffen edges of cut metal panel units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.
 2. Cut and treat edges to comply with manufacturer's written instructions.
- H. Install acoustical ceilings in coordination with suspension system and moldings and trim. Comply with manufacturer's installation tolerances.
 1. Install panels with undamaged edges and fit accurately into suspension-system runners and edge moldings.
 2. Scribe and cut panels at borders and penetrations to provide precise fit.
 3. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions, unless otherwise indicated.
 4. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.
 5. Install panels with butt joints at wood panels ceilings.
 6. Where metal pan ends are visible, install end caps unless trim is indicated.
 7. Install filler strips where indicated.
 8. Install sound-absorbent pads at right angle to perforated metal pans so pads do not hang unsupported.
 9. Provide access sections of sizes required below mechanical items (VAV boxes, controls, valves, and other items requiring service.)
- I. Install sound attenuation panels in areas indicated by reflected ceiling plans or room finish schedules. Lay panels directly on ceiling system and close major openings to form complete coverage in required areas. Lay second sound-absorbent pads on sound attenuation panels.
- J. Install clips where indicated and required.

- K. Follow manufacturer's recommended procedures for operating torsion spring assemblies, seismic and hold-down type clips.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Periodic inspection during the installation of suspended ceiling grids in accordance with ASCE/SEI 7.
- B. Acoustical ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 CLEANING

- A. Clean exposed surfaces of acoustical metal pan ceilings, including trim and edge moldings, after removing strippable, temporary protective covering, if any. Comply with manufacturer's written instructions for stripping of temporary protective covering, cleaning, and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

END OF SECTION 095100

SECTION 096623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes epoxy-resin, 3/8-inch thick, thin-set terrazzo flooring and site-finished base over crack isolation membrane (TZR4).

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 090561, Common Work Results for Flooring Preparation: for moisture mitigation system and underlayment requirements.
- B. Section 092900, Gypsum Board; for cement board as substrate for flash-cove base.

1.3 REFERENCES

- A. ANSI A326.3: Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials.
- B. ASTM: American Society for Testing and Materials
 - 1. ASTM C241: Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.
 - 2. ASTM D2047: Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
 - 3. ASTM F2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in Situ Probes
- C. NTMA: National Terrazzo and Mosaic Association
- D. VOC Limits State of Oregon Department of Environmental Quality

1.4 SUBMITTALS

- A. Product Data: For each type of terrazzo, component material, and accessory specified.
- B. Shop Drawings: Show terrazzo fabrication and installation requirements including plans, elevations, sections, component details, and attachments to other work. Show layout of the following:
 - 1. Divider, edge, control-joint, and accessory strips. Show type, location and widths of each strip.
 - a. Show control-joint strips at slab-on-ground joint and where recommended by NTMA.
 - 2. Large-scale details of terrazzo patterns.

- C. Samples for Verification:
 - 1. For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and marble-chip and aggregate types, sizes, and proportions. Prepare samples of same thickness and from same material to be used for the work in size indicated below.
 - a. Terrazzo: Minimum 6-inch-square samples.
 - b. Accessories: 6-inch-long samples of each exposed strip item required.
 - 2. Provide iterations of terrazzo samples until each color and pattern is deemed acceptable by the Port.
 - 3. Where matching an existing color, remove the finish from an inconspicuous area of existing terrazzo to be matched to achieve best color match. The Port will determine the area to be used for this purpose.
- D. Qualification Data: To demonstrate capabilities and experience of firms and persons. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Material Certificates signed by suppliers or manufacturers certifying that each material complies with NMTA requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each terrazzo type to include in the maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed terrazzo installations similar in material, design, and extent to that indicated for this work and with a record of successful in-service performance.
- B. Comply with the NTMA Guide Specification and written recommendations, unless more stringent requirements are specified.
- C. Pre-Installation Meeting: Conduct the meeting at work site. Review related methods and procedures including, but not limited to, the following:
 - 1. Condition of substrate and other preparatory work performed by other trades.
 - 2. Review structural loading limitations.
 - 3. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review dust control procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to work site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number, if any.

- B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.8 PROJECT CONDITIONS

- A. Comply with manufacturer's instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.
- B. Control and collect dust produced by grinding operations. Protect any adjacent construction from detrimental effects of grinding operations. Provide dustproof partitions and temporary enclosures to limit dust and migration and to separate areas from noise.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. After grinding and sealing, terrazzo surfaces shall have a dynamic coefficient of friction of at least 0.42 when tested in accordance with ANSI A326.3.
- B. Regulatory Requirements: The quantity of VOC's in materials provided under this section shall not exceed the limits permitted by the Oregon Department of Environmental Quality (DEQ) for architectural coatings used in the Portland Oregon Air Quality Management Area.

2.2 MATERIALS

- A. Source Limitations for Marble: Obtain each color, grade, type, and variety of marble from one source with resources to provide materials of consistent quality in appearance and physical properties without delaying the work.
- B. Manufacturer and Products: See Part 3 schedule. Provide products specified or pre-bid approved equal subject to product and sample review.
- C. Underlayment for Leveling, Elevations: Provided by manufacturer of terrazzo flooring to comply with Section 090561, for materials applied over moisture mitigation system.
- D. Aggregate (Marble, Glass, Synthetics, Metal):
 - 1. Comply with NTMA gradation standards.
 - 2. Abrasion and Impact Resistance: Loss of 40 percent or less when tested according to ASTM C 131 (LA Abrasion).
 - 3. Aggregates shall contain no deleterious or foreign matter.
 - 4. For each color, use aggregate mix indicated in Terrazzo Color Schedule at end of this section.
- E. Epoxy-Resin Matrix: Two-component, high solids product meeting NTMA Guide Specification and DEQ VOC limits. For each color, use epoxy mix indicated in Terrazzo Color Schedule at end of this section.

- F. Strips: Metal profiles for separating, embedded in matrix.
 - 1. Products: By Manhattan American, Domus, or equal.
 - 2. Depth: 3/8 inch deep.
 - a. Provide 1/2-inch deep for wall base top to align with finishes above.
 - 3. Material: Alloy of white zinc.
 - 4. Divider Strips: L-type.
 - a. Top Width: 1/8 inch.
 - 5. Control-Joint Strips (CJs): Separate, double L-type white zinc with infill material matching matrix.
 - a. L-dividers of 16-gauge thickness, with 1/8-inch infill width.
 - 6. Accessory Strips: In profiles indicated.
- G. Control-Joint Sealant: Self-leveling aliphatic urethane.
- H. Flexible Epoxy Membrane, Crack Suppression: Epoxy-resin matrix manufacturer's 100% solids epoxy membrane for crack suppression. Membrane shall provide 140% to 160% elongation to allow for substrate movement.
- I. Fiberglass Scrim: Fiberglass reinforcing membrane approved for use with the flexible epoxy membrane, by the epoxy-resin matrix manufacturer.
- J. Divider-Strip Adhesive: Adhesive recommended by manufacturer for this use and acceptable to epoxy-resin matrix materials manufacturer.
- K. Primer: As recommended, manufactured, and supplied by epoxy-resin matrix materials manufacturer.
- L. Finishing Grout: Epoxy-resin matrix material manufacturer's resin-based finishing grout.
- M. Patching and Fill Material: Epoxy-resin matrix material manufacturer's resinous product approved and recommended by manufacturer for application indicated.
- N. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.
- O. Sealer: Use slip- and stain-resistant sealer that is chemically neutral with pH factor between 7 and 12, has a surface friction of not less than 0.6 according to ASTM D2047, does not affect color or physical properties of terrazzo type indicated, is recommended by sealer manufacturer for this use, and complies with NTMA Guide Specification for terrazzo type indicated.
 - 1. 3M Stone Floor Protection System. No substitution allowed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and areas for compliance with requirements for installation tolerances and other conditions affecting performance of terrazzo.
 - 1. Verify slab elevations for work are correct.
 - a. Install underlayments for slab elevations provided under Section 090561.

2. Verify concrete work and items embedded in concrete and resinous flooring are complete.
 3. Verify wall substrates are acceptable for work.
- B. Do not proceed with installation until unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

- A. Concrete is prepared in Section 090561, including moisture mitigation system, prior to work of this Section.
- B. Clean substrates of substances that impair terrazzo's or underbed's bond including oil, grease, and curing compounds. Provide clean, dry, and neutral substrate for terrazzo application. Prepare thin-set-terrazzo substrates according to epoxy-resin matrix material manufacturer's instructions.
- C. Concrete Slabs, Preparation for Resinous Flooring: Coordinate with Section 090561.
1. See Section 090561 for moisture mitigation system and general preparation requirements.
 2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Repair damaged and deteriorated concrete according to epoxy-resin matrix material manufacturer's written recommendations.
 - c. Use patching and fill material to fill holes and depressions in substrates according to epoxy-resin matrix material manufacturer's instructions.
 3. Verify that concrete substrates are visibly dry and free of moisture.
 4. Test for moisture content by method recommended in writing by epoxy-resin matrix materials manufacturer or the following if the manufacturer has no specific recommendations.
 - a. Test for moisture by relative humidity probe and digital meter method according to ASTM F2170. Proceed with installation only after substrates have a maximum relative-humidity-measurement reading of 70 to 75 percent in 24 hours.
 - b. Proceed with installation only after substrates pass testing.
- D. Walls: Prepare and fill joints with epoxy joint filler with fiberglass scrim embedded in filler.
- E. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with governing environmental protection regulations and requirements of the contract documents. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 INSTALLATION

- A. General: Comply with NTMA Guide Specification for terrazzo type indicated and NTMA's written recommendations for substrate preparation and terrazzo installation.
1. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's instructions and NTMA's "Terrazzo Specifications and Design Guide."

2. Installation Tolerance:
 - a. From Level: Limit variation in terrazzo surface from level to 1/8 inch in 10 feet, noncumulative.
 - b. From Smooth: Limit variation in terrazzo surface from smooth to 1/32 inch in 2 feet.
 3. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.
 4. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.
- B. Thickness: 3/8 inch, nominal.
1. Flash-Cove Base: As required to align with finishes above; nominal 3/8-inch and 1/2-inch.
 - a. Coordinate finish thickness of assembly above base for alignment.
- C. Flexible Reinforcing Membrane:
1. Pour flexible epoxy membrane to produce full substrate coverage in areas receiving terrazzo.
 2. Prepare and prefill substrate cracks:
 - a. Cracks up to 1/8 inch: Fill with flexible epoxy membrane.
 - b. Cracks over 1/8 inch: Embed fiberglass scrim into wet flexible epoxy membrane and saturate with additional membrane material across crack a minimum of 6 inches on either side.
 - c. Extensive cracks: Embed fiberglass scrim over entire area. Place into wet flexible epoxy membrane and saturate with additional membrane material.
 3. Prepare membrane according to manufacturer's instructions before applying substrate primer.
- D. Primer: Apply to terrazzo substrates according to manufacturer's instructions.
- E. Install strips and similar accessories in adhesive setting bed without voids below strips. Provide mechanical anchorage of strips as required for adequate attachment of strips to substrate. Locate strips and joints between strips as indicated.
1. Install divider, control-joint, and accessory strips according to NTMA's written recommendations according to approved shop drawings.
 2. Divider and Control-Joint Strips:
 - a. Locate divider strips in locations indicated.
 - b. Install control-joint strips directly above concrete-slab saw-cut control joints in locations indicated. Install one strip on both sides of the concrete control joint. Pour sealant in gap. Keep sealant off top surface of control-joint strips.
 - c. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.
 3. Accessory Strips: Install accessory strips as required to provide a complete installation in locations indicated.
 4. Apply primer to metal surfaces of dividers and accessories.
- F. Mix epoxy resin matrix and aggregate per manufacturer's recommendations for maximum aggregate density (about 30 pounds of aggregate per gallon of epoxy resin matrix) to ensure good density and even distribution.
- G. To distribute the aggregate evenly in all areas, it is acceptable to broadcast aggregate into the poured epoxy resin and work it into the matrix, per manufacturer's recommendation.

- H. Pour terrazzo matrix to complete a section or quadrant in one pour. Cold joints within a section or quadrant are not acceptable.
- I. Fine Grinding: Grind with stones 120 grit or finer until all grout is removed from surface. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding.
- J. Repair: Remove and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, if approved by the Port.

3.4 SEALER APPLICATION

- A. Remove grinding dust from installation and adjacent areas.
- B. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's instructions.
- C. Rinse surfaces with water and allow to dry thoroughly.
- D. Seal surfaces according to NTMA's written recommendations and according to sealer manufacturer's instructions.
- E. Apply in multiple coats to achieve a coverage of 3,000 to 4,000 square feet per gallon of sealer product.

3.5 PROTECTING AND CLEANING

- A. Provide final protection and maintain conditions that ensure terrazzo is without damage or deterioration at the time of substantial completion.
- B. Clean terrazzo as recommended by manufacturer of sealer when area is ready for substantial completion.

3.6 TERRAZZO COLOR SCHEDULE

- A. General: Match color of existing terrazzo installation. All epoxy mixes shall be Terrazzo & Marble Supply (T&M), Terroxy Resin Systems.
- B. TZR4:
 - 1. Color: 18GG-694 – Portland Standard Restroom.
 - a. Epoxy Matrix: #6945 Gray Matters.
 - b. Aggregate mix:
 - 1) 30% Italian Black #0.
 - 2) 15% Persian Cream #1.
 - 3) 15% Persian Cream #0.
 - 4) 15 MOP (FW) #0.
 - 5) 12.5% Misty Gray #1.
 - 6) 12.5% Misty Gray #0.

2. Site-Finished, Flash-Cove Base: Height indicated.
 - a. Cap with divider strip of face width shown.
 - b. Radius: As indicated.

END OF SECTION 096623

SECTION 096800 – BROADLOOM CARPETING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes direct-glued broadloom carpet, adhesives, and accessories.
 - 1. CPT-4, walk-off.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 016116, VOC Content Restrictions.
- B. Section 017000, Execution: For patching broadloom carpet.
- C. Section 017419, Construction Waste Recycling.
- D. Section 024119, Selective Demolition: For existing flooring removal.
- E. Section 090561, Common Work Results for Flooring Preparation: For substrate preparation, remediation and moisture mitigation system installed prior to carpeting.

1.3 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI Standard 140: Sustainability Assessment for Carpet
- B. CRI: Carpet and Rug Institute
 - 1. CRI Carpet Installation Standard
 - 2. CRI Green Label Testing Program
 - 3. CRI Green Label Plus Testing Program
 - 4. CRI Test Method 103: Standard test method for the Evaluation of Texture Appearance Retention of Carpets for Minimum Carpet Standards Program

1.4 SUBMITTALS

- A. Product Data: Provide data on adhesives describing physical and performance characteristics and method of installation.
- B. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings, edge bindings, and the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - 2. Carpet type and color.
 - 3. Seam locations, types, and methods.

4. Type of installation.
 5. Pattern type, repeat size, location, direction, and starting point.
 6. Type, color, and location of edge, transition, and other accessory strips.
 7. Transition details to other flooring materials.
- C. VOC Report: Submit data documenting VOC content of carpet, backing, and adhesives. A copy of the current CRI Approved Products Listing is acceptable.
- D. Carpet Manufacturer's Installation Instructions: Indicate any special procedures.
- E. Qualification Data:
1. For qualified installation company and installation crew. Submit certification letter from manufacturer.
 2. For qualified carpet dealer. Submit certification letter from manufacturer.
- F. Sustainable Characteristics:
1. NSF/ANSI Standard 140 certification.
 2. Proof of compliance with testing and product requirements of CRI's "Green Label Plus" emissions program.
- G. Warranties: Special warranties specified in this section.

1.5 QUALITY ASSURANCE

- A. Carpet Dealer Qualifications: Company specializing in the installation of commercial carpet with minimum of 10 years of documented experience and approved by manufacturer.
- B. Installer Qualifications: Company specializing in installing commercial carpet with minimum 10 years documented experience and approved by manufacturer.
1. List at least five projects of successful in-service installations of tufted broadloom carpet in buildings with similar flooring use and wear to that of the Portland International Airport.
 2. Upon request, submit list of references for supervisor performing this work, substantiating that such person has experience working on projects of similar size for a minimum of 10 years.
- C. Pre-installation Meeting: Conduct the meeting at work site with installers of other work adjoining carpeting including resilient base and representatives of other entities directly concerned with performance of carpet, including Port and product manufacturers.
1. Review contract documents, submittals, status of coordinating work, proposed installation schedule, and procedures.
 2. Review laydown area and logistics.
 3. Review ambient conditions and ventilation procedures.
 4. All related submittals shall be approved prior to the pre-installation meeting.
 5. Discuss carpet protection requirements for the duration of construction.
- D. Roll-Out Inspection Upon Delivery:
1. Notify the Port at least 48 hours in advance of deliveries and coordinate to allow the Port to observe roll-out inspections.
 2. Take pattern measurements to verify pattern is within installation guidelines.
 3. Review to verify carpet meets the tolerances for variation in pattern stated in Part 2.

1.6 CONSTRUCTION MOCK-UP

- A. Before installing carpet, install construction mock-up, in location indicated on the drawings, to verify selections made and to demonstrate installation, aesthetic effects, and set quality standards for materials and execution.
- B. Schedule construction mock-up review meeting, at least 5 business days prior to commencing mock-up construction, and include the Port, manufacturer, and installer.
- C. The construction mock-up will be reviewed by the Port to confirm criteria for installation are being met. Approved mockup may, at the discretion of the Port, become part of the completed work if undisturbed at time of substantial completion.

1.7 SITE CONDITIONS

- A. Store materials in an area with the same temperature and humidity as the area of installation for a minimum of 24 hours prior to installation.
- B. Store adhesives and all accessories needed for carpet installation for a minimum of 24 hours at a temperature of 65°F to 95°F prior to installation.

1.8 EXTRA STOCK MATERIALS

- A. Furnish extra stock material for each carpet, in the minimum quantities:

<u>Carpet Type</u>	<u>Extra Stock</u>
CPT-4	50 square yards

- B. The minimum acceptable roll size for meeting the above listed quantities of extra stock material is 20'-0" long by full width.
- C. Deliver extra stock material pre-rolled, taped, and in labelled shipping containers. Deliver to PDX Maintenance facility and obtain a receipt.
- D. At the Contractor's option and at no additional cost to the Port, the Port will accept unused scraps of the following minimum dimensions:
 - 1. CPT4: Minimum length of 20 feet and minimum width of 4 feet.
- E. Dispose of all other unused scraps in accordance with the recycling requirements of the contract documents. Scraps shall not be used to fulfill the extra stock material requirement.

1.9 WARRANTY

- A. Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation which fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, lack of color retention, poor wear and staining, change in texture, and delamination.
 - 2. There shall be no limitations to:
 - a. Full warranty coverage due to age of carpet or other deductive warranty considerations or pro-rations.
 - b. Duration of adhesive cure time received prior to use of the carpeted area.
 - 3. Warranty period shall be manufacturer's standard warranty period or 10 years from date of substantial completion, whichever is greater.

PART 2 - PRODUCTS

2.1 WALK-OFF BROADLOOM CARPET

- A. Broadloom Walk-Off Carpet: Type CPT-4.
 - 1. Product: Abrasive Action II #02578, Tarkett (www.tarkett.com), no substitutions.
 - 2. Color: Winter Gray, 19103.
 - 3. Backing: Powerbond cushion.
 - 4. Dye: 100% solution dyed.
 - 5. Face Weight: 24 ounces/square yard.
 - 6. Gauge: 1/12
 - 7. Stitches per Inch: 8.0.
 - 8. Tuft Density: 96 tufts/square inch.
 - 9. Pile Height Average: 0.187 inch.
 - 10. Pile Thickness: 0.115 inch.
 - 11. Density Factor: 7,513 ounces/cubic yard.
 - 12. Fiber System: TDX nylon.
 - 13. Soil/Stain Protection: Ensure.
 - 14. Roll Width: 6 feet.

2.2 ACCESSORIES

- A. General:
 - 1. Accessories shall be those acceptable to the carpet manufacturer and compatible with materials being adhered, non-toxic, low odor, VOC free, solvent free with no alcohol glycol and ammonia, antimicrobial with no hazardous vapors and no carcinogenic material per OSHA regulation 29 CFR 1910-1200, and CRI Green Label certified.
 - 2. Accessories shall be water-resistant, mildew-resistant, non-staining type to suit products and subfloor conditions indicated, complying with flammability requirements for installed carpet, and recommended or provided by carpet manufacturer.
 - 3. Provide aluminum extrusions in profiles indicated where installed with carpet at transitions other than those in other Sections.

- B. Flooring Adhesive: High solids content that is approved by the carpet manufacturer. Meet requirements of Section 016116, VOC Content Restrictions.
- C. Surface Primer: Meet requirements of carpet manufacturer and of Section 016116, VOC Content Restrictions.
- D. Seam Adhesive: Meet requirements of the carpet manufacturer and of Section 016116, VOC Content Restrictions. The seam sealer adhesive applicator shall be one approved by the floor covering manufacturer and that also allows seam adhesive to be applied such that both edges receive adhesive in an equal amount, covering primary and secondary backing without contaminating face yarns.

PART 3 - EXECUTION

3.1 PREPARATION AND EXAMINATION

- A. Remove existing carpet and adhesive where indicated and in accordance with Section 024119, Selective Interior Demolition.
- B. Protect edges of existing flooring. Provide transitions between flooring edge and subfloor where exposed to foot traffic.
- C. Prepare floor substrates for installation of flooring in accordance with Section 090561, Common Work Results for Flooring Preparation.
- D. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.
- E. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesives to subfloor surfaces.
- F. Perform concrete pull test(s) according to the requirements of Section 090561, Common Work Results for Flooring Preparation.
- G. At the start of each day perform a bond test of carpet installed the previous day. Test according to the requirements and recommendations of the floor covering and adhesive manufacturers.
- H. Verify that substrates are dry enough and ready for carpet installation, as required by the carpet manufacturer, by testing in accordance with Section 090561, Common Work Results for Flooring Preparation, for moisture and pH. If test results are not within limits recommended by the flooring manufacturer and adhesive materials manufacturer, provide moisture mitigation as specified in Section 090561.
- I. Verify that new or relocated floor-mounted utilities are in correct location.
- J. Proceed with installation only after unsatisfactory conditions have been corrected, and corrected conditions have been accepted by the Port.
- K. Prepare carpet prior to installation as recommended by carpet manufacturer.

3.2 DIRECT-GLUED CARPET INSTALLATION

- A. Starting installation constitutes Contractor's acceptance of subfloor conditions.
- B. Install carpet in accordance with manufacturer's instructions and the CRI Carpet Installation Standards.
- C. Verify carpet match to ensure minimal variation between dye lots. Minimal color dye variation is acceptable across borders but not at side or head seams to same pattern.
- D. Lay out carpet runs according to seaming diagram on approved shop drawings. Continuously repeat pattern. Align carpet to proper position. Carpet length between head seams shall be a minimum of 7 feet. Maintain alignment and repeat of pattern across borders.
- E. Where confined configurations, mis-cuts, or other conditions result in a small carpet piece being needed, the minimum distance from the nearest head seam shall be 7 feet, and the piece shall be full width without an additional running seam. Areas of small carpet pieces will not be accepted.
- F. Trim carpet seams with accurate pattern match. Use trim tools best suited to carpet style in accordance with carpet manufacturer's recommendations. Trim edges far enough into material to maintain structural integrity and pattern design. Locate seams as indicated in approved shop drawings. Make cuts true to pattern. Make seam edges tightly abutted without gaps or overlaps. Side seam saddles may be used at doors to reduce waste only if depth of side saddle is 6 inches or greater.
- G. Trim carpet neatly at walls and around interruptions.
- H. Install carpet tight and flat on subfloor, well adhered, with a uniform appearance.
- I. Install carpet smooth, tight, and neat to adjacent vertical surfaces and existing trim where not removed. Gap tolerances at edges:
 - 1. Adjacent to Vertical Surfaces: 1/32 inch maximum.
 - 2. Adjacent to Horizontal Non-Carpet Surfaces: 1/64 inch maximum.
- J. Use all tools, techniques, and methods necessary to achieve pattern match.
- K. Apply surface primer, if required, and adhesive to floor uniformly at rate recommended by manufacturer with the appropriate trowel. After sufficient open time for adhesive to become tacky to the touch, press carpet into adhesive.
- L. Prepare edges of new and existing carpet for seams. Apply seam adhesive in a manner that both edges receive adhesive in an equal amount, covering primary and secondary backing without contaminating face yarns. Seam adjoining carpets following seam adhesive manufacturer's written instructions.
- M. Roll with appropriate roller for complete contact of adhesive to carpet backing.
- N. Complete installation of edge strips, concealing exposed edges. Bind-cut edges where not concealed by edge strips.

- O. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- P. Lay out carpet and locate seams in accordance with the approved shop drawings.
 - 1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
 - 2. Do not locate seams perpendicular through door openings.
 - 3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
 - 4. Locate change of color or pattern between rooms under door centerline.
 - 5. Provide monolithic color, pattern, and texture match within any one area.
- Q. Pattern Trueness of Installation:
 - 1. Border Carpet: Down the length and across the width maximum variation from true installation is non-cumulative 1/8 inch in 12 feet. Take special care to meet this tolerance as a straight border is essential for an acceptable looking installation.
 - 2. Standard broadloom field carpets:
 - a. Maximum variation from true installation is non-cumulative 1/2 inch in 12 feet or not visible from a standing position for the following pattern conditions:
 - 1) Bow.
 - 2) Skew/bias.
 - 3) Elongation.
 - b. Maximum variation from true installation is non-cumulative 1/4 inch in 12 feet or not visible from a standing position for the following condition:
 - 1) Trueness of edge.
 - 3. Match all patterns at seam lines.
- R. When possible, perform work in areas with heavy traffic early in the shift to maximize cure time before opening for use. This does not apply to areas designated to receive a one day cure.
- S. Do not move wheeled vehicles over uncured carpet.

3.3 CLEANING AND PROTECTION

- A. Repair damaged carpet or patch according to Section 017000. Replace damaged carpet where directed by Port.
- B. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive from floor, base, wall, and other adjacent surfaces without damaging those surfaces. Use the appropriate adhesive remover recommended by adhesive manufacturer.
 - 2. Remove incidental yarns that protrude from carpet surface or that don't match the color of the carpet.
 - 3. Clean and vacuum carpet surfaces.
- C. Protect installed carpet to comply with the Carpet and Rug Institute's CRI 104.

- D. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer and Port.

END OF SECTION 096800

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes painting work, generally as follows:
 - 1. Interior items and surfaces that are new, or listed on Finish Schedule, or indicated on drawings by notes or symbols, or by any of these methods. In addition, paint items specified in this section are not otherwise indicated to be painted.
 - 2. If a new item or surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces whether schedules indicate colors. Resolve any conflicts of material colors with the Port prior to application.
 - 3. Repair of existing surfaces as specified in this section.
 - 4. Labels: Do not paint over Underwriters Laboratories Inc. (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- B. Do not paint prefinished items, concealed surfaces unless otherwise noted, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Glass and glazing.
 - b. Metal ceilings.
 - c. Rubber base.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Furred areas.
 - b. Ceiling plenums.
 - c. Duct shafts.
 - 3. Finished metal surfaces include the following:
 - a. Prefinished aluminum.
 - b. Stainless steel.
 - 4. Operating parts include moving parts of operating equipment and the following:
 - a. Coiling doors.
 - b. Exposed door closer arms.
 - 5. Labels: Do not paint over Underwriters Laboratories Inc. (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 1 for volatile organic compound (VOC) content restrictions.
- B. Division 5 for shop priming structural steel and ferrous metal.
- C. Division 8 for shop priming steel doors and frames.

- D. Division 9 for surface preparation of gypsum board, GFRG, and for industrial paints and coatings.
- E. Painting of mechanical and electrical work is specified in Divisions 21 through 23 and 26 through 28, respectively.

1.3 SUBMITTALS

- A. Product Data: Describe every required paint system.
 - 1. Material List: Provide an inclusive list of surfaces and proposed coating materials, including anticipated minimum dry film thickness of each coat. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification. Include composition of pigment and vehicle, with percentages.
 - 2. Manufacturer's certification that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- B. Submit 8" x 10" drawdowns for review of color and texture only. Resubmit samples as requested until required sheen, color and texture is achieved.
- C. Samples for Verification: Provide seven samples of all paint materials as specified in the Color Schedule article at the end of this section.
- D. Field-Conditions Report: Submit documentation of existing conditions for items indicated as matching existing conditions.
 - 1. Show each sheen and color indicated.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the requirements of Section 016116, Volatile Organic Compound (VOC) Content Restrictions.
- B. Reference Standard for Workmanship: MPI.
- C. Show product name on label of containers identical with that used in product data submitted as specified above.
- D. Field Control Samples: Mockups.
 - 1. Request review of first finished room, space, or item of each color scheme required as a sample of selected colors, finish, texture and workmanship; under illumination equal to that expected at occupancy.
 - 2. For spray or roller application, paint at least 100 sq. ft. of surface.
 - 3. For column covers, paint one column cover in entirety to review finish and color.
 - 4. Consider approved samples as the project standard.
- E. The thickness of the dry paint film will be verified at various intervals and locations during the course of the painting work. At each test, several readings will be taken to determine the average mil thickness.

1. An area will be considered deficient where, when compared to the dry film thickness specified by the manufacturer or calculated from the recommended spreading rate, the average of 5 readings is more than 10 percent low or a single reading is more than 30 percent low.
 2. Paint will be considered testable after twice the manufacturer's recommended time for recoating or 24 hours, whichever is longer.
- F. Apply and reduce materials only as specified or recommended by the manufacturer's printed instructions. Where manufacturer has made additional recommendations apparently in conflict with these specifications, allow for review and approval of additional recommendations before proceeding.
- G. Provide and install paints and stains for mockups indicated in other technical sections.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original containers, materials specified by name, manufacturer or standard with labels legible and intact.
- B. Store in suitable location as directed, in accordance with label instructions.
- C. Do not store paint-soiled rags, waste, etc., on premises, except where stored in metal containers with tight metal covers.

1.6 FIELD CONDITIONS

- A. Comply with paint manufacturer's recommendations concerning environmental conditions under which coatings and coating systems may be applied.
 1. Apply paint only when surface and air temperatures are above 50°F.
- B. Do not apply finish in areas where dust is being generated.
- C. Protect work of other trades. Correct painting related damage by cleaning, repairing or replacing and refinishing, as directed.
- D. Do not paint any moving parts of operating units, or over any equipment identification, performance rating, name or nomenclature plates or code-required labels.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Material Requirements: Low Emitting Materials: All paints and accessories used in installation shall meet applicable requirements of sustainability as detailed in Section 016116 "VOC Restrictions".

1. Typical Gypsum Wall Paints: Ingredients to contain no BPA or alkylphenol or alkylphenol ethoxylates, no non-preservative antimicrobials, and SCAQMD 1113 No heavy metals.

2.2 ACCEPTABLE MANUFACTURERS OF PAINT MATERIALS

- A. Products shall comply with MPI standards indicated and shall be listed in the “MPI Approved Products List.”
- B. Manufacturer name abbreviations in this section may include the following:
 1. BM: Benjamin Moore.
 2. PPG: PPG Industries.
 3. SW: Sherwin Williams.
 4. TN: Tnemec.
 5. MP: Miller Paint.

2.3 MATERIALS

- A. See painting schedule at the end of this section.
- B. Provide brands and qualities of materials for use on work exactly as specified.
- C. Provide products of a single manufacturer for coating systems applied to each type of surface.
- D. Coordination: Provide finish coats which are compatible with prime paints used. Provide barrier coats over incompatible primers where required. Submit written notification of anticipated problems using specified coatings with substrates primed by others.
- E. Paint Colors:
 1. Colors as indicated.
 2. Paint area of each color for observation, review and revisions before batch mixing of colors, or shipping large quantities of that color to job. Allow revisions to approved colors and textures after review of initial area of each color.
 3. Vary top coats in shade from preceding coat without affecting finish color.
- F. Mixing and Tinting:
 1. Job mix or job tint only if approved. Mix only in pails in suitably sized non-ferrous or oxide-resistant metal pans.
 2. Strain to remove lumps and specks.
 3. Use tinting colors recommended by manufacturer for the specific type of finish.
 4. Add non-mercuric fungicidal agent to exterior finishes by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that spaces are broom clean, with surfaces free of foreign matter.
- B. Moisture Content:
 - 1. Surfaces: Suitably dry and adequately protected from dampness.
 - 2. Follow recommendations of paint manufacturer for allowable moisture for specific type surfaces.
- C. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work as specified. Correct unsatisfactory conditions.
- D. Proceed with surface preparation and coating application only after conditions are suitable.

3.2 PREPARATION

- A. For items indicated as field-matching, verify existing sheen with appropriate light meter and document conditions.
- B. Do not apply finishes until surfaces are dry and clean and in proper condition to receive finish.
- C. In addition to painting specified, sand and patch prime coats specified under other sections.
- D. Perform preparation and cleaning procedures in accordance with coating manufacturer's instructions for each substrate condition.
- E. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be finish-painted or provide surface-applied protection. Reinstall removed items.
- F. Plaster and Wallboard Materials:
 - 1. Test plaster with one percent solution of phenolphthalein in alcohol for dryness and excess acid. Treat excess lime with zinc sulfate solution after observation.
 - 2. Rake cracks, scratches and abrasions. Fill with thin layers of patching plaster or joint cement as appropriate.
 - 3. Sand smooth; do not raise nap of paper on wallboard.
- G. Concrete and Masonry: Fill minor holes to provide uniform texture over surface as approved. Acid etch concrete surfaces receiving oil-based paints and rinse thoroughly.
- H. Ferrous Metal Surfaces:
 - 1. Remove dirt and grease with mineral spirits.
 - 2. Remove dust, mill scale, and defective paint down to sound surface using scraper, sandpaper or wire brush as necessary. Clean rusted surfaces down to bare metal.
 - 3. Feather edges of sound paint by grinding.

4. Where large areas of bare metal are exposed prime with anti-rust primer recommended for this exposure.
- I. Galvanized Steel and Aluminum Surfaces:
 1. Clean surface with solvent to remove oily residue. Dry with clean cloth.
 2. Prime with anti-rust 2-coat primer system recommended for this exposure.
- J. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 1. Prime wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood.
 2. For surface preparation of other materials not specifically noted, provide appropriate primers and cleaning agents.
- K. For surface preparation of other materials not specifically noted, provide appropriate primers and cleaning agents.

3.3 SURFACE PREPARATION, EXISTING SURFACES

- A. For surfaces damaged during construction or indicated as being re-painted: Remove existing loose, blistered, scaled or crazed finish to bare base material surface. Where new work joins existing work, prepare existing surfaces extending to the nearest break in the plane. Wash surfaces with TSP and water or other solution as required.
 1. Prevent impaired bond or bleed through by removing accumulated films of wax, oil, grease, smoke or other foreign matter.
 2. After washing, rinse with potable water and let thoroughly dry.
- B. High-Gloss and Semi-Gloss surfaces: Wash and rinse as noted above, then wipe with liquid deglosser or other acceptable preparation compound.
- C. Existing Painted Concrete (surfaces of existing building exposed at completion of this work):
 1. Remove loose, flaking and blistered paint.
 2. Fill contraction and other cracks with elastomeric sealant, work well into the cracks to prevent further leaks. Wipe off excess material.
 3. Apply latex base filler or suitable prime and fill material to fill "pock marks," air bubbles and other surface irregularities, including those due to paint removal (or sand existing finish to featheredge). Wipe off excess; let dry at least 24 hours before applying specified primer.
- D. Existing Painted Ferrous Metal:
 1. Remove rust and loose paint to bare metal; solvent wash and prime as specified for new work.
 2. Sand rough edges of bare areas to feather edge at adjacent sound paint before priming.
- E. Existing Gypsum Board and Gypsum Veneer:
 1. Bring to attention of appropriate trades, in timely manner, broken and disintegrated wallboard or areas with major damage or holes.
 2. Fill cracks and defects with spackle, "Swedish putty" or approved patching plaster; vinyl base spackle may be used at gypsum board. Apply texture as required to match existing adjacent surfaces.

3. Prime bare, filled and patched surfaces with primer specified.

3.4 APPLICATION

- A. Paint materials may be applied to fields of walls, ceilings and painted doors with rollers or airless spray equipment. Brush-paint other work except as specifically indicated.
 1. Doors:
 - a. Where silk-screened signage is applied to painted doors as specified elsewhere, apply paint to doors with airless spray equipment.
 - b. Lay off other painted doors with roller of acceptable texture after application of paint.
 2. Apply each coat evenly, without brush marks, skipped or missed areas; and without sags, runs or other blemishes.
 3. Where spray application is permitted, spray each coat without streaking, lapping or pile up of paint, and lay off with roller for light stippled surface (except as noted).
- B. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted. Apply prime coat to material which is required to be painted or finished, and which has not been prime coated by others.
- C. Apply each material at not less than the manufacturer's recommended spreading rate, to provide a total dry film thickness of not less than 3.0 mils for the coating systems applied under this section.
- D. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.
- E. Observation of Surfaces:
 1. Do not apply additional coats until completed coat has been reviewed and approved.
 2. Only observed coats of paint will be considered in determining number of coats applied.
- F. Paint surfaces behind furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment or furniture with prime coat only, wherever possible.
 1. Paint interior surfaces, where visible through registers or grilles, flat, non-specular black.
 2. Paint backsides of access panels, and removable or hinged covers to match exposed surfaces.
- G. Sand lightly between succeeding coats.
- H. Finish door edges, tops and bottoms to match faces.
- I. Refinish whole wall where portion of finish has been damaged or is not acceptable.
- J. Make edges of paint adjoining other materials or colors clean and sharp without overlapping.
- K. Exercise care that paint does not lap or splatter onto surfaces scheduled to receive other finishes or which are not to be painted.

3.5 CLEANING

- A. Remove spilled, splashed or spattered paint.
- B. Do not mar surface finish of item being cleaned.
- C. Leave storage space clean and in condition required for equivalent spaces in project.
- D. Produce a satisfactory finish by painting or repainting as directed, surfaces from which paint spatters cannot satisfactorily be removed.

3.6 PAINTING SCHEDULE

- A. Epoxy Paint
 - 1. Apply two coats epoxy finish to surfaces shown in Finish Schedule.
 - a. Apply over block filler at concrete masonry.
 - b. Add "Non-Skid" additive where used on concrete floors.
 - c. Colors: See color schedule.
 - d. Block Filler: As recommended by epoxy coating manufacturer. Apply at a rate providing complete coverage, with pores filled.
- B. Other Interior Surfaces, including Walls and Ceilings of Concrete, Concrete Masonry Units, Plaster and Veneer Plaster, Glass Fiber Reinforced Gypsum Fabrications and Gypsum Wallboard:
 - 1. First Coat at Concrete Masonry Units: Block filler recommended by coating manufacturer. Apply at a rate providing complete coverage, with pores filled.
 - 2. First Coat at Other Surfaces: PVA polyvinyl acetate primer.
 - 3. Second and Third Coats: Water-based eggshell enamel; top coat applied with fine stippling roller.
 - 4. Provide products listed in the approved products list.
 - 5. Colors: Refer to schedule at the end of Part 3.
- C. Interior Metalwork:
 - 1. In addition to priming and touch-up, apply two coats of solvent based semi-gloss enamel.
 - 2. Provide products listed in the approved products list.
 - 3. Third Coat at Flatwork: Match adjoining finish.
 - 4. Apply to:
 - a. Exposed ductwork and wall grilles: Omit third coat at ductwork. Ductwork in mechanical rooms not painted under this section.
 - b. Exposed piping: Omit third coat.
 - c. Electrical and electronic panels, including metal faces of wall-mounted exit signs.
 - d. Ductwork and piping need not be painted where ceiling is not finished, unless otherwise noted.
 - e. Apply also to other interior metal surfaces not scheduled for other finishes; work of this article is not limited to the items listed above.
 - 5. Basic Criteria for Painting Interior Metal Items:
 - a. Where suspended ceilings are installed, paint all exposed items below and at the perimeter.
 - b. Where metal ceiling is scheduled, paint exposed items in cavity above ceiling, including sprayed fireproofing.

- c. At other locations, painting of mechanical and electrical items is not required.
 - d. Spray-apply to exposed door closer covers (remove from door first).
 - e. Colors: Refer to schedule at the end of Part 3.
- D. Take special care to keep the items scheduled for “No Finish” clean; finish not required.

3.7 PAINT SYSTEM SCHEDULE

- A. Source Limitations: Obtain all paint materials for each system from single manufacturer from single supplier.
- B. Gypsum Substrates:
- 1. Acrylic: two finish coats over primer.
 - a. Applications and Sheens:
 - 1) Ceilings and Soffits: Flat.
 - 2) Walls: Eggshell.
 - b. Products:
 - 1) BM
 - a) Primer: Ultra Spec 500 Interior Latex Primer, 1.8 mils dft.
 - b) Finish Coats: Ultra Spec 500 Interior Finish, 1.8 mils dft.
 - 2) PPG
 - a) Primer: Speedhide Zero Interior Zero VOC Latex Sealer, 1.2 mils dft.
 - b) Finish Coats: Speedhide zero Interior Zero VOC Latex 6, 1.3 mils dft.
 - 3) RD
 - a) Primer: Master Painter Ultra Low VOC Interior Primer/Sealer, 1.5 mils dft.
 - b) Finish Coats: Master Painter Ultra Low VOC Interior, 1.5 mils dft.
 - 4) SW
 - a) Primer: ProMar 200 Zero VOC Primer B28 Series, 1.5 mils dft.
 - b) Finish Coats: ProMar 200 Zero VOC 1.6 mils dft.
 - 2. Epoxy: P#E.
 - a. Application: Use at Restroom walls, lactation room walls, and other locations indicated to receive epoxy paint.
 - b. Sheen: Match gypsum board, acrylic system.
 - c. Products:
 - 1) PPG
 - a) Primer: Speedhide Zero Interior Zero VOC Latex Sealer 6-2, 1.2 mils dft
 - b) Finish Coats: Aquapon WB EP, 2 mils dft
 - 2) RD
 - a) Primer: ScotSeal, 1.5 mils dft.
 - b) Finish Coats: EcoLogic 705 Interior, 1.5 mils dft.
 - 3) SW
 - a) ProMar 200 Zero VOC Primer B28 Series 1.5 mils dft and S-W Moisture Vapor Barrier Latex Primer B72W1 at exterior walls, 1.8 mils dft.
 - b) Pro Industrial Waterbased Catalyzed Epoxy.
- C. Glass-Fiber-Reinforced-Gypsum Column Covers:

1. Matching Adjacent Metal Columns:
 - a. Primer: Waterborne acrylic recommended by topcoat manufacturer.
 - b. Topcoat: Two-component 2K polyurethane, two coats.
 - c. Products:
 - 1) SW: Sher-Cryl HPA primer with Acrolon 218 HS topcoat.
 - 2) TN: Series 113 Multiprimer primer with Series 1074 Endura-Shield topcoat.
2. Matching Adjacent GFR Columns: Specified primer for gypsum board with spefield water based, light industrial topcoats for metal substrates.
3. Sheen: Field verify and match existing.
4. Application Method: Spray or airless spray. Brush and roller are prohibited.

D. Metal Substrates:

1. Interior Coatings: Water based, light industrial:
2. Products:
 - a. BM
 - 1) Primer: Corotech V110 Acrylic Metal Primer, 3 to 4 mils dft or HP04 Ultra Super Spec HP Acrylic Metal Primer, 1.7 to 2.3 mils dft.
 - 2) Finish Coats: Corotech V540 Waterborne Urethane, 2.1 mils dft.
 - b. PPG
 - 1) Primer: Aquapon WB Primer 98-46, 3-4 mils dft.
 - 2) Finish Coats: Pithane SG 95-8800, 2-5 mils dft.
 - c. RD
 - 1) Primer: DTM 1300v100 Series, High Build Modified Epoxy Primer, 3 mils dft.
 - 2) Finish Coats: PC3v100 Series, Acrylic Polyurethane Topcoat, 1.5 to 3.0 mils dft.
 - d. S-W
 - 1) Primer: Pro Industrial Pro-Cryl Primer, B66-310 Series, 2 to 4 mils dft.
 - 2) Water Based Alkyd Urethane Enamel, B53-1150/2150 Series, 1.4 to 1.7 mils dft.
 - e. TN
 - 1) Primer: 394, 3 mils dft. 27 at galvanized surfaces
 - 2) Finish Coats: Series 27WB, 5.0 mils dft. Or Series 1081 Endura-Shield, 2.5 mils dft.

3.8 PAINT COLOR SCHEDULE

- A. Colors: P#. P#E is epoxy system matching its same P# color. Provide the following colors:

Designation	Manufacturer and Color Notes
P1	Miller Paint, 5760W "White Shadow" May be referred to as "Port White" in documents.
P5	Sherwin Williams 7005 "Pure White"

END OF SECTION 099100

SECTION 101400 - IDENTIFYING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the fabrication and installation of building code, identifying and wayfinding signage as scheduled and indicated in the drawings.
- B. The Port will furnish the following:
 - 1. Production ready artwork will be provided in vector (outline) files saved in either EPS or Adobe Illustrator (AI) format. All fonts (text) will be converted to curves or outlines.
- C. Obtain all necessary permits and inspections required by the authorities having jurisdiction over this Work.
- D. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for steel supports required for signage installation.
 - 2. Section 057000 "Decorative Metal" for requirements for metal signage elements.
 - 3. Section 092216 "Non-Structural Metal Framing" for suspended system supports for signage attached to gypsum veneer ceilings and soffits.
 - 4. Section 092900 "Gypsum Board" for substrate preparation.
 - 5. Section 260500 "Common Work Results for Electrical."
 - 6. Section 265000 "Lighting."

1.2 COORDINATION

- A. Coordinate location and anchor point installation for all signs, and for structural, digital and electrical integration.
- B. Coordinate and furnish anchorages and setting drawings, diagrams, templates, instructions and directions for installation of items having integral anchors which are installed by others. Coordinate delivery of such items to construction site to not delay work.
- C. Where room or gate numbers are being updated, coordinate scheduling of the work with other trades. Signage, including door tags, shall not be replaced until all related mechanical, electrical, and technology systems and equipment have been updated. This work includes any re-programming of control systems and the addition of tags and labels to new equipment, conduit, and cabling.
- D. Where changes are made to the fire alarm system programming, all signage changes must be made within two business days of those changes to ensure that the physical signs reflect the room or gate numbers in the programming.

1.3 SUBMITTALS

- A. **Product Data:**
For each type of product indicated include manufacturer's product specifications, anchor details and installation instructions for products used in sign fabrication, including paint products, lighting, and electrical devices.
- B. **Shop Drawings:**
1. Submit complete shop drawings for fabrication and installation of signs and related work including plans, elevations and details of components and attachments to other work. Indicate materials and profiles of each member, fitting, joinery, finishes, fasteners, anchorages and accessory items. Include anchor type, material and spacing for attachment to other work.
 2. For structural elements include details of cuts, connections, camber, holes and other pertinent data. Indicate welds by standard AWS symbols, and show size, length and type of each weld.
 3. Provide setting drawings, templates and directions for the installation of anchor bolts and other anchorages shall be installed in work described in other sections.
 4. Show sign mounting heights, locations of supplementary supports shall be provided under other sections, and accessories.
 5. Provide message list, typestyles, graphic elements, including tactile characters and braille, and layout for each sign.
 6. Include diagrams for power and control wiring.
- C. **Typefaces:** Submit digital file of live text in Adobe Illustrator of full typographic alphabets for each typeface and weight specified indicating origin of typeface.
- D. **Material and Finish Samples:** Submit seven (7) samples of each sign component material showing finishes, colors, surface textures and qualities of manufacture and design including graphics. Component material samples must be approved before completed product samples are fabricated. Size of samples shall be at least 6" x 6", but not larger than 8-1/2" x 11".
- E. **Sign Layouts:** Submit typical typographic layouts for each typical sign showing letter, word and line spacing at a minimum scale of 1 1/2" = 1'-0" for large signs, half full scale for small signs. Request digital artwork from the Port prior to preparing sign layouts.
- F. **Completed Product Samples:** Upon approval of all material and finish samples, submit full-size sample units of completed product for the following sign types. Do not begin fabrication on the remaining signs in each sign type until approval has been received from the Port of completed product sample. 100% completed and approved product samples may be installed. Remaining samples will be retained by the Port unless noted otherwise:
1. Completed product samples for each sign type.
- G. **Qualification Data:** For installer and fabricator, submit qualification data for firms and persons to demonstrate their capabilities and experience. Include list of completed projects identifying project name, address, designer and owner.
- H. **Periodic Shop Visits:** Allow review of signage by the Port during fabrication progress.
- I. **Maintenance Data:** Include cleaning recommendations. Provide information on methods and products for field paint repair and graffiti removal.

- J. Warranty: Special warranty specified in this section.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: For each sign form and graphic image process indicated furnish products from shop that employs skilled workers who custom-fabricate products similar to those required for this work and whose products have a record of successful in-service performance.
- B. The completed installation shall conform to all applicable federal, state and local codes, ordinances and regulations.
- C. Where specified materials or methods exceed minimum standards allowed by applicable codes, the more stringent requirement shall apply.
- D. Source Limitations for Signs: Obtain each sign type and graphic image process indicated from a single manufacturer.
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- F. Fabrication Observation: During pre-construction meeting, discuss construction milestones for fabrication observation, review, and approval. Fabricator shall supply review schedule and notify Port 15 days prior to shop visits, up to ten shop visits may be required. Photos of identified sign types shall be part of meeting record.
- G. Periodic Shop Visits: In addition to scheduled fabrication observation, allow review of signage by Port during fabrication progress.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver work to project site when adjacent finishes are complete and ready for immediate installation.
- B. Handling Materials and Equipment: Handle finished product in careful manner in order not to damage or mar surfaces of finished product or adjacent finished surfaces.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of work. Verify recess openings by field measurements before fabrication and indicate measurements on shop drawings.

1.7 WARRANTY

- A. Special Warranty: Manufacture's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Deterioration of metal and polymer finishes beyond normal weathering.
- b. Deterioration of embedded graphic image colors and sign lamination.
- c. Deterioration of applied vinyl graphics.
- d. Deterioration of lighting quality and consistency.
- 2. Warranty periods from substantial completion:
 - a. Vinyl graphics: 6 years.
 - b. Direct printed graphics: Minimum of 5 years against fading, cracking, chipping for interior use.
 - c. LED lighting array and driver as assembly: 5-year full replacement, non-prorated warranty is required on electronic components.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNIT

- A. Where electrical and low voltage devices are indicated, provide UL-listed components installed in compliance with applicable codes. Provide a UL listing on the completed assembly.
- B. FM2 Signcomp fram #3092 – front load soft.

2.2 PERFORMANCE REQUIREMENTS

- A. Fabrication Tolerances: Sign panels shall show no visual distortion.
- B. Panel Alignment at Butt Joints: Sign panels shall align parallel and flat without visible variation when viewed from the normal viewing distance.
- C. Fire-Test-Response Characteristics: Applied materials, 0.036-inch thick or more, shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 75 or less.
 - b. Smoke-Developed Index: 450 or less.

2.3 GRAPHIC COMPONENTS

- A. General:
 - 1. All graphics, including text, symbols and arrows shall be executed in such a manner that all edges and corners are true and clean.
 - 2. Type Sizes: As indicated on drawings for particular units.
 - 3. Typefaces: All work shall precisely replicate the typefaces as indicated on drawings.
 - 4. Typographic Spacing: Match letter, word and line spacing as indicated on drawings for all text configurations.
 - 5. Symbols and Arrows: Match artwork as indicated on the drawings.

B. Acrylic Sign Panels:

1. Fabricate units to configurations and sizes as indicated on reviewed shop drawings. Edges and surfaces shall be straight, true, smooth to the touch and not sharp.
2. Face for window signs: Optix NG Non-Glare Acrylic Heavy Matte.
3. Face for second surface graphic application: Plexiglas Perfexion Non-Glare Acrylic sheet ready for second surface (backside) application of graphics. Thickness as indicated on drawings.
4. Finish: As indicated on drawings.
5. Typeface: As indicated on drawings.
6. Provide strippable protective coating or wrapping.

C. Photopolymer Sign Panels:

1. Fabricate units to configurations and sizes as indicated on reviewed shop drawings. Edges and surfaces shall be straight, smooth and true.
2. Tactile and Braille Messages: Photo-chemically etch to create message to comply with ADA Guidelines. Braille dots shall be smooth and dome shaped. The Contractor shall be responsible for all text translation from English to Braille.
3. Assembly: Laminate photopolymer sign face to substrate backing with VHB adhesive.
4. Colors: Match colors as indicated on drawings.
5. Where clear photopolymer is used, clear coat sign to prevent yellowing.
6. Exterior Sign Locations: Fabricate using exterior grade photopolymer, Jet#388EX, or equal.

D. Pressure Sensitive Vinyl Graphics:

1. Provide pressure sensitive vinyl messages installed at finished surfaces in the sizes, mounting heights, letter spacing, and alignment indicated on drawings.
2. Sign messages shall be provided pre-spaced in type sizes, colors and typeface as shown on the drawings and specified herein. All lettering shall be executed in such a manner that all edges and corners of letterforms are true, clean, photographically precise and accurately reproduce the typeface. Messages shall be smooth and free of air bubbles, accurately reproduce the typeface. Messages shall be smooth and free of air bubbles, open cuts, bulging and foreign matter between message and application surface.
3. Material: High performance vinyl sheeting, for Pantone 2955 Blue: Oracal Series 631 Calendered Film Color #50 Dark Blue matte finish. For other colors: 3M Opaque Series 180, matte finish; ORACAL charcoal metallic 937 for glass, matte finish; Reflective Series 680, diamond grade retro-reflective white; or equal.
4. Color and Gloss: As indicated on drawings.

E. Digitally Printed Vinyl Graphics:

1. Substrate: 3M film TBD.
2. Printing: All graphics shall be printed consistently using solvent or UV ink jet printer output.
3. Lamination: 3M overlamine.
4. Resolution: true 1200 x 1200 dpi.
5. Install Conditions: Install area will have a constant minimum temperature of not less than 60 degrees for at least seven days prior to and throughout the installation period for seven days after.
6. Installation: Graphics will be installed by certified installer per manufacturer recommendation to preserve warranty.

- F. Etched Zinc Tactile Signs:
1. Material: Etched zinc, Photocast, manufactured by Braille-Tac division of Advance Corporation, or equal.
 2. Thickness: 1/16".
 3. Size: Indicated on drawings, without borders.
 4. Braille Message: Photochemically etch to provide 1/32" raised copy and Grade II Braille.
 5. Sanded Face Metal Tone Color: Silvertone.
 6. Background Color: As indicated in drawings.
- G. Digitally-Printed Fabric:
1. Material: 100% Polyester / Berger Textiles, Samba Twin FR.
 2. Finish: Direct digital print to fabric using UV treated inks. Matte finish with smooth, even distributed printed surface intended for back illumination.
 3. Weight: 195 g/m².
 4. Thickness: 250 um.
 5. Stretch Length: < 1,0%.
 6. Stretch Width: < 1,4%.
 7. Transmission Factor: 38%.
 8. Whitepoint: 94, 1, -6 L*a*b.
 9. Flame Retardancy: Tested and certified as flame retardant in accordance with the National Fire Protection Association 3 NFPA 701: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
- H. Direct Printed Graphics:
1. Construction/substrate: as indicated on drawings.
 2. Printing: All pictorials shall be printed on UV ink jet printer output at 6 color CMYK + Lt. Magenta + Lt. Cyan for maximum color gamut.
 3. Resolution: True 1200 x 1200 dpi or better.
 4. Double passes which show as double images, faint or fuzzy line and edge quality will not be accepted.
- I. Tactile Lettering:
1. Fabricate letters to configurations and sizes as indicated on reviewed shop drawings. Edges and surfaces shall be straight, smooth and true.
 2. Apply precision cut acrylic letters to face of door jamb with Very High Bond adhesive. Message to stand off 1/32" from face of door jamb surface.
 3. Braille Message: Press fit 1/16" diameter clear acrylic beads into pre-drilled holes to create Class II Braille. Contractor shall be responsible for all text translation from English to Class II Braille.
 4. Finish and color: As indicated on drawings.
 5. Typeface: As indicated on drawings.

2.4 METALS

- A. Steel: Provide steel in form indicated complying with ASTM requirements:
1. Tube: ASTM A 500, Grade B.
 2. Shapes and Plates: ASTM A 36.
 3. Sheet: ASTM A 240, Type 304.

- B. Stainless Steel:
 - 1. Sheet: ASTM A240, Type 304.
 - 2. Extrusion: ASTM A167.
 - 3. Wire: ASTM A5555.
 - 4. Bar: ASTM A267.
 - 5. Plate: ASTM A167.
- C. Aluminum:
 - 1. Sheets: ASTM B 209, 5052-H32.
 - 2. Extruded Bar and Shapes: ASTM B221, Alloy 6063-T6.
 - 3. Extruded Structural Pipe and Tube: ASTM B429.

2.5 MISCELLANEOUS PRODUCTS AND MATERIALS

- A. Fasteners: Of same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals which are corrosive or otherwise incompatible with metals joined.
 - 1. Fastening devices between dissimilar materials shall be 300 Series non-magnetic stainless steel.
 - 2. Material: Galvanically compatible with adjacent materials.
 - 3. Finish: Where exposed to view match adjacent finish.
 - 4. Provide fasteners of the type, size and spacing required for proper performance.
- B. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal shall be welded, complying with applicable AWS specifications, and as required for color match, strength and compatibility in the fabricated items.
- C. Adhesives:
 - 1. General: Provide low or no VOC adhesives.
 - 2. Very High Bond (VHB) Adhesive: 3M Company, product as recommended by manufacturer for type of use, materials and fabrication; or equal.
 - 3. Foam Tape: Double faced pressure sensitive foam tape, 3M Company, product in width and thickness as recommended by manufacturer for type of use, materials and fabrication; or equal.
 - 4. Silicone: FS TT-S-001543B, Class A, silicone sealant #1200, General Electric Company; or equal.
 - 5. Epoxy: Epoxy shall be two-component thermosetting epoxy adhesive with 100% solids content. Acceptable products include #NP-428, Miracle Adhesives Corporation; Chemlok #304, Hughson Chemical Division of Lord Corporation; or equal.
- D. Magnetic Tape.
 - 1. Self-adhesive magnetic tape, size as indicated on drawings.
 - 2. Self-adhesive ferrous metal.

2.6 METAL FABRICATION

A. General:

1. Use materials of size and thickness indicated or, if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.
2. For exposed work fabricate true to line and level with accurate angles and surfaces and straight sharp edges. Exposed edges shall be square unless otherwise shown. Ease corners and edges where exposed to public touch. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
3. Provide metal work composed of metals of the forms and types which comply with requirements of referenced standards and which are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, "oil canning", stains, discolorations or other imperfections on finished units will not be accepted.
4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, flat-head screws or bolts.
5. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.
6. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum shall contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Welded Construction:

1. Select type of weld for best appearance. Use concealed and plug welds as indicated on drawings.
2. Comply with American Welding Standards (AWS) Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Select weld sizes, sequence and equipment to limit distortions to allowable tolerances. Surface "bleed" of back side welding on exposed surfaces will not be accepted.
3. Assemble and weld structural system by methods which shall produce true alignment of axes without warp. Grind butt welds flush; dress all exposed welds, feather edges onto base material and polish as required for smooth painted surfaces.
4. Weld corners and seams continuously, complying with AWS recommendations. All exposed welds shall be clean, consistent and uniform in appearance. Grind and finish exposed welds smooth and flush to match adjacent contours and finish. Remove loose rust, mill scale, and spatter, slag or flux deposits.

D. Miscellaneous Trim and Hardware:

1. Provide shapes and sizes as required for profiles shown. Except as otherwise noted, fabricate units from structural shapes, plates and bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other work.

2. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous shapes as required for supporting of signage.
 3. Fabricate items to sizes, shapes and dimensions required.
- E. Holes for Other Work:
1. Provide holes required for securing other work to structural system, and for the passage of other work through steel members, as shown on the final shop drawings.
 2. Provide threaded nuts welded to framing, and other specialty items as shown to receive other work.
 3. Drill holes 1/16" oversize for field alignment and fitting.
 4. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning.
 5. Holes required for other work to be smooth and free of sharp edges so not to cut pass through cabling
- F. Shop Assembly:
1. Fabricate units to configurations indicated on reviewed shop drawings.
 2. Provide required text and artwork as indicated on reviewed shop drawings.
 3. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- G. Surface Preparation: After inspection and before finishing, clean metal work shall be painted. Clean metal by "wheel abrader" process or other method to achieve results defined by Steel Structures Painting Council (SSPC) for "SP-6 Commercial Blast Cleaning"
- H. Preparation for Shipping and Handling: Provide strippable protective coating or wrapping.

2.7 COATINGS FOR METAL, ACRYLIC, AND PHOTOPOLYMER

- A. Basis-of-Design Products: Provide the following over substrates indicated, or equal.
1. Aluminum: Provide manufacturer's recommended primers, catalysts and reducers. Match colors, gloss and finish as indicated in drawings.
 - a. Matthews Acrylic Polyurethane (MAP).
 - b. DuPont Imron Ultra Low VOC products.
 - c. Or equal.
 2. Steel: Provide manufacturer's recommended primers, catalysts and reducers. Match colors and gloss as indicated.
 - a. Matthews Acrylic Polyurethane (MAP).
 - b. DuPont Imron Ultra Low VOC products.
 - c. Or equal.
 3. Acrylic and Photopolymer: Match colors and gloss as indicated.
 - a. Matthews Tie Bond, 74-777SP or as recommended by manufacturer. Followed by Matthews Acrylic Polyurethane (MAP).
 - b. DuPont Imron Ultra Low VOC products.
 - c. Or equal.
 4. Clearcoat: Provide protective clearcoat over all finished surfaces, using clearcoat compatible with and manufactured by undercoat manufacturer or approved for use by undercoat manufacturer.
 - a. Matthews Acrylic Polyurethane (MAP), Super Satin Clear 290 228SP.

- b. DuPont Imron Ultra Low VOC products.
 - c. Or equal.
- B. Field Repair: Provide coating and application system recommended by manufacturer for field repair by untrained applicators employed by the Port.
- C. Application:
 - 1. Substrates shall be cleaned, and surface prepared as recommended by paint manufacturer.
 - 2. The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until previous coat has cured as recommended by coating manufacturer. Sand between coat applications where required to produce an even, smooth surface in accordance with coating manufacturer's directions.
 - 3. Apply additional coats when undercoats or other conditions show through final coat until the cured film is of uniform finish, color and appearance.
 - 4. Minimum Coating Thickness: Apply each material at not thinner than manufacturer's recommended spreading rate, as listed above. Provide a total dry film thickness of entire coating system as recommended by manufacturer, unless otherwise indicated.
 - 5. Apply an even film, free of cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections.
 - 6. Completed Work: Match approved samples for color, gloss, texture and coverage. Remove, refinish, or recoat work not in compliance with specified requirements.
- D. Color Schedule: Use colors as indicated on drawings to match samples provided by the Port.

2.8 ELECTRICAL COMPONENTS

- A. Include all required mounting accessories for wiring and devices as required for complete installation.
- B. Provide all electrical components, i.e. receptacles, disconnect switches, connectors, power supplies, converters, utilizing minimum #12 AWG THWN conductors, in cable assembly protected by metal cladding or installed in metallic conduit, with all connections complete and ready for connection to building power system, 120 volt, 20 amp 60 Hz, branch circuit.
- C. Install all electrical components in accordance with manufacturer installation instructions, and applicable codes and instructions as indicated elsewhere in the specifications.
- D. Refer to individual signage drawings for type of devices.
- E. Reference section 260533 for additional electrical component information.

2.9 LED LIGHTING

- A. General: Make connections at power supply and perform electrical work at sign light fixture. All work shall be installed in accordance with requirements of Division 26. LEDs and power supply shall be accessible for maintenance. Provide adequate ventilation for power source.

- B. White Illumination (Acceptable Products):
1. ZLight Super Bright LEDs, Z-Ultra2-Box, L70 Rating, White 6700K (for use behind printed fabric graphics).
 2. SloanLED Prism Mini, 6500K (for use in Top Light Bar).
 3. GE Tetra Power Max, White. Temperature TBD with product samples.
 4. SloanLED V-Series, White. Temperature TBD with product samples.
 5. LEDCONN LuxFIT Panel, 4100K (for use in Concessions Signage).
 6. Or equal.
- C. Acceptable LED Manufacturers:
1. ZLight Technology LLC
 2. GE Lighting Solutions Corporate Headquarters
 3. SloanLED.
 4. LEDCONN Corp.
 5. Or equal.
- D. Power Source:
1. High power factor, rapid start, energy efficient. UL listed Class2, electronic type LED driver shall be capable of 24-volt output with output power up to 80 watts (sign types FM and FM2). Universal AC input full range and up to 305 volts AC. Built-in active power factor correction function. All power sources shall be fully encapsulated with IP67 level and suitable for damp location.
 - a. L.T.F. UniDriver Series Dimmable LED Driver 3 300WDS300W-4002, 120-277VUniDriver Series, or equal.
- E. Dimming:
1. Signs shall be internally illuminated with dimming controls capable of 0% to 100% light output.
 2. Signs connected to lighting controller, shall be controlled by timer and dim in the evening and be brighter during the day. Final light output determined during testing.
- F. Driver and electronics deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10)
1. Flicker index shall be less than 5 percent at frequencies below 1000Hz.
- G. Testing: Upon completion of installation of sign light fixtures, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance, otherwise, remove and replace with new units and proceed with re-testing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that mounting surfaces to receive signage are properly prepared. Do not start work until conditions are satisfactory.
- B. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- C. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- D. Verify that anchorage devices embedded in permanent construction are correctly sized and located to accommodate signs.
- E. Verify that electrical service is correctly sized and located to accommodate signs.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install anchorage required for supporting signage.
- B. Protect mounting surfaces and adjacent areas against damage and discoloration caused by work in this section.

3.3 INSTALLATION

- A. General: Fabricator to confirm, develop, and list in shop drawings, mounting method for wall mounted signs using "Typical Mounting Surfaces" detail in drawings. Locate sign units and accessories where shown or scheduled, using mounting methods of the type described and in compliance with the manufacturer's instructions. Install sign units level, plumb and at the height indicated, with sign surfaces free from distortion or other defects in appearance. Notify Port of installation conflicts.
- B. Installation Alignment: Signs will be reviewed by Port for acceptance. Criteria will include plumbness, trueness, alignments and relationships with adjacent work.
- C. Mechanical Fastener Mounting: Install signs securely to wall with fasteners and anchoring devices as indicated on drawings and as specified.
- D. VHB Adhesive Mounting: Install signs with full sheet VHB adhesive where indicated on the drawings. Trim adhesive flush to exposed edges of material being installed.
- E. Foam Tape Mounting: Use 3M, or equal, product as specified for mounting signs to smooth, non-porous surfaces as indicated on the drawings. Do not use this method for vinyl-covered or rough surfaces. Position tape at back of sign for optimum performance and shall be hidden from view.
- F. Silicone Adhesive Mounting: Use silicone adhesive as specified to attach sign units to irregular, porous or vinyl-covered surfaces as indicated on the drawings. Use foam tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured. Remove visible adhesive.
- G. Field-Applied, Vinyl-Character Signs: Clean and dry substrate. Align sign characters in final position before removing release liner. Remove release liner in stages and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fishmouths. Remove carrier film without disturbing applied vinyl film.

- H. Bracket Mounted Units: Provide fittings and hardware as appropriate for mounting signs from ceiling, columns or walls. Attach brackets and fittings securely with fasteners and anchoring devices as indicated on drawings and as required for intended use.

3.4 ELECTRICAL CONNECTIONS

- A. Provide final hook-up of illuminated signs and electrical devices.
- B. Test operation of signs and identifying devices and adjust as needed to produce fully functioning units that comply with requirements.

3.5 PROTECTION AND REPAIR

- A. Protect finishes from damage during construction period, field handling and installation by use of temporary protective coverings. Protect adjacent surfaces from damage during field fabrication and installation. Remove protective covering at time of substantial completion.
- B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Touch up any exposed fasteners and connecting hardware to match color and finish of surrounding surface. Touch up damaged surfaces carefully, using airbrush technique where necessary. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

3.6 CLEANING

- A. Clean all exposed surfaces just prior to substantial completion in accord with manufacturer's written cleaning instructions. Protect units from damage until final acceptance.

END OF SECTION 101400

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Include:
 - 1. Solid surface toilet compartments (TC3).
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for concealed support members.
 - 2. Section 092216 "Non-Structural Metal Framing" for wall blocking.
 - 3. Section 095100 "Acoustical Ceilings" for metal panel ceilings interfacing with toilet compartments.
 - 4. Section 102800 "Toilet, Bath, and Laundry Accessories" for accessories mounted on toilet compartments.

1.2 COORDINATION

- A. Coordinate requirements for supports, blocking, reinforcing, and other supports concealed within wall to ensure that toilet compartments can be supported and installed as indicated.
- B. Coordinate installation of toilet compartments and fittings, inserts, rough-in frames, and anchoring devices that are anchored to, embedded in, or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Manufacturer's Installation Instructions: Indicate special procedures.
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of integrated, concealed reinforcement for hardware and panel-mounted items.
 - 3. Show locations of cutouts for compartment-mounted toilet accessories.
 - 4. Show locations of centerlines of toilet fixtures.
 - 5. Show ceiling grid, ceiling-mounted items, and overhead support or bracing locations.

- D. Coordination Drawing: Incorporate toilet compartment layouts in reflected ceiling plans, drawn to scale, coordinated.
 - 1. Coordinate with Section 095100 for requirements for interfaces of partitions with ceiling assemblies.
 - 2. Show items coordinated with each other, using input from installers of the items involved:
 - a. Suspended ceiling components, including panels and grid, interfacing with toilet partitions.
 - b. Additional support members to which partition elements are attached to and supported by suspension systems.
- E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.
- F. Delegated Design Submittals: For grab bars mounted on toilet compartment panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Include structural design calculations indicating compliance with specified structural-performance requirements.
 - 2. Where the manufacturer's standard product documentation includes structural calculations or third-party load testing data demonstrating compliance with the specified performance requirements, such documentation, prepared and certified by the manufacturer's professional engineer, may be submitted in lieu of a project-specific delegated design submittal, at Port's discretion for approval.
- G. Samples: Submit samples of partition panels, 6 by 6 inches in size illustrating panel finish, color, and sheen; include one edge profile routed for privacy.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For toilet compartments.

1.5 QUALITY ASSURANCE

- A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."
- B. Where design of members and connections is specified as part of the work of this section, structural analysis shall be by a structural engineer registered in Oregon.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. Obtain each type of toilet compartment type and finish from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 200 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Restraints: Provide wall and floor attachments in adequate strength for supporting partitions of sizes and configurations indicated.
- C. Structural Performance:
 - 1. Where grab bars are mounted on toilet compartments, design panels to be capable of withstanding a concentrated load on grab bar of at least 250 lbf applied at any direction and at any point, without deformation of panel.
 - 2. Wall hooks (tag 1033) shall support no less than 200 lbf applied at any direction, without deformation of panel.
- D. Regulatory Requirements: Comply with applicable provisions in ICC A117.1 for toilet compartments designated as accessible.

2.3 TOILET COMPARTMENTS

- A. Type (TC3) Toilet Compartment: Solid Surface, full height, floor mounted, overhead braced, no sightline joints.
 - 1. Product: Ironwood Manufacturing, Solid Surface Partitions or pre-bid approved equal.
 - a. Solid Surface Material, Product: Corian.
 - 1) Color: Verdant.
 - 2. Construction: Manufacturer's product standard, bonded double-sheet. Cast, nonporous, filled polymer with through body colors. Chemically bonded splices with finish edges matching faces.
 - a. Reinforce fabrications for hardware and for mounting, concealed in lamination.
 - 3. Door, Panel, and Pilaster Dimensions:
 - a. Thickness: 1 inch.
 - b. Door Width: As indicated, minimum 32 inches.
 - c. Door Width for ADA Use: 36 inch, outswinging, self-closing.
 - d. Panel Heights: Extending 1/2-inch inch from floor and ceiling.
 - 1) Provide transom panels where door heights indicate exceed operational hardware limits.

2.4 HARDWARE AND ACCESSORIES

- A. Door Hardware, Fittings, and Accessories: Manufacturer's standard profiles, operating hardware, anchors and accessories. Mount with through bolts.
 - 1. Materials and Finish:
 - a. Stainless Steel:
 - 1) Type 304 for fabricated units and ASTM A351 type CF8 for cast items.
 - 2) Finish: No. 4, satin brushed.
 - b. Aluminum:
 - 1) ASTM B209 for extrusions and plates and alloy appropriate for application.
 - 2) Finish: As specified.
 - a) Clear anodized, satin finish.
 - b) Powder coated in various colors selected by Port to match finish indicated.
 - 2. Astragal: Provide manufacturer's standard rabbeted no-sight edge profile or aluminum plate and flush fasteners.
 - 3. Port reserves the right to reject hardware samples not submitted and approved prior to procurement.
- B. Hardware in Section 102800 "Toilet Accessories":
 - 1. Items: For each compartment.
 - a. 1033 wall hook, mounted on panel. OFCI.
 - 1) Provide (2), 1/4-inch diameter stainless steel sexed bolts with tamper resistant heads for each.
 - b. 1060 wall bumper, mounted on panel.
 - c. 1065 occupancy stall indicator; for each partition door.
 - 2. Provide reinforcement at each unit attached to toilet compartment panels.
 - 3. Coordinate mounting and installation requirements.
- C. Hinges: Suitable for door sizes and weight.
 - 1. Provide separate closers or hinge types that swing door to a closed position for doors without closers.
 - 2. TC2: Stainless steel, continuous cam type.
 - 3. TC3: Manufacturer's standard aluminum continuous gear hinge, powder coat finished to match panel color.
- D. Latch and Keeper: Manufacturer's standard stainless steel, surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at toilet enclosures designated as accessible.
- E. Door Pull: Complying with regulatory requirements.
 - 1. Stainless steel with minimum 5-inch by 1-1/2-inches hand opening.
 - 2. Product: Jacknob.com; Door pull set 189373 or pre-bid approved equal.
 - a. Stainless steel, satin finished; 5-1/2-inch centers, 2-inches tall; back-to-back mounted on 3/4- to 1-inch doors, with torx-security fasteners.
- F. Closer: At full height door units. Manufacturer's commercial grade parallel arm closer, with adjustable backcheck for latching control and drop plate.

1. BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force of not more than 5 lbf.
 2. Drop Plate: Where required for operation and mounting on partition side. Aluminum plate. Sized for mounting closer with reinforcement for headrail installation. Color match to be selected by Port.
 3. Comply with Section 087100 "Door Hardware."
- G. Pilaster Shoes: Stainless steel welded sheet caps, height indicated.
- H. Bracket Fittings:
1. Full-Height (Continuous) Type: Manufacturer's standard design, stainless steel.
 2. Two-Ear Bracket: Inside partitions.
 3. One-Ear Brackets: At corners and partition panels facing room, with ear side of bracket oriented within partition enclosure.
 4. Clip: Stainless steel, for transom panels and other applications standard to manufacturer.
 - a. Rectangular clips sized to attach and support panels to pilasters and adequately support operating hardware attached to transom panels.
- I. Overhead Bracing: Manufacturer's standard continuous, aluminum head rail with antigrip profile.
1. Color and Finish: Clear anodized.
- J. Anchorages: Manufacturer's standard anchors and fasteners, with exposed fasteners of stainless steel and finished to match items they are securing, with theft-resistant-type heads.
1. Provide sex-type bolts for through-bolt applications.
 2. For concealed anchors, use stainless steel or hot-dip galvanized-steel and compatible with related materials or with required separator for use.

2.5 MATERIALS

- A. Aluminum: ASTM B221.
- B. Stainless Steel Sheet: ASTM A666/ASTM A666, Type 304.
- C. Stainless Steel Castings: ASTM A743/A743M.
- D. Solid Surface: Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
1. Superficial damage to a depth of 0.010 inch shall be repairable by sanding and/or polishing.
- E. Laminating Adhesive: Type and product by substrate manufacturer or approved for use by panel and laminating material manufacturer.
1. Solid Surface: Use solid surface manufacturer's hard seam adhesive in full bed, continuous and uniform layer.
 - a. Color-match Dupont Corian Joint Adhesive. No substitutions.

2.6 FABRICATION

- A. Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
 - 1. Confirm all door, side panel, pilaster and screen panel types and dimensions in shop drawings submittal prior to fabrication.
 - 2. Provide with no-sightline system consisting of door and pilaster lapped rabbeted edges on strike side of door and door and pilaster lapped edges on hinge side of door (unless continuous hinge is used).
 - 3. Integrate concealed steel reinforcement in panel substrates or within laminated construction, of adequate strength for the intended use and exposure, for support and attachment of hardware and surface-mounted items indicated to resist indicated forces.
 - 4. Reinforce during lamination for panel supported and mounted hardware:
 - a. Reinforcement: Provide concealed internal reinforcement for grab bars and wall hooks mounted on units of size and material adequate for panel to withstand applied downward load on grab bar when tested according to ASTM F446, without deformation of panel.
 - b. Tapping Reinforcement: Provide concealed reinforcement for tapping (threading) at locations where machine screws are used for attaching items to units.
 - c. Provide reinforcement at locations where accessories are mounted to panels and doors.
 - d. Provide reinforcement for hardware installed on single side where not through-fastened.
 - 5. Provide separate hardware reinforcement for surface mounting for operational hardware as required for function and attachment.
- B. Integrate manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pedestals and walls to suit floor and wall conditions.
- C. Door Size and Swings: Provide doors with minimum clear opening indicated for toilet enclosures, standard and designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels or Screens: 1/2 inch.
 - b. Panels or Screens and Walls: 1 inch.
 - 2. Full-Height (Continuous) Brackets: Secure panels or screens to walls and to pilasters with full-height brackets.
 - a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten; conceal with shoe caps. Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions or required for conditions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Mounting Toilet Accessories: Comply with Section 102800 and performance requirements.
 - 1. Door Stops: Do not install on doors. Install on side panel, to hit near door latch edge, not on latch mechanism and not where it will be either stood or hung on.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on outswinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Corner guards (CG1).
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door protection units.
 - 2. Section 092900 "Gypsum Board" for substrate preparation.
 - 3. Section 096500 "Resilient Flooring" for substrate preparation.

1.2 COORDINATION

- A. Coordinate corner guards with base installation.
- B. Coordinate required surface preparation for mounting corner guards.

1.3 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For each type of wall and door protection, indicating type, size, and locations.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show accessories.
- C. Samples for Verification: Submit for each type of exposed finish of the following products, prepared on samples of size indicated below:
 - 1. Corner Guards: 6 inches long. Include example top caps if applicable.
- D. Maintenance Data: For each type of wall product.
 - 1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of wall protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of wall protection sheet goods under anticipated use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.5 MOCKUPS

- A. Build mockups to verify selections, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 1. Build mockups of typical installation for each wall and door protection type.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.7 FIELD CONDITIONS

- A. Field Measurements: Where wall protection units are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication or modification, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of wall and door protection units that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
 - b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.2 CORNER GUARDS

- A. Type (CG1): Stainless Steel Corner Guard:
 1. Product: Inpro, Surface Mount Stainless Steel Corner Guard or equal by Schluter, Construction Specialties or Nystrom.
 2. Material: Type 304 stainless steel.
 3. Thickness: 16 gauge.
 4. Wing Size: 1-1/2 inch.
 - a. Factory-bent edge of wing to allow for sealant.
 5. Height: 8'-6" long, full height to ceiling and above base, unless otherwise indicated.
 - a. Installed above wall base. Do not install under scheduled base.
 - b. Extend to top of finishes above ceiling where wall-to-ceiling gap occurs.
 6. Attachment Method: Adhered.

2.3 ACCESSORIES

- A. Accessories, General: Provide all accessories required for complete installation.
 1. All adhesives and sealant accessories used in installation shall meet applicable requirements of sustainability as detailed in Section 016116 "VOC Content Restrictions".
- B. Adhesive: As recommended by protection product manufacturer and compatible with and with sufficient bond strength for guards and substrates.
 1. Inrpo Bond 535 or equal.
- C. Sealant: Single component, neutral cure, 100-percent silicone recommended for use by sealant manufacturer and compatible with substrates. Clear or matching corner guard, as selected by Port.

2.4 FABRICATION

- A. Fabricate wall and door protection in accordance with requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges finished. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.5 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 - 1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.
- C. Prime protection unit and substrates for adhered units.

3.3 INSTALLATION

- A. Install wall protection in accordance with manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.
- B. Mounting Heights: Install wall protection in locations and at mounting heights indicated on Drawings.
- C. Apply adhesive following manufacturer's instructions, in straight, vertical beads.
- D. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation. Install accessories per manufacturer's recommended method.
- E. Sealant: Apply sealant according to Section 079200 as follows:
 - 1. To top of corner guards where tops are at or below 6'-8" from finished floor.
 - 2. Along sides where voids are present and visible.
 - 3. Tool clean and straight.

3.4 CLEANING

- A. Remove excess adhesive using methods and materials recommended in writing by manufacturer.
- B. Immediately after completion of installation, clean covers and accessories using a standard household cleaning agent.
- C. Repair damaged finishes. Replace units where repair is not acceptable to Port or damage cannot be repaired.

END OF SECTION 102600

SECTION 102800 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes toilet room accessories.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Items for mounting on toilet partitions include, but are not limited to, the following:
 - a. Grab bars, 1013x.
 - b. 1033.
 - c. 1060.
 - d. 1065.
- C. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing", Section 061053 "Miscellaneous Rough Carpentry" and Section 092216 "Non-Structural Metal Framing" for blocking and wall framing.
 - 2. Section 055000 "Metal Fabrications" for steel spacers.
 - 3. Section 057000 "Decorative Metal" for formed metal shrouds provided for this Section.
 - 4. Section 066116 "Solid Surfacing Fabrications" for solid surfaces receiving toilet accessories.
 - 5. Section 088300 "Mirrors" for frameless mirrors.
 - 6. Section 093000 "Tiling".
 - 7. Section 102113 "Toilet Compartments."

1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Coordinate installation of toilet accessory components, inserts, rough-in frames, and anchoring devices that are anchored to, embedded in, or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
 - 1. Coordinate delivery of such items to the work site and electronic transmittal for distribution.
 - a. Provide to solid surface fabricators for shop cutting openings.

1.3 SUBMITTALS

- A. Product Data: For each product.
 - 1. Include data describing size, finish, details of function, rough opening requirements, and attachment methods.
 - 2. Include electrical characteristics.

- B. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention, clearances, operation, and power connections and requirements.
- C. Samples: For each exposed product and for each finish specified, manufacturer's standard sizes.
- D. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For accessories to include in operation and maintenance manuals.
 - 1. Product Schedule: For each operating accessory item, include the following:
 - a. Designation indicated on Drawings.
 - b. Locations using room designations indicated.
 - c. Manufacturer's name and model number.
 - d. List of factory-authorized service agencies including addresses and telephone numbers.
 - e. Include electrical characteristics.
 - f. Schedule for maintenance of operating components.
 - g. Spare parts catalogs for each accessory with operating components.
 - h. Cleaning procedures, methods and materials for exposed surfaces.
 - i. Replacements part numbers, for dispenser, disposal inserts, filters, etc.

1.5 MAINTENANCE MATERIALS

- A. Extra Stock Material: Furnish extra materials, compatible and manufactured for toilet accessories that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sharps Disposal Insert (1023): One for each cabinet installed in addition to scheduled quantities.
 - 2. Safety Strap Kit (1095): Provide one kit for each station installed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver toilet accessories and accessory materials to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Handle accessories carefully to avoid damaging units and finishes.

PART 2 - PRODUCTS

2.1 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. Regulatory Requirements, Accessibility: Comply with ICC A117.1.
- C. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
 - 2. Wall Hooks: Installed units are able to resist 200 lbf concentrated load applied in any direction.

2.2 PRODUCTS

- A. Source Limitations: Provide accessories from single-source manufacturers of each type scheduled.
- B. Toilet Accessories Schedules: See Part 3.
 - 1. All B-# products are by Bobrick.
 - 2. OFCI: Owner (Port)-Furnished, Contractor Installed:
 - a. OFCI products contribute to totals required for the Project.
 - b. Coordinate procurement and storage with Port.
 - c. Damaged products shall be the responsibility of the Port to replace or replaced by contract change at Port's discretion.
 - 3. CFCI, Contractor Furnished, Contractor Installed:
 - a. Products: As scheduled, or pre-bid approved equal.

2.3 ACCESSORIES AND MATERIALS

- A. Accessories, General: Factory assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. All adhesives and sealants used in installation shall meet applicable requirements in Section 016116 "VOC Content Restrictions".
 - 2. Stainless steel custom fabrications are provided to comply with Section 057000 "Decorative Metal" and installed to comply with this Section.
- B. Keys: Provide 3 keys for accessories to Port; master key all lockable accessories.
- C. Fasteners, Screws, and Bolts: Provide anchors for each accessory as indicated and as required for installation. Select anchor type suitable for substrates, hot-dip galvanized or stainless steel.
 - 1. Exposed or accessible: Stainless steel, tamper-proof, security type.
 - 2. Coordinate with fastener types installed on other work, for matching.
 - a. For toilet partitions, match its hardware and fittings.

3. Provide stainless steel or painted to match unthreaded spacers at tile surfaces, depth matching assembly from face of backer board over solid backed blocking to face of finish with holes sized for anchors.
 - a. Grab Bars: Match diameter of and to align with mounting plates of grab bars.

- D. Adhesive: Two component epoxy type, waterproof.
- E. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.
- F. Joint Adhesive: Manufacturer's standard one- or two-part adhesive that results in inconspicuous, nonporous joints.
- G. Sealant: Manufacturer's standard mildew-resistant, FDA-compliant, UL-listed sealant. Silicone sealant will not be allowed.
- H. Stainless Steel Sheet: ASTM A666, Type 304.
- I. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- J. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

2.4 FINISHES

- A. Stainless Steel: Satin no. 4 finish, unless noted otherwise.
- B. Back paint components where contact is made with building finishes or other construction to prevent electrolysis.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation. Verify adequate blocking is installed for to resist forces indicated.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings for locations.

3.2 PREPARATION

- A. Provide templates and rough-in measurements as required for installation of accessories.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings.
- D. Place spacers for anchoring, inset in tile for items resisting force.
 - 1. Place over solid-backing to transfer forces, at each anchor point, for accessory bearing and without reduction of required resistance.
 - 2. Provide 1/4 sealant joint around spacer between finishes.
 - 3. Coordinate that required openings in finishes are cut prior to finish placement and not modified in place.
 - a. Cut openings in finish prior to placement of finish.
- E. Grab Bars: Install to resist 250-lbs force applied to grab bar at any point in any direction.
- F. Wall Hooks: Install to resist 200-lbs forces applied to wall hooks, in any direction.

3.4 TOLERANCES

- A. Maximum Variation from True Position: 1/4 inch.
- B. Maximum Variation from Level and Plumb: 1/8 inch.

3.5 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

3.6 TOILET ACCESSORIES SCHEDULES

OFCI – TOILET ACCESSORIES			
TAG	ITEM/ DESCRIPTION	MODEL / MANUFACTURER	QUANTITY (each)
1033	Wall Hook	Stainless steel. Mounting hardware provided by installer – see CFCI 1033-MNT.	(1) Per toilet stall and where indicated. Coordinate quantities required with Port.

--Specification continues next page--

CFCI – TOILET ACCESSORIES			
TAG	DESCRIPTION	MODEL NUMBER/ MANUFACTURER	NOTES
1012	Toilet Seat Cover Dispenser	B-3013	Recess mounted behind toilet as access to plumbing chase. Reinforce opening.
1013A	Grab Bar – 18” L	B-6806.99x18	
1013B	Grab Bar – 36” L	B-6806.99x36	
1013C	Grab Bar – 42” L	B-6806.99x42	
1014	Toilet Tissue Dispenser	B-4288	
1015	Sanitary Napkin Disposal	B-270	
1016	Roll Towel Dispenser	B-29744	Provide AC Adapter B-3974-57
1017	Hand Dryer	Toto HDR111#SS	
1020	Paper Towel Dispenser with Waste Receptacle	B-3974	Provide AC Adapter B-3974-57
1021	Paper Towel Dispenser	B-29744	Standalone Recess dispenser.
	AC Adapter	B-3974-57	Mount under
1023	Sharps Disposal Cabinet, Recessed	B-35016	
	Insert, Sharps Disposal	Becton, Dickinson and Co, Model 305443	Provide (1) disposal inserts for each cabinet.
1024	Tampon/Sanitary Napkin Dispenser	B-3706C	With trim flange. Free – no coin operation. With custom shroud to prevent theft.
	Shroud, custom	Stainless steel, as indicated.	Fabricated under 057000.
1025	Foam Soap Dispenser System, 3 to 5 lav-mounted sinks in a row.	B-830 SureFlo Foam Soap System	B-830 Foam Soap Cabinet (1 per sink grouping, 5 sinks max) B-833-359 Foam Dispenser Spout 4” with swivel assembly (1 per sink) B-830-341 Connector Kit (1 per sink) B-82512 Foam Green Soap Box (1 per sink grouping, 5 sinks max)
1026	Foam Soap Dispenser, wall mounted	B-26637	

1027	Foam Soap Dispenser, 1 to 2 lav-mounted sinks in counter	B-823	Foam dispenser with 4" Spout 34oz. top filling container
1030	Self-Retracting Step	Step-N-Wash SNW-SS 975B	
1033 MNT	Mounting hardware for OFCI 1033	Provided by installer of unit, (2) each wall hook.	Wall: #12 stainless steel screw; wood lag with 1-1/2-inches into wood or self-drilling with 1/4-inch into metal blocking. Toilet Partition: See 102113.
1034	Baby Changing Station, recessed wall-mounted	Koala Kare KB110-SSRE	
1035	Baby Changing Station, recessed counter	Koala Kare KB112-01 RE	
1036	Liner Dispenser, Changing Station	Foundations, 200-SSLD dispenser	Stainless steel. Required at recessed counter changing station Tag 1035.
1038	Mop Holder with Shelf	B-239 x 34	
1039	Shelf	B-295 x 16	
1050	Flush Ring Pull	Baldwin 0394-260	
1060	Wall Bumper, Stainless Steel	Ives WS406/4070CVX	US32D finish. Provide for all in-swinging toilet partition doors and out-swinging doors where door contacts wall. Coordinate with toilet partition manufacturer.
1065	Occupancy Stall Indicator	Peep No More	Stainless steel. www.peepnomore.com
1070	Trash Receptacle, inside cabinet	Tough Guy 4PGU6	16 gallon, gray, nominal 11" wide, 20" depth, 25" tall, includes handles in depth.
1071	Countertop Gromet at Trash	Mockett TM1A6"	6" diameter stainless steel ring
1095	Safety Strap Kit (Extra Stock)	Koala Kare 285-KIT (for KB112, tag 1035)	See Part 1 "Maintenance Materials"

END OF SECTION 102800

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The intent of the Division 21 specifications and the accompanying drawings is to provide complete and workable fire suppression systems as shown, specified and required by applicable codes. Include all work specified in Division 21 and shown on the accompanying drawings.
- B. The drawings that accompany the Division 21 specifications are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Architectural reflected ceiling plan drawings indicate suggested sprinkler head placement. Follow the drawings as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions from measurements taken at the building, subject to approval, and with no additional cost to the Port.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 017329, Cutting and Patching
- B. Section 024119, Selective Interior Demolition
- C. Section 078400, Firestopping
- D. Section 083100, Access Doors and Panels
- E. Section 099100, Painting

1.3 REFERENCES

- A. FM: FM Global
- B. NEMA: National Electrical Manufacturers Association
- C. OR-OSHA: Oregon Occupational Safety and Health Administration

1.4 SUBMITTALS

- A. General:
 - 1. Comply with the requirements of Section 013300, Submittal Procedures, and the additional requirements specified herein.

B. Shop Drawings:

1. The contract drawings indicate the general layout of the piping, ductwork and various items of equipment. Coordination with other trades and with field conditions is required. For this purpose, submit shop drawings of all installations not detailed on the contract drawings, and of all changes to the contract drawings.
2. Shop drawings shall be new drawings prepared by the Contractor and shall not be reproductions or tracings of the contract drawings. Conflicts shall be resolved through BIM. Shop drawings shall be the same size as the contract drawings with title blocks similar to the contract drawings. Shop drawings shall identify the related contract drawing number or related reference drawing. Shop drawings shall be fully dimensioned, including both plan and elevation dimensions. Do not use shop drawings to make scope changes.
3. Shop drawings shall include but not be limited to:
 - a. Sprinkler floor plans to a minimum of 1/8" = 1'-0" scale.
 - b. Sections of congested areas to a minimum of 1/4" = 1'-0" scale.
4. Submit shop drawings for review as required by the contract documents. Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field, or when there is a question as to whether contract documents are being complied with or the design intent is being met.

C. Product Data:

1. Submit product data for review on all scheduled pieces of equipment, equipment requiring electrical connections or connections by other trades, and as required by the contract documents. Include manufacturer's detailed shop drawings, specifications, and data sheets. Data sheets shall include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures and similar data. Manufacturer's abbreviations or codes are not acceptable.
2. List the name of the motor manufacturer and service factor for each piece of equipment.
3. Indicate equipment operating weights including bases and weight distribution at support points.
4. In the case of equipment specified by specific catalog number, such as wiring devices, time switches, valves, etc., a statement of conformance will suffice.

D. Operation and Maintenance Data:

1. Submit operation and maintenance data for review on all scheduled pieces of equipment, and as required by the contract documents.

1.5 QUALITY ASSURANCE

- A. Materials and equipment shall be new. Work shall be of good quality, free of faults and defects.
- B. All equipment shall fit in the space provided.
- C. Systems shall be built and installed to deliver their full rated capacity at the efficiency for which they were designed.
- D. Systems shall operate at full capacity without objectionable noise or vibration.
- E. Materials and Equipment:
 1. Each piece of equipment provided shall meet all detailed requirements of the drawings and specifications and shall be suitable for the installation.

2. Where two or more units of the same class of equipment are provided, use products of the same manufacturer; component parts of the entire system need not be products of the same manufacturer.
- F. Workmanship:
1. Install all materials in a neat and workmanlike manner.
 2. Follow manufacturer's directions. If they are in conflict with the contract documents, obtain clarification before starting work.
- G. Cutting and Patching:
1. Comply with Section 017329.
 2. Cutting, patching and repairing for the proper installation and completion of the work specified in this division, including plastering, masonry work, concrete work, carpentry work, firestopping, and painting, shall be performed by skilled craftsmen of each respective trade in conformance with the appropriate division of work. Additional openings required in building construction shall be made by drilling or cutting with prior approval for each location in building structure.
 3. Fill holes which are cut oversize so that a tight fit is obtained around the objects passing through.
 4. Do not pierce beams or columns without permission of the Port and then only as directed.
 5. New or existing work that is cut or damaged shall be restored to its original condition. Where alterations disturb existing finishes, the surfaces shall be repaired, refinished and left in condition existing prior to commencement of work.

1.6 PROJECT CONDITIONS

- A. Coordinate exact requirements governed by actual work conditions. Check all information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.
- B. Comply with the requirements of Section 017000, Execution Requirements, for investigation prior to penetration of floor slabs.

PART 2 - PRODUCTS

2.1 ACCESS PANELS

- A. Provide access panels where indicated and where required to access valves, switches, and other appurtenances requiring operation, service, or maintenance. Review locations prior to installation. Comply with the requirements of Section 083100.

2.2 PIPE SLEEVES

- A. Interior Wall and Floor Sleeves: 18-gauge galvanized steel.
- B. Exterior Wall Sleeves: Cast iron.

- C. On-Grade Floor Sleeves: Cast iron.

2.3 FLOOR, WALL, AND CEILING PLATES

- A. Provide stamped split-type plates as follows:
 - 1. Floor Plates: Cast brass, chromium plated.
 - 2. Wall and Ceiling Plates: Spun aluminum.

2.4 SEALANT

- A. General Purpose: Tremco Dymeric Sealant, or equal.
- B. Floor Penetration Sealant: Hydro Ban Sealant by Laticrete, or equal.
- C. Firestop Sealant: See Section 078400.

2.5 MACHINERY GUARDS

- A. Provide guards for protection on all rotating and moving parts of equipment.
- B. Provide shaft holes in guards for easy use of tachometers.
- C. All guards shall meet OR-OSHA requirements including back plates.

2.6 ELECTRICAL EQUIPMENT

- A. General: All equipment and installed work shall be as specified under Division 26, Electrical.
- B. Motors:
 - 1. Motors shall be furnished as integral part of driven equipment. Motors shall be drip-proof induction type with ball bearings. Motors 1 hp and above shall be NEMA Premium Efficiency type, except for emergency equipment motors. Motors shall be built to NEMA standards for the service intended. The motors shall be rated for the voltage specified, suitable for operation within the range of 10 percent above to 10 percent below the specified voltage. Energy efficient motors shall be Century E-plus 3, Baldor Super E, TECO-Westinghouse MAX E-2, General Electric X\$D, Toshiba EQPIII, or equal.
 - 2. Motors 1/2 hp and Larger: 3-phase, 60 cycle, 460V, service factor of 1.15, unless specifically noted otherwise.
 - 3. Motors 1/3 hp and Below: 1-phase, 60 cycle ac, 115V unless specifically noted otherwise, complete with integral thermal protection.
 - 4. Provide motors on belt drive equipment of nominal nameplate horsepower with not less than 120 percent of equipment brake horsepower required for performance specified.
 - 5. Motors shall have built-in thermal overload protection or be protected externally with separate thermal overload devices with low-voltage release or lockout. Hermetically sealed motors shall have quick trip devices.

- C. Starters: See Division 26, Electrical. Starters shall be suitable for performing the control functions required, with the exception of self-contained equipment and where the starters are furnished as part of the control package.
- D. Equipment Wiring: Interconnecting wiring within or on a piece of mechanical equipment shall be provided with the equipment unless shown otherwise on the drawings. This does not include the wiring of motors, starters and controllers specified in Division 26, Electrical.

PART 3 - EXECUTION

3.1 DEMOLITION AND SALVAGE

- A. Prior to any demolition activities, coordinate safe-off of live utilities with the Port.
- B. Remove or relocate fire suppression system piping, wiring, devices and other equipment encountered in existing areas affected by this work as indicated on the drawings.
- C. Protect equipment identified to be salvaged. Remove salvaged equipment prior to demolition of adjacent services. Arrange with the Port for storage and return of salvaged equipment.
- D. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations. Prior to demolition, verify that demolished services will not affect the operation of existing systems that are to remain and notify the Port.
- E. Demolition Service/System Requirements:
 - 1. Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical systems serving areas to be selectively demolished.
 - 2. Demolish all service back to nearest active main or point of future connection as indicated. Verify with Port extent of demolition prior to proceeding if extent is not clear.
 - 3. The Port will arrange to shut off indicated services/systems when requested by the Contractor.
 - 4. Where demolished systems contain a regulated chemical, the systems shall be drained with contents captured and properly disposed of prior to demolishing the systems. Coordinate with the Port regarding environmental regulations.
 - 5. If services/systems are required to be removed, relocated, or abandoned: Before proceeding with selective demolition, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 6. Remove all accessories associated with removed utilities including supports, hangers, braces, clips, etc., in their entirety.
 - 7. Patch penetrations of walls and floors related to demolished services restoring existing fire separations, assembly ratings, and waterproofing membranes.

3.2 SYSTEM WATER DISPOSAL

- A. Do not drain water from systems treated with chemicals into the sanitary or storm sewers without written approval from the Port.

3.3 ACCESS PANELS

- A. Install in accordance with manufacturer's recommendations, coordinated with architectural features. Review intended locations with the Port prior to installation.

3.4 SLEEVES

- A. General:
 - 1. Lay out work prior to concrete forming. Do all cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.
 - 2. All core-drilled penetrations shall be sleeved, unless detailed otherwise on the drawings.
 - 3. Sleeves shall be large enough to allow clearance around pipe in accordance with NFPA 13. When pipe is insulated, insulation shall pass continuously through sleeve with 3/4-inch clearance between insulation and sleeve.
- B. Interior Wall Sleeves:
 - 1. Pack with fiberglass insulation.
 - 2. Terminate sleeve flush with face of wall unless indicated otherwise.
- C. Below-Grade Exterior Wall Sleeves: Sleeves shall be large enough to allow for caulking and made watertight. Caulk from outside using link-seal modular wall and casing seal or lead and oakum. Secure sleeves against displacement.
- D. Above-Grade Exterior Wall Sleeves: Similar to interior wall sleeves, except caulk outside with sealant.
- E. Sleeves Through Floors:
 - 1. Floor sleeves shall extend 1 1/2 inch above finished floor, except waste stacks using carriers shall have sleeve flush with floor.
 - 2. Do not support pipes by resting pipe clamps on floor sleeves. Provide supplementary members so pipes are floor-supported.
 - 3. Penetrations shall be made watertight by sealing gap between sleeve and the floor with floor penetration sealant as specified in Part 2.
- F. Sleeves Through Fire-Rated Floors: Install the same as sleeves through floors, except:
 - 1. Make penetrations through floor watertight by sealing gap between sleeve and floor with floor penetration sealant as specified in Part 2, and
 - 2. Provide firestopping system both inside and outside of sleeve as specified in Section 078400 and in accordance with recommendations of FM Global.
- G. Sleeves Through Fire-Rated Walls: Provide firestopping system as specified in Section 078400 and in accordance with recommendations of FM Global.
- H. On-Grade Floor Sleeves: Same as for below-grade exterior wall sleeves, except caulked from inside.
- I. Sleeves Through Roof: Extend 8 inches above roof.

3.5 FIRESTOPPING

- A. Comply with the requirements of Section 078400.
- B. Provide fire-rated assemblies at all penetrations of 1 hour or more.

3.6 CLEANING

- A. Clean equipment, piping and appurtenances of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

3.7 EQUIPMENT PROTECTION

- A. Keep pipe and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect piping, conduit, equipment, and apparatus against dirty water, chemical, or mechanical damage both before and after installation. Restore damaged or contaminated piping, conduit, equipment, and apparatus to original conditions or replace at no additional cost to the Port.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.8 ACCESSIBILITY

- A. Conveniently locate control panels, hardware and devices, valves, gauges, and other equipment or specialties requiring frequent reading, adjustments, inspection, repairs, or removal and replacement.
- B. Install gauges to be easily read from floors, platforms, and walkways.
- C. Provide access panels in linear metal, wood slat, gypsum board, or other hard ceilings and walls to permit convenient access to valves, switches, and other significant maintenance components.

3.9 FLOOR, WALL AND CEILING PLATES

- A. Install plates on piping passing through finished walls, floors, ceilings, partitions and plaster furrings. Plates shall completely cover opening around pipe.
- B. Secure wall and ceiling plates to pipe, insulation, or structure.
- C. Plates are not required in mechanical rooms or unfinished spaces.

3.10 ELECTRICAL EQUIPMENT

- A. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in the dedicated electrical space around electrical equipment.
- B. The area above the dedicated electrical space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks, or breaks in such foreign systems.
- C. Protect outdoor electrical equipment from accidental spillage or leakage from piping systems.

3.11 EQUIPMENT CONNECTIONS

- A. Make final connections to equipment in accordance with manufacturer's instructions, shop drawings, and as indicated.
- B. Piping connections shall be independently supported to prevent undue strain on equipment.

3.12 PAINTING

- A. Comply with the requirements of Section 099100.
- B. Equipment Rooms and Finished Areas:
 - 1. Insulation: Not painted.
 - 2. Miscellaneous Iron Work, Structural Steel Stands, Uninsulated Tanks, Equipment Bases: Paint one coat of black enamel.
 - 3. Steel Valve Bodies and Bonnets: Paint one coat of black enamel.
 - 4. Brass Valve Bodies: Not painted.
 - 5. Equipment Without Factory Finish: Paint one coat of grey machinery enamel. Do not paint nameplates.
 - 6. Hangers and Uninsulated Piping: Not painted.
- C. Concealed Spaces (above ceilings, not visible):
 - 1. Insulation: Not painted.
 - 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Valve Bodies and Bonnets: Not painted.
- D. Sprinkler Piping:
 - 1. Concealed From View: Not painted.
 - 2. Exposed to View: Paint pipe and hangers exposed to view, including equipment spaces, with one coat approved rust inhibiting primer. Paint finish coat as specified in Section 099100.
 - 3. Alarm Gong: Factory paint with two coats of red enamel.
- E. Exterior Black Steel: Wire brush and apply two coats of rust-inhibiting primer and one coat of grey exterior machinery enamel.

3.13 POWER-ACTUATED FASTENERS

- A. Power-actuated fasteners are not allowed except as otherwise noted in section 017000.

3.14 ADJUSTING AND CLEANING

- A. Before operating equipment or systems, make thorough checks to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made properly and that recommended lubricants have been used.
- B. Use particular care in lubricating bearings to avoid blowing out seals from over-lubrication. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment or replace with new equipment as directed by the Port.

END OF SECTION 210500

SECTION 210523 – GENERAL DUTY VALVES FOR WATER-BASED FIRE SUPPRESSION PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes general duty valves, specialty valves, and safety shutoff valves.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 210553, Identification for Fire Suppression Piping and Equipment

1.3 REFERENCES

- A. MSS: Manufacturers Standardization Society

1.4 SUBMITTALS

- A. Submit product data, shop drawings, and maintenance data for products specified in this section.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All instances of each valve type shall be of one manufacturer.
- B. All gate, butterfly, and check valves shall meet MSS standards.
- C. Bronze gate and check valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Full lug and grooved butterfly valves shall be suitable for bi-directional dead-end service at full rated pressure without use or need of a downstream flange.
- E. Valves in insulated piping: Valves shall have 2-inch stem extensions and the following features:
 - 1. Gate Valves: Rising-stem type.
 - 2. Butterfly Valves: Shall have extended necks.

2.2 CHECK VALVES

- A. Acceptable Manufacturers: Apollo, Crane, Hammond, Nibco, or equal.

- B. Horizontal Bronze Swing Check: Bronze body, bronze-mounted, screwed, TFE disc, 150 psi SWP, 300 psi CWP, Nibco T-443-Y. With soldered ends, Nibco S-433-Y.
- C. Horizontal Bronze Swing Check, High Pressure: Bronze body, bronze-mounted, screwed, regrinding bronze disc, 300 psi SWP, 600 psi CWP, Nibco T-473-B.
- D. Horizontal Iron Swing Check: Iron body, bronze-mounted, flanged, regrinding bronze disc and seat ring, 125 psi SWP, 200 psi CWP, Nibco F-918-B.
- E. Vertical and Silent Check Valves: Iron body, stainless steel spring, wafer type, globe style. To fit class 125 flanges, 200 psi CWP, Nibco W-910-B-LF, with flanged ends, Nibco F-910-B. To fit class 250 flanges, 400 psi CWP, Nibco W-960-B-LF, with flanged ends, Nibco F-960-B.

2.3 BUTTERFLY VALVES

- A. Acceptable Manufacturers: Apollo, Nibco, Keystone, Victaulic, or equal.
- B. Ductile iron body, aluminum-bronze disc and one-piece stainless-steel shaft, copper bushing, with lever handle and locking feature on valves 6 inches and smaller, gear operator on valves 8 inches and larger; treaded lug or grooved end type, EPDM liner or disc, 200 psi CWP, Nibco LD 2000 (lug style), Nibco GD-4765 (grooved ends). Do not use fasteners and pins to attach stem to disc.

2.4 SPECIALTY VALVES

- A. Acceptable Manufacturers: Nibco, Apollo, or equal.
- B. Drain Valves: Bronze ball valve, garden hose end, cap and chain 3/4-inch size, bronze cast body, chrome-plated full port ball, threaded, with handle, Teflon seat, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, 600 psi CWP, Nibco T-585-70-HC.
- C. Gauge Cocks: Brass, tee handle, male to female, 200 psi working pressure, 1/4-inch, Conbraco 41 series.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide valves at connections to equipment where shown or required for equipment isolation.
- B. Install all valves accessible and same size as connected piping.
- C. Provide separate support for valves where necessary.
- D. Grooved type valve end connections may be used in lieu of flanged on services where mechanical pipe couplings and fittings are specified.

- E. Provide drain valves in all low points in the piping system, at coils and equipment and as indicated.

3.2 APPLIED LOCATIONS

- A. Fire Protection Service and Fire Pumps:
 - 1. In piping 2 inches and smaller, bronze gate valve, high pressure, fire protection.
 - 2. In piping 2 1/2 inches and larger, iron gate valve, high pressure, fire protection.
 - 3. UL-approved butterfly valves.
 - 4. Horizontal bronze swing check, high pressure.
- B. Provide gauge cock for all pressure gauges.

3.3 VALVE IDENTIFICATION

- A. Identify valves to indicate their function and system served.

END OF SECTION 210523

SECTION 210529 – HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the following:
 - 1. Hangers, supports, and anchors for fire protection equipment, tanks, and piping systems.
 - 2. Supplementary steel for support or attachment of fire protection tanks, equipment, and piping to general construction elements of the project.

1.2 REFERENCES

- A. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers
 - 1. ASHRAE Chapter 41: Absorption, Cooling, Heating, and Refrigeration Equipment
- B. IBC: International Building Code
- C. NFPA: National Fire Protection Association
 - 1. NFPA 13: Standard for the Installation of Sprinkler Systems
- D. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association, Inc.

1.3 SUBMITTALS

- A. Product Data: For all products specified herein.
- B. Shop Drawings:
 - 1. Submit shop drawings of Contractor-fabricated piping support structures, pipe racks, and anchors.
 - 2. Suspended Piping: Indicate point loads and support locations, along with applicable details keyed to layouts.
 - 3. Support Frames, Piping, Tank, and Equipment Supports, and Anchorage: Indicate point loads and support locations, along with engineers' calculations and details keyed to the layouts pertaining to supports, support frames, and anchorages.
 - 4. Supplementary Steel: Show details of fabrication and installation. Indicate materials, thicknesses, gauges, sizes, dimensions, methods of joining and fastening, welds, finishes, details of reinforcement and embedment, attachments, anchorages, miscellaneous metal items incidental to basic fabrication shown, provisions for work of other trades, and other pertinent information. Submit structural calculations for necessary supplementary steel for supports, anchors, and attachment of equipment and pipes to general construction. Calculations shall be prepared, stamped, and signed by a registered professional structural engineer licensed in the state of Oregon.
 - 5. As-Constructed Drawings and Data.

PART 2 - PRODUCTS

2.1 SUPPORTS AND ANCHORAGE

- A. Provide pipe and equipment hangers and supports in accordance with the following:
 - 1. When supports and anchorages for tanks, equipment, conduit, and piping are not shown on the drawings, the Contractor shall be responsible for their design.
 - 2. Supports and anchorages shall resist forces due to hydraulic testing and seismic forces as specified in the OSSC for the ground motion accelerations corresponding to the project location.
 - 3. Supports and anchorages shall not introduce stresses in the piping caused by thermal expansion or contraction.
 - 4. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. The following engineered support systems shall be designed, stamped, and signed by a registered professional structural engineer licensed in the state of Oregon:
 - 1. Supports, floor and roof-mounted tanks, and supports for suspended tanks and equipment.
 - 2. Support frames, such as pipe racks or stanchions, for piping and equipment which provide support from below.
 - 3. Tank equipment and piping support frame anchorage to supporting slab or structure.

2.2 SUPPORTS, GENERAL

- A. Acceptable Manufacturers: B-Line Systems, Anvil, Superstrut, or equal.
- B. Fabricate support members from welded standard structural shapes, pipe, and plate. Carry the necessary rollers, hangers, and accessories as required. Piping less than 4-inch pipe size may be supported from or by prefabricated roll-formed channels as specified in this section with necessary accessories to adequately support piping system.
- C. Supports and Accessories: Preformed roll-formed channels and accessories with matching compatible accessories as shown, as specified, and as required.
- D. Dissimilar Metal Protection: Cush-a-Strip, Hydra-Zorb cushions, or equal.

2.3 PIPE ATTACHMENTS

- A. Acceptable Manufacturers: B-Line Systems, Elcen, Anvil, Michigan Hanger, Superstrut, Tolco, or equal.
- B. Clamps: Superstrut Series 700 through 702.
- C. Insulated Horizontal Steel Piping:
 - 1. 2 Inches and Under: Anvil Fig. 300. Fig. 260 or 70 with Fig. 167 shield.
 - 2. Over 2 Inches: Anvil Fig. 300. Fig. 260 with Fig. 167 shield.

- D. Uninsulated Horizontal Steel Piping:
 - 1. 2 Inches and Under: Anvil Fig. 260.
 - 2. Over 2 Inches: Anvil Fig. 260.
- E. Sprinkler Bulk Mains: Anvil Fig. 69 or wrought U-hangers as required by NFPA 13.
- F. Riser Clamps, Steel Pipe: 3/4-inch to 20-inch, Anvil Fig. 261.

2.4 PIPE RACKS

- A. Acceptable Manufacturers: B-Line Systems, Superstrut, Uni-Strut, or equal.
- B. Supports and Accessories: Preformed roll-formed channels and accessories with electrochromate or equal finish and matching compatible accessories as shown, as specified, and as required.

2.5 PROTECTION SHIELDS

- A. Select protection shields based on actual outside diameter of pipe plus insulation. Use protection shields at hanger or roller assemblies on cold water piping and where hangers are installed around insulation.

2.6 BUILDING ATTACHMENTS

- A. Acceptable Manufacturers: B-Line Systems, Elcen, Anvil, Superstrut, Tolco, or equal.
- B. Beam Hangers: Beam Clamps - Anvil Fig. 228, adjustable malleable iron beam clamp, or Fig. 292, adjustable forged steel beam clamp.
- C. Inserts:
 - 1. Malleable iron or steel inserts, Superstrut M-732CB or S. Inserts sized for required rod to support load being carried.
 - 2. Malleable iron or steel inserts, Anvil, Fig. 152. Inserts sized for required rod to support load being carried.
- D. Expansion Plugs: Similar and equal to Phillips “red-head” self-drilling flush shell, selected for safety factor of 4.

PART 3 - EXECUTION

3.1 HANGERS AND SUPPORTS

- A. General:
 - 1. Install all support systems as detailed and in accordance with manufacturer’s recommendations. Provide pipe racks, pipe stands, trapeze hangers, etc., as required and as detailed in the drawings.

2. Provide adjustable hangers complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., for all pipes, except where specified otherwise.
 3. Size hangers to clear insulation for piping services conveying liquids less than 70 degrees F.
 4. Support fire protection piping independently of other piping.
 5. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods. Do not use tape for isolation.
 6. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
 7. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
 8. Install piping systems in accordance with NFPA standards.
- B. Vertical Piping:
1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved by the Port.
 2. Riser clamps shall be directly under fitting or welded to pipe.
 3. Support risers at each floor of penetration.
 4. Provide structural steel supports at the base of pipe risers. Size supports to carry all forces exerted by piping system when systems are in operation.
- C. Insulated Horizontal Piping:
1. Install hangers outside of insulation.
 2. On piping 1 1/2-inch and larger, provide insulation protection shields at each hanger location.
- D. Trapeze Hangers: Multiple pipe runs where indicated shall be supported on channels with rust resistant finish. Provide all necessary supporting steel.
1. Channels: Unistrut with electro-chromate finish, or equal.
- E. Hanger Spacing: Provide hangers at minimum spacing in accordance with NFPA 13 installation standards.
- F. Insulation Protection:
1. Where piping is suspended from insulation, provide 16-gauge galvanized steel protection shields, 12 inches long and under piping insulation at all points of suspension.
 2. Band shields firmly to insulation to prevent slippage.
- G. Building Attachments:
1. Where possible, support all piping and equipment from structural members, beams, and joists.
 2. Provide structural steel angles, channels, or other members to support piping and equipment where structures do not occur as required for proper support.
 3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points or provide web reinforcing as required.

4. Provide transverse and longitudinal bracing as required by code to provide a stabilized piping system. Bracing shall not introduce stresses in the piping system caused by thermal expansion or contraction.
 5. Do not fasten or attach to unfilled steel roof deck structure.
 6. Attach to concrete-filled steel floor deck structure for loads up to 400 pounds. Loads larger than 400 pounds shall be designed per code. Submit structural calculations stamped and signed by a registered professional structural engineer licensed in the state of Oregon, showing that the concrete-filled floor deck has sufficient capacity to support the load at the points of anchorage.
- H. Pipe Racks:
1. General: Provide racks as shown with additional elements to adequately support piping.
 2. Coordination: Where mechanical piping, tubing, etc., and electrical conduit, wiremold, wireways, etc., follow common routings, coordinate routing. Allow sufficient clearance to adequately operate, access, and maintain all devices without dismantling racks.
- I. General: Support all piping within 2 feet of change of direction on both sides of fitting.

END OF SECTION 210529

SECTION 210548 - VIBRATION AND SEISMIC CONTROL FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes isolation of fire suppression equipment and piping.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 210529, Hangers and Supports for Fire Suppression Piping and Equipment
- B. Section 212000, Fire Suppression System

1.3 REFERENCES

- A. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers

1.4 SEISMIC RESTRAINT

- A. Conform with the requirements of Section 212000.
- B. Values for calculating seismic design forces shall be as described in Section 212000.

1.5 SUBMITTALS

- A. Shop Drawings: Show complete details of construction for steel and concrete bases including:
 - 1. Equipment mounting holes.
 - 2. Dimensions.
 - 3. Isolation selected for each support point.
 - 4. Details of mounting brackets for isolator.
 - 5. Weight distribution for each isolator.
 - 6. Details of seismic snubbers.
 - 7. Code number assigned to each isolator.
- B. Product Data: For isolators include:
 - 1. Size, type, load and deflection of each required isolator.
 - 2. Percent of vibration transmitted based on the lowest disturbing frequency of the equipment.
 - 3. Calculation sheets.
- C. Installation Procedures: Procedures for setting and adjusting isolation devices.

- D. Package Equipment Calculations: Where buses, isolators and other equipment specified in this section are provided as part of packaged equipment, submit calculations certifying compliance with this section.
- E. Installation Report: Submit installation report as specified in Part 3 of this section.
- F. Structural Certifications: Calculations stamped and signed by a registered professional structural engineer licensed in the state of Oregon certifying mounting attachment points for isolators and seismic restraints.
- G. Shop drawings and calculations shall be prepared, stamped, and signed by a registered professional structural engineer licensed in the state of Oregon.

1.6 QUALITY ASSURANCE

- A. Except for packaged equipment with integral isolators, a single manufacturer shall select and furnish all isolation required.
- B. Isolation performance requirements shall be as indicated on the drawings. All deflections indicated shall be minimum actual static deflections for specific equipment supported.
- C. Isolator Stability:
 - 1. Size springs of sufficient diameter to maintain stability of the equipment being supported with minimum horizontal to vertical stiffness ratio not less than 1:1. Spring diameters shall be not less than 0.8 of the compressed height at rated load.
 - 2. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection.
- D. Maximum Allowable Vibration Levels: Peak vibration velocities shall not exceed 0.08 in/sec. If operating vibration velocities exceed this criterion, the equipment shall be repaired or replaced at no added expense to the Port.

PART 2 - PRODUCTS

2.1 ISOLATING SLEEVES

- A. Provide for all piping through walls and floors of mechanical rooms. Size for piping as required.
- B. Manufacturers: Potter-Roemer PR isolators or equal.

2.2 SEISMIC RESTRAINTS

- A. Provide seismic restraints for all vibration isolated equipment. Refer to Section 210529 for additional and specific requirements. The structural requirements for the restraints, including their attachment to the equipment or piping and the building structure, shall meet the following provisions:
 - 1. The seismic restraints shall consist of interlocking steel members restrained by shock absorbent neoprene materials compounded to bridge bearing specifications. The elastomeric materials shall be replaceable and 3/4-inch-thick, minimum. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch, nor more than 1/4 inch.
 - 2. Each snubber shall be capable of restraint in all three mutually orthogonal directions.
 - 3. Submittals shall include load versus deflection curves up to 1/2 inch on the x, y, and z planes. Conduct tests in an independent laboratory or under the signed supervision of an independent registered engineer. Bolt snubber assemblies to the test machine as the snubber is normally installed. For test reports to be acceptable, tests shall show that neither the neoprene elements nor the snubber body has sustained any obvious deformation after release of the load.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not install any equipment or pipe which makes rigid contact with the building other than at points of support. "Building" includes slabs, beams, studs, walls, etc.
- B. The installation or use of vibration isolators shall not cause any change of position of equipment or piping which would result in stresses to piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be maintained in a rigid position during installation. The load shall not be transferred to the isolator until the installation is complete and under full operational load.

3.2 PREPARATION

- A. Treat all isolators, including springs, brackets, and housing, with a rustproof metal primer.
- B. Coat items exposed to weather with cadmium plating, galvanizing, or plastic coating.

3.3 INSTALLATION

- A. General:
 - 1. Install isolation where indicated on the drawings by type and location and where indicated below. For all other equipment with rotating parts or motors, isolation and minimum static deflections shall comply with the ASHRAE Handbook, HVAC Applications, Sound and Vibration Control.
 - 2. The assigned code number shall be marked on the isolators and bases to assure placement in the proper location.

3.4 SEISMIC RESTRAINTS (VIBRATION ISOLATED PIPING)

- A. General: Install and adjust seismic restraints so that the piping vibration isolation is not degraded by the restraints.

3.5 ELECTRICAL COORDINATION

- A. All electrical connections to isolated equipment shall be made using flexible electrical conduit. Do not use conduit clamps or hangers between the flexible conduit and equipment. Provide non-stressed loop in conduit, unrestrained in all directions.

3.6 FIELD QUALITY CONTROL

- A. Confirm that all isolation is installed correctly and submit report stating that isolators are installed as shown on shop drawings, isolators are free to work properly, and that installed deflections are as scheduled and as specified.

END OF SECTION 210548

SECTION 210553 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the identification of valves, piping, and equipment components of the fire suppression systems to indicate their function and system served.

1.2 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI A13.1: Scheme for the Identification of Piping Systems
- B. OSPSC: Oregon State Plumbing Specialty Code

1.3 SUBMITTALS

- A. Product Data: Submit product data for products specified herein.
- B. Valve Tag Directory: Submit for approval prior to fabrication of valve tags.
- C. Equipment Nameplate Directory: Submit for approval prior to fabrication of labels.
- D. Include copy of valve tag and equipment nameplate directories in each set of operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 VALVE IDENTIFICATION

- A. Valve Tags:
 - 1. General: Identify valves with metal tags. Legends shall be stamped or embossed. Tags shall indicate the function of the valve and its normal operating position; for example:

PDX SARA	(SPECIFIC PROJECT IDENTIFIER)
56 HW	(NUMBER AND CONTENT OF PIPE)
ISOLATION	(VALVE FUNCTION)
NO	(NORMAL OPERATION POSITION)
 - 2. Size: Valve tags 2-inch diameter with 1/4-inch-high letters.
 - 3. Material: Use 0.050 or 0.064-inch brass tags.
 - 4. Automatic Valves and Regulating Valves: Use 1/16-inch-thick laminated 3-ply plastic, center ply white, outer ply red, "lamicoid," or equal. Form letters by exposing center ply.

5. Existing Buildings and Systems: Contact the Port for coordination with existing building tagging system and supplementary information required for any specific system before valve tagging begins.

- B. Valve Tag Directory: Include tag number, location, exposed or concealed, service, valve size, valve manufacturer, valve model number, tag material, and normal operating position of valve.

2.2 PIPING MARKERS

- A. Acceptable Manufacturers: Brady, Seton, Marking Systems, Inc. (MSI), or equal.
- B. Label pipes with all-vinyl, self-sticking labels or letters. For pipe covering sizes up to and including 3/4-inch outside diameter, select labels with 1/2-inch letters. For sizes from 3/4- to 2-inch outside diameter, 3/4-inch letters; above 2 inches outside diameter, 2-inch letters. The pipe markers shall be identified, and color coded as follows with black directional arrows. Exposed sprinkler piping within circulation areas is void from labeling.

SERVICE	PIPE MARKER	BACKGROUND COLOR
Fire Protection	"FIRE PROTECTION WATER"	Red
Fire Sprinkler	"FIRE SPRINKLER"*	Red

* Adjacent to pipe marker, provide abbreviated zone identification as indicated on "key plans - Fire Protection."

2.3 EQUIPMENT IDENTIFICATION

- A. Nameplates:
 1. Tag all pumps and miscellaneous items of fire suppression equipment with engraved nameplates. Nameplates shall be 1/16-inch-thick, 3 x 5 laminated 3-ply plastic, center ply white, outer ply black. Form letters by exposing center ply.
 2. Identify unit with code number as shown on the drawings and area served.
- B. Equipment Nameplate Directory: List pumps and other equipment nameplates. Include Port- and Contractor-furnished equipment. List nameplate designation, manufacturer's model number, location of equipment, area served or function, disconnect location, and normal position of HOA switch.

PART 3 - EXECUTION

3.1 VALVE IDENTIFICATION

- A. Valve Tags:
 1. Attach to valve with a brass chain.

2. Valve tag numbers shall be continuous throughout the building for each system. Contractor shall obtain a list for each system involved from the Port to establish numbers following the listed sequences.
- B. Valve Tag Directory: Post final copy in operation and maintenance manual.
 - C. Concealed Valves: Affix color coded "dot" to walls or ceilings wherever valves are concealed. Colors shall be as follows:
 1. Fire Protection: Red.

3.2 PIPING MARKERS

- A. Unless recommendations of ANSI A13.1 are more stringent, apply labels or letters after completion of pipe cleaning, insulation, painting, or other similar work, as follows:
 1. Every 20 feet along continuous exposed lines.
 2. Every 10 feet along continuous concealed lines.
 3. Adjacent to each valve and stubout for future.
 4. Where pipe passes through a wall, into and out of concealed spaces.
 5. On each riser.
 6. On each leg of a "T."
 7. Locate conspicuously where visible.
- B. Further, apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above. Apply arrow labels indicating direction of flow.
- C. Spray a protective coating of clear epoxy over markers and arrows in corrosive atmosphere areas.
- D. Comply with OSPSC regarding identification of non-potable piping systems.

3.3 EQUIPMENT IDENTIFICATION

- A. Nameplates: Attach to prominent area of equipment, either with sheet metal screws, brass chain, or contact cement as applicable.
- B. Nameplate Directory: Post final copy in operation and maintenance manual.

END OF SECTION 210553

SECTION 210590 – PRESSURE TESTING OF FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes pressure testing of fire suppression systems.

1.2 SUBMITTALS

- A. Submit the following:
 - 1. Test plan and schedule: Submit test plan and schedule for testing of piping and ductwork systems.
 - 2. Test Reports:
 - a. Submit certificate of completion, inspection and test by authority having jurisdiction on required piping systems.
 - b. Submit certificate of test approval by the Port on all systems.
 - c. The Port will record tests that it witnesses.
 - 3. Coordinate with commissioning plan and schedule.

1.3 QUALITY ASSURANCE

- A. Code Compliance: Perform required tests in the presence of the authority having jurisdiction.
- B. Port Witness: Perform all tests in the presence of the Port.
- C. Simultaneous Testing: Test observations by the authority having jurisdiction and the Port need not occur simultaneously.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. Piping: Test prior to concealment, insulation being applied, and connection to equipment, fixtures, or specialties. Conduct tests with all valves 10 percent closed except for those used to isolate the test section.
- B. Leaks: Repair all leaks and retest until stipulated results are achieved.
- C. Notification: Provide the Port 48 hours' notice in advance of each test. Failure to so notify will require test to be rescheduled.

- D. Testing Equipment: Provide all necessary pumps, gauges, connections and similar items required to perform the tests.
- E. Sprinkler Piping: Arrange for required testing of installed system as required by the fire marshal.
- F. Pneumatic Leakage Testing: At the Contractor's option and as approved by the Port, pneumatic leakage testing prior to hydronic pressure testing or system filling is permitted with a maximum air pressure of 5 psig. This does not replace requirements for hydronic pressure testing at a higher pressure specified herein. Pneumatic testing of plastic piping is not permitted unless approved by the Port.

3.2 TESTING REQUIREMENTS

- A. Piping: Test all piping as noted below with no leaks or loss in pressure for time indicated. Repair or replace defective piping until tests are completed successfully.
- B. Confirm test pressure before proceeding with the work.

<u>System</u>	<u>Test Pressure</u>	<u>Test Medium</u>	<u>Test Duration</u>
Fire Protection	200 psig	Hydrostatic Water	2 hours

END OF SECTION 210590

SECTION 211100 - FIRE SUPPRESSION PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes piping, pipe fittings, and incidental related items as required for complete piping systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 210500, Common Work Results for Fire Suppression
- B. Section 210529, Hangers and Supports for Fire Suppression Piping and Equipment
- C. Section 210548, Vibration and Seismic Control of Fire Suppression Piping and Equipment
- D. Section 210553, Identification for Fire Suppression Piping and Equipment
- E. Section 212000, Fire Suppression Systems

1.3 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI B16.1: Gray Iron Pipe Fittings and Flanged Fittings: Classes 25, 125, and 250.
- B. ASTM: American Society for Testing and Materials
 - 1. ASTM A53 or A120: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. ASTM A135: Standard Specification for Electric-Resistance-Welded Steel Pipe.
 - 3. ASTM A183: Standard Specification for Carbon Steel Track Bolts and Nuts.
 - 4. ASTM A234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - 5. ASTM A307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
 - 6. ASTM A47: Standard Specification for Ferritic Malleable Iron Castings.
- C. AWWA: American Water Works Association
 - 1. AWWA C151: Ductile Iron Pipe, Centrifugally Cast, for Water.
 - 2. AWWA C209: Cold-Applied Tape Coatings for Steel Water Pipe and Fittings.
 - 3. AWWA C214: Tape Coating Systems for the Exterior of Steel Water Pipelines.
- D. NFPA: National Fire Protection Association
 - 1. NFPA 13: Standard for the Installation of Sprinkler Systems.

1.4 SUBMITTALS

- A. Product Data: For all products specified herein.
- B. Shop Drawings: For systems layout. Coordinate with the work of other divisions and existing facilities, systems, equipment, and components.
- C. Test Reports and Certificates: Inspections and pipe tests.
- D. Other: Certified welders' certificates.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Piping material and installation shall meet requirements of the local fire and building codes and serving utility requirements.
- B. Pipe Cleaning: Should any pipe be plugged or should foaming of water systems occur, disconnect piping, re-clean, and reconnect with no additional cost to the Port.
- C. Correct any damage to the building or systems resulting from failure to properly clean the system with no additional cost to the Port.

PART 2 - PRODUCTS

2.1 LIGHT WALL BLACK STEEL PIPE

- A. Pipe: ASTM A135 or A53.
 - 1. For Fire Protection:
 - a. Schedule 10 in sizes 2 1/2-inches and above.
- B. Fittings: Roll grooved ends with mechanical couplings.
- C. Service: Fire protection system only for sizes listed, as approved by NFPA 13. All dry pipe sprinkler systems shall be hot dip galvanized.

2.2 BLACK STEEL PIPE, SCHEDULE 40

- A. Pipe: Schedule 40, in accordance with ASTM A120 or A53.
- B. Fittings: 150-pound screwed malleable iron on 2 inches and below, Schedule 40 welded fittings in accordance with ASTM A234 for 2 1/2 inches and above or mechanical couplings on select piping as herein specified. Fittings below grade shall be welding fittings. All elbows on pumped systems shall be long radius type. Short radius elbows are not acceptable for use except as approved by the Port on a case-by-case basis.

- C. Service:
 - 1. Fire protection system, except fire protection fittings shall be 175-pound cast iron. All dry pipe sprinkler systems shall be hot dip galvanized.
 - 2. Miscellaneous drains and overflows.

2.3 GALVANIZED STEEL PIPE

- A. Pipe: Schedule 40 in accordance with ASTM A120.
- B. Fittings: 150-pound screwed galvanized malleable iron on 2 inches and below. Mechanical couplings as herein specified on 2 1/2 inches and above.
- C. Service: Miscellaneous indirect waste piping.

2.4 FLANGED JOINTS

- A. Flanges shall be cast iron or steel for screwed piping and forged steel welding neck for welded line sizes. Pressure rating and drilling shall match the apparatus, valve or fitting to which they are attached. Flanges shall be in accordance with ANSI B16.1; 150-pound for system pressures to 150 psig; 300-pound for system pressures 150 psig to 400 psig. Gaskets shall be 1/16-inch thick, non-asbestos ring type, coated with graphite and oil to facilitate making a tight joint. Make joint using American Standard hexagon head bolts, lock washers and nuts (in accordance with ASTM A307 GR.B) for service pressures to 150 psig; alloy steel stud bolts, lock washer and American Standard hexagon head nuts (in accordance with ASTM A307 GR.B) for service pressures 150 psig to 400 psig. Use length of bolt required for full nut engagement. Provide electro-cad plated bolts and nuts on cold and chilled water lines.

2.5 UNIONS

- A. Unions shall be 150 psi malleable iron or brass, brass to iron seat or viton O-ring, ground joint, black or galvanized to match pipe. 200 psi WOG bronze, ground joint, solder type for copper tubing. Where dissimilar metals join, dielectric unions, couplings or flanges shall be installed.

2.6 MECHANICAL PIPE COUPLINGS AND FITTINGS

- A. Acceptable Manufacturers: Victaulic, Anvil, or equal.
- B. Flexible Couplings and Fittings:
 - 1. Coupling housing shall be zero flex rigid type coupling with angled bolt pad design. Similar to Victaulic Type 07. Use flexible couplings only when expansion contraction, deflection, or noise and vibration is to be dampened. Flexible coupling shall be similar to Victaulic Type 77. Coupling gasket shall be similar to Victaulic's Grade E molded synthetic rubber, Grade No. R615BZ. Flushseal gasket configuration on all applications. Coupling bolts shall be oval neck track head type with hexagonal heavy nuts in accordance with ASTM A183.

2. Fittings used with pipe couplings shall be fabricated of malleable iron castings in accordance with ASTM A47. Where malleable fitting pattern is not available, fittings fabricated from Schedule 40 steel pipe or standard wall seamless welding fittings with grooved ends may be used. Elbows on pumped systems shall be long radius type.

C. Service: Fire protection systems.

2.7 MECHANICAL JOINT RESTRAINTS

- A. Acceptable Manufacturers: EBAA Iron Inc., Megalug Series 1100, or pre-bid approved equal.
- B. Incorporate mechanical restraint into the joint follower gland, consisting of individually actuated wedges that increase their resistance to pullout as pressure increases. Use twist-off nuts, 350 psi working pressure. Restraints shall be UL listed and FM Global approved.
- C. Service:
 1. Dry standpipe, below grade.
 2. Fire protection main, below grade.

2.8 PIPING, HANGERS, SUPPORTS, ANCHORAGE, AND SEISMIC RESTRAINTS

- A. Conform to the requirements of Section 210529, Section 210548, and Section 212000.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measurements, Lines, and Levels:
 1. Check dimensions at the building site and establish lines and levels for the work specified in this section.
 2. Establish all slopes and elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with the drawings and specifications.
 3. Use established grid and area lines for locating trenches in relation to buildings and boundaries.

3.2 PIPING INSTALLATION

- A. Install unions in all non-flanged piping connections to apparatus and adjacent to all screwed valves and appurtenances requiring removal for servicing, located so that piping may be disconnected without disturbing the general system.
- B. Mechanical Couplings:
 1. On systems using galvanized pipe and fittings, fittings shall be galvanized at factory.
 2. Before assembly of couplings, lightly coat pipe ends and outside of gaskets with Port-approved lubricant.

3. Pipe grooving shall be in accordance with manufacturer's specifications contained in latest published literature.
- C. Install all piping to drain.
- D. Support all piping independently so that its weight is not carried by the equipment.
- E. Underground Water Systems: Provide mechanical joint restraints or concrete thrust blocks, prior to testing pipe, at changes in direction. Block size as required for types of fittings involved.
- F. Flexible Joints/Seismic Connectors: Install where piping crosses building expansion joints and where indicated on drawings. Install in accordance with the manufacturer's instructions.

3.3 PIPING JOINTS

- A. Join pipe and fittings using methods and materials recommended by the manufacturer, in accordance with standard practice and applicable codes. Cleaning, cutting, reaming, grooving, etc., shall be done with proper tools and equipment. Hacksaw pipe cutting is prohibited. Peening of welds to stop leaks is not permitted.
- B. Do not install couplings in floor, wall, or grade beam sleeves.
- C. Steel Piping:
 1. Screwed Joints: Cut pipes evenly with pipe cutter, and ream to full inside diameter, with all burrs and cuttings removed. Joints shall be made up with suitable lubricant or Teflon tape, applied to male threads only, leaving two threads bare. Tighten joints so not more than two threads are left showing. Make junctions between galvanized steel waste pipe and bell of cast iron pipe with tapped spigot or half coupling on steel pipe to form spigot end and caulk.
 2. Flanged Joints: Pressure rating of flanges shall match valve or fitting joined. Coat joint gaskets with graphite and oil.
- D. Welded Joints:
 1. Preparation for Welding: Bevel piping on both ends before welding.
 - a. Use following weld spacing on all butt welds:

NOMINAL PIPE WALL THICKNESS	SPACING	BEVEL
1/4" or less	1/8"	37 1/2°
Over 1/4", less than 3/4"	3/16"	27 1/2°
 - b. Before welding, remove all corrosion products and foreign material from surfaces.
 2. Joints shall be made by the arc-welding process using ASME certified welders. Port openings of fittings shall match the inside diameter of the pipe to which they are welded. Use full radius welding elbows for all turns; use welding tees for all tees. Use reducing fittings for size reduction. Weldolets or threadolets may be used for branches up through one-half the pipe size of the main to which they are attached. Nipples will not be allowed.
 3. Welding Operation:
 - a. After deposition, clean each layer of weld metal to remove slag and scale by wire brushing or grinding. Chip where necessary to prepare for proper deposition of next layer.

- b. Weld reinforcement no less than 1/16 inch nor more than 1/8 inch above normal surface of jointed sections. Reinforcement shall be crowned at center and tapered on each side to surfaces being joined. Exposed surface of weld shall be free of depressions below surface of jointed members.
 - c. No welding shall be done when temperature of base metal is lower than 0°F. Material to be welded during freezing temperatures shall be made warm and dry before welding is started. Metal shall be warm to the hand or approximately 60°F.
- E. Screwed Joints: Use Teflon tape or Teflon liquid dope applied to male threads only.

3.4 ADJUSTING AND CLEANING

- A. Clean interior of all piping before installation.
- B. Flush sediment out of all piping systems with a minimum velocity of 5 to 6 FPS.
- C. Prepare system for adjusting and balancing. If any system components, including control valves, balancing valves, automatic flow control valves, strainers, or other valves and specialties have sediment present, remove, clean and replace damaged or worn components.

END OF SECTION 211100

SECTION 212000 - FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes a complete, bidder designed automatic fire sprinkler system with zoning and layout to be integrated into the existing building fire sprinkler systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 210500, Common Work Results for Fire Suppression
- B. Section 210523, General Duty Valves for Water-Based Fire Suppression Piping
- C. Section 211100, Fire Suppression Piping

1.3 REFERENCES

- A. FM: FM Global
- B. NFPA: National Fire Protection Association
 - 1. NFPA 13: Standard for the Installation of Sprinkler Systems
 - 2. NFPA 25: Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

1.4 SUBMITTALS

- A. Shop drawings, hydraulic calculations, and seismic calculations shall be stamped and signed by a fire suppression engineer registered in the State of Oregon.
 - 1. Prepare fire protection system layout drawings showing the types, location, and layout of sprinkler heads and outlets, alarm valves, and devices, pipe sizes and cutting lengths, test tees and valves, seismic braces, and other related items, coordinated with architectural, structural, mechanical, and electrical details. Indicate types and locations of couplings and seismic support locations and details.
 - 2. Show complete sway brace layout, including proposed brace type and size, anchor methods and sizes, angle of attachment, etc. The design shall demonstrate that an adequate load path is available from the sprinkler pipe to the primary building structure. Note flexible vs. rigid coupling locations as well as clearances where pipes pass through floors and walls.
 - 3. Prepare hydraulic calculations in accordance with the quality assurance requirements of this section.
 - 4. Submit fire protection system layout drawings to the Port for preliminary review prior to submitting documentation to AIG and the fire marshal for final review and approval. Include hydraulic calculations, seismic bracing calculations, and product data.

5. Upon receipt of comments from the Port, revise and re-submit fire protection system layout drawings, product data, hydraulic calculations, and seismic calculations for final review and approval by AIG and the fire marshal.
- B. Product data for the following:
 1. Sprinkler heads.
 - C. Samples: One of each type of head.
 - D. Operation and maintenance data, and operation and maintenance manuals.
 - E. Legible copy of approved shop drawings neatly marked with as-constructed changes.
 - F. A shutdown plan for the existing fire sprinkler system based on phasing of work. Minimize system shutdown time where existing systems will be capped, removed, or modified.
 - G. Commissioning Documentation:
 1. Submit commissioning plans and schedules; checkout, startup, operational, functional and final acceptance test plans, procedures, checklists, and reports; systems manuals; and operation and maintenance training plans.
 2. Submit certificates of completion of tests and inspections.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 1. Fire protection system components shall be new and FM-approved with an installation meeting the current FM NFPA 13 standards covering sprinkler system installation.
 2. On hydraulically designed systems, the remote shall be calculated with a dimension parallel to the branch line equal to 1.4 times the square root of the demand (design) area instead of the NFPA 13 requirement. Should roll grooved pipe be used, account for additional friction loss in the hydraulic calculations resulting from displaced pipe wall material protruding into the waterway. For straight-through flow, regardless of size, each coupling shall have one equivalent foot added to the pipe length. For tees and elbows, regardless of size, add two equivalent feet of pipe to the hydraulic calculations.
 3. Design and install earthquake protection of sprinkler systems in accordance with FM's Earthquake Protection of Water Based Fire Protection Systems standards. Design details and seismic load calculations are required. Base calculations on water-filled weight of sprinkler piping within the zone of influence times a horizontal acceleration "G" factor of 0.5.
 4. Storage areas shall include a 500 gpm hose allowance, while other areas should reserve 250 gpm hose allowance. All designs shall include a 10 percent cushion in the water supply.
 5. Underground fire mains shall be cement-lined ductile iron pipe. Provide 3-1/2-foot depth of cover for freeze prevention. Install fire service in accordance with FM guidelines. The last underground elbows below the riser or riser manifold shall be rodded to the base of riser as part of seismic protection. Restraining by rod and clamping and/or thrust blocking shall be in accordance with FM guidelines.

- B. Hydraulically Calculated Sprinkler System shall be in accordance with the following table:

AREA	TYPE OF SYSTEM	HEAD RATED TEMP	DESIGN DENSITY (gpm/sq.ft.)	DESIGN AREA (sq.ft.)	MAXIMUM COVERAGE (per head)
Public Areas - Lounges, & Circulation Areas, Enplaning, Deplaning, Offices	Wet	165°F	0.10	3000	150 ft ²
Mechanical & Electrical Equipment Rooms, Elevator Equipment Rooms	Wet	286°F	0.20	3000	100 ft ²
Storage	Wet	286°F	0.20	2500	130 ft ²

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. All manufacturers and products shall be FM approved.

2.2 SPRINKLER HEADS

- A. As indicated; equivalent products by Reliable or pre-bid approved equal.
- B. All heads shall be UL listed for application and installation and FM approved. Provide high temperature heads for mechanical rooms, areas below skylights, and other areas which have high heat producing equipment to prevent accidental tripping.
- C. Sprinkler Heads:
1. Sprinklers installed in finished ceilings shall be recessed plate ceiling type, chrome finish, FM approved.
 2. Sprinklers installed at areas with unfinished ceilings shall be upright or pendant type, rough bronze finish, FM approved.
 3. In finished areas, extended coverage horizontal sidewall, fast response, chrome plated, FM approved.

2.3 MISCELLANEOUS ACCESSORIES

- A. Items shall be UL labeled for application as required.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Notify the Port 72 hours in advance of any shutdown of existing sprinkler system.
- B. Coordinate fire protection piping and appurtenances with ducts, other piping, electrical conduit, moving walkways, and other equipment.
- C. Conceal fire protection piping and equipment except in areas without ceilings and as noted on the drawings.
- D. Locate valves, piping, heads, and equipment where shown on the drawings. System drain valves are not shown. Install as required to permit drainage of all systems.

3.2 INSTALLATION

- A. General:
 - 1. Install fire protection systems to serve the entire building.
 - 2. The drawings indicate approximate locations of piping, sprinkler zones, and types of systems. The drawings do not indicate the locations of sprinkler heads in ceiling areas. In general, sprinklers shall be located in the center of ceiling panels and symmetrically within rooms and down corridors, coordinated and in pattern with lights and grilles. Deviations shall be approved in writing prior to initiation of work.
 - 3. Locations of sprinkler heads, outlets, piping, and appurtenances are not shown in all areas and therefore shall be installed in accordance with code requirements.
- B. Piping:
 - 1. Hold piping as tight to structure as possible. In general, run piping in areas without ceilings parallel to building elements.
 - 2. Provide test tees as required.
- C. Drain Piping:
 - 1. Pitch drain piping 1/2-inch per 10 feet minimum; no traps will be allowed.
 - 2. Pipe inspector test connections to exterior at grade level only and discharge onto suitable splash plate as approved by local applicable governing authorities. Inspector test discharge for mezzanine level or roof/penthouse sprinkler zones shall not discharge onto roofs. Provide chrome plated wall flanges on exterior building wall penetrations.
 - 3. Drain valves shall be no higher than 5'-0" above floor level.
 - 4. Pipe drain valves for pre-action systems located within the interior of the building through air gap to the sanitary sewer.
 - 5. For drains piped to the outside, provide an additional full-sized tee inside the building to discharge to the nearest floor drain.
- D. Electrical: All electrical work shall comply with Division 26.
- E. Fire Service: Connect to sprinkler line where it enters the building.

- F. Pre-Action System: Install pre-action system riser assembly, compressed air supply, and control panel outside of the area being protected.

3.3 EXTRA STOCK

- A. Provide additional number of heads of each type and temperature rating installed as required to meet NFPA 13 requirements.
- B. Provide storage cabinet or cabinets as required to receive reserve sprinkler heads and special installation tools required.
- C. Inside the cabinet, provide a list of heads stored within and a brief description of where installed.
- D. Provide index label for each head indicating manufacturer, model, orifice size or K-factor, and temperature rating.
- E. Provide two sets of tools for removal of flow switch covers.
- F. Locate cabinet near sprinkler control station as approved.

3.4 TESTING

- A. Check out, start up, and test items specified in this section.
- B. Notify the Port 48 hours prior to any test. Provide final test and certification in the presence of the Port.
- C. Deluge System Testing: Notify the Port and City of Portland Fire Department personnel one week in advance of the deluge system testing. The Port will determine the date and time of the testing. Witnesses for testing and final certification shall include the Port and City of Portland Fire Department personnel.

END OF SECTION 212000

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The intent of the Division 22 specifications and the accompanying drawings is to provide a complete and workable plumbing system as shown, specified, and required by applicable codes. Include all work specified in Division 22 and shown on the accompanying drawings.
- B. The drawings that accompany the Division 22 specifications are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Follow the drawings as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions from measurements taken at the building, subject to approval, and at no additional cost to the Port.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 017329, Cutting and Patching
- B. Section 024119, Selective Interior Demolition
- C. Section 078400, Firestopping
- D. Section 083100, Access Doors and Panels
- E. Section 099100, Painting
- F. Section 230900, Instrumentation and Controls for HVAC

1.3 REFERENCES

- A. FM: FM Global
- B. NEMA: National Electrical Manufacturers Association
 - 1. NEMA MG1: Motors and Generators
- C. OR-OSHA: Oregon Occupational Safety and Health Administration

1.4 SUBMITTALS

- A. General:
 - 1. Comply with the requirements of Section 013300, Submittal Procedures, and the additional requirements specified herein.

B. Shop Drawings:

1. The contract drawings indicate the general layout of the piping and various items of equipment. Coordination with other trades and with field conditions is required. For this purpose, submit shop drawings of all installations not detailed on the contract drawings, and of all changes to the contract drawings.
2. Shop drawings shall be new drawings prepared by the Contractor and shall not be reproductions or tracings of the contract drawings. Overlay drawings with shop drawings of other trades and check for conflicts. Shop drawings shall be the same size as the contract drawings with title blocks similar to the contract drawings. Shop drawings shall identify the related contract drawing number or related reference drawing. Shop drawings shall be fully dimensioned, including both plan and elevation dimensions. Do not use shop drawings to make scope changes.
3. Shop drawings shall include but not be limited to:
 - a. Complete floor plans with plumbing to a minimum of $1/8" = 1'-0"$ scale.
 - b. Plumbing of mechanical and fan rooms to a minimum of $1/4" = 1'-0"$ scale.
 - c. Sections of congested areas to a minimum of $1/4" = 1'-0"$ scale.
 - d. Fabricated equipment to a minimum of $1/4" = 1'-0"$ scale.
4. Submit shop drawings for review as required by the contract documents. Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field, or when there is a question as to whether contract documents are being complied with or the design intent is being met.

C. Product Data:

1. Submit product data for review on all scheduled pieces of equipment, equipment requiring electrical connections or connections by other trades, and as required by the contract documents. Include manufacturer's detailed shop drawings, specifications, and data sheets. Data sheets shall include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures and similar data. Manufacturer's abbreviations or codes are not acceptable.
2. List the name of the motor manufacturer and service factor for each piece of equipment.
3. Indicate equipment operating weights including bases and weight distribution at support points.
4. In the case of equipment specified by specific catalog number, such as wiring devices, time switches, valves, etc., a statement of conformance will suffice.
5. For motors 20 hp and greater, submit the following supplemental data:
 - a. Number of stator slots.
 - b. Number of rotor bars.
 - c. Load current.
 - d. Stator resistance.
 - e. Stator configuration delta or wye.

D. Operation and Maintenance Data:

1. Submit operation and maintenance data for review on all scheduled pieces of equipment, and as required by the contract documents.

E. Commissioning Documentation:

1. Submit commissioning plans, schedules, and related documentation in accordance with the contract documents.

1.5 QUALITY ASSURANCE

- A. Materials and equipment shall be new. Work shall be of good quality, free of faults and defects.
- B. All equipment shall fit in the space provided.
- C. Systems shall be built and installed to deliver their full rated capacity at the efficiency for which they were designed.
- D. The entire plumbing system shall operate at full capacity without objectionable noise or vibration.
- E. Materials and Equipment:
 - 1. Each piece of equipment provided shall meet all detailed requirements of the drawings and specifications and shall be suitable for the installation.
 - 2. Where two or more units of the same class of equipment are provided, use products of the same manufacturer; component parts of the entire system need not be products of the same manufacturer.
- F. Workmanship:
 - 1. Install all materials in a neat and workmanlike manner.
 - 2. Follow manufacturer's directions. If they are in conflict with the contract documents, obtain clarification before starting work.
- G. Cutting and Patching:
 - 1. Cutting, patching and repairing for the proper installation and completion of the work specified in this division, including plastering, masonry work, concrete work, carpentry work, firestopping, and painting, shall be performed by skilled craftsmen of each respective trade in conformance with the appropriate division of work. Additional openings required in building construction shall be made by drilling or cutting.
 - 2. Fill holes which are cut oversize so that a tight fit is obtained around the objects passing through.
 - 3. Do not pierce beams or columns without permission of the Port and then only as directed.
 - 4. New or existing work that is cut or damaged shall be restored to its original condition. Where alterations disturb existing finishes, the surfaces shall be repaired, refinished and left in condition existing prior to commencement of work.

1.6 PROJECT CONDITIONS

- A. Coordinate exact requirements governed by actual work conditions. Check all information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.
- B. Comply with the requirements of Section 017000, Execution Requirements, for investigation prior to penetration of floor slabs.

1.7 PROVISIONS FOR LARGE EQUIPMENT

- A. Make provisions for the necessary openings in the building to allow for admittance of all equipment.

PART 2 - PRODUCTS

2.1 ACCESS PANELS

- A. Provide access panels where indicated and where required to access valves, fire dampers, trap primers, shock arresters, and other appurtenances requiring operation, service, or maintenance. Review locations prior to installation. Comply with the requirements of Section 083100.

2.2 PIPE AND DUCT SLEEVES

- A. Interior Wall and Floor Sleeves: 18-gauge galvanized steel.
- B. Exterior Wall Sleeves: Cast iron.
- C. On-Grade Floor Sleeves: Cast iron.

2.3 FLOOR, WALL, AND CEILING PLATES

- A. Provide stamped split-type plates as follows:
 - 1. Floor Plates: Cast brass, chromium plated.
 - 2. Wall and Ceiling Plates: Spun aluminum.

2.4 SEALANT

- A. General Purpose: Tremco Dymeric Sealant, or equal.
- B. Floor Penetration Sealant: Hydro Ban Sealant by Laticrete., or equal.
- C. Firestop Sealant: See Section 078400.

2.5 MACHINERY GUARDS

- A. Provide guards for protection on all rotating and moving parts of equipment.
- B. Provide shaft holes in guards for easy use of tachometers at shaft centers. Guards shall be easily removable.
- C. All guards shall meet OR-OSHA requirements including back plates.

2.6 ELECTRICAL EQUIPMENT

- A. General: All equipment and installed work shall be as specified under Division 26, Electrical.

B. Motors:

1. Motors shall be furnished as integral part of driven equipment. Motors shall be completely enclosed, fan cooled induction type with sealed ball bearings. Motors 1 hp and above shall be NEMA Premium Efficiency type except for emergency equipment motors, sump pumps, and sewage ejector pump motors. Motors shall be built to NEMA standards for the service intended. The motors shall be rated for the voltage specified, suitable for operation within the range of 10 percent above to 10 percent below the specified voltage. Energy efficient motors shall be Century E-plus, Baldor Super E, Westinghouse Life Line, General Electric Energy Saver, Toshiba, or equal.
2. Designed for a synchronous speed of 1800 rpm unless specified otherwise.
3. Motors 1/2 hp and Larger: 3-phase, 60 cycle, 460V, service factor of 1.15, unless specifically noted otherwise.
4. Motors 1/3 hp and Below: 1-phase, 60 cycle ac, 115V unless specifically noted otherwise, complete with integral thermal protection.
5. Provide motors on belt drive equipment of nominal nameplate horsepower with not less than 120 percent of equipment brake horsepower required for performance specified.
6. Have built-in thermal overload protection, or be protected externally with separate thermal overload devices with low-voltage release or lockout. Hermetically sealed motors shall have quick trip devices.
7. Motors controlled by variable speed drives shall be inverter duty rated and shall have a Class F insulation or better. Motors shall be able to withstand repeated voltage peaks of 1600 volts with rise times of 0.1 microseconds and greater, in accordance with NEMA Standard MG1, Part 31.
8. Motors served from variable frequency drives shall be equipped with a shaft grounding system utilizing brush grounding kits to provide a path for current to flow between the shaft and the motor frame.
9. Frequency drive manufacturers shall provide necessary filters and line reactor type equipment to protect motors from excessive voltage spikes that may exceed insulation requirements of NEMA MG1, Part 31. Use SGS, or equal.

C. Starters: See Division 26, Electrical. Starters shall be suitable for performing the control functions required, with the exception of self-contained equipment and where the starters are furnished as part of the control package.

D. Equipment Wiring: Interconnecting wiring within or on a piece of mechanical equipment shall be provided with the equipment unless shown otherwise on the drawings. This does not include the wiring of motors, starters and controllers specified in Division 26, Electrical.

E. Control Wiring: All control wiring for plumbing equipment (circulating pumps, sump pumps, etc.) shall be as specified in Section 230900.

2.7 SEALING

A. Seal below grade and between exterior piping and wall sleeves.

B. Use modular, elastomeric pipe sealing.

1. Material: EPDM.
2. Hardware: Stainless steel.
3. Acceptable Manufactures: Link-seal or equal.

PART 3 - EXECUTION

3.1 DEMOLITION AND SALVAGE

- A. Prior to any demolition activities, coordinate safe-off of live utilities with the Port.
- B. Remove or relocate plumbing piping, wiring, devices and other equipment encountered in existing areas affected by this work as indicated on the drawings.
- C. Protect equipment identified to be salvaged. Remove salvaged equipment prior to demolition of adjacent services. Arrange with the Port for storage and return of salvaged equipment.
- D. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations. Prior to demolition, verify that demolished services will not affect the operation of existing systems that are to remain and notify the Port.
- E. Demolition Service/System Requirements:
 - 1. Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical systems serving areas to be selectively demolished.
 - 2. Demolish all service back to nearest active main or point of future connection as indicated. Verify with Port extent of demolition prior to proceeding if extent is not clear.
 - 3. The Port will arrange to shut off indicated services/systems when requested by the Contractor.
 - 4. If services/systems are required to be removed, relocated, or abandoned: Before proceeding with selective demolition, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 5. Remove all accessories associated with removed utilities including supports, hangers, braces, clips, etc., in their entirety.
 - 6. Patch penetrations of walls and floors related to demolished services restoring existing fire separations, assembly ratings, and waterproofing membranes.

3.2 SYSTEM WATER DISPOSAL

- A. Do not drain water from systems treated with chemicals into the sanitary or storm sewers without written approval from the Port.

3.3 ACCESS PANELS

- A. Install in accordance with manufacturer's recommendations, coordinated with architectural features. Review intended locations with the Port prior to installation.

3.4 SLEEVES

- A. General:
 - 1. Lay out work prior to concrete forming. Do all cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.
 - 2. Sleeve all core-drilled penetrations, unless detailed otherwise on the drawings.
 - 3. Sleeves shall be large enough to allow clearance around pipe in accordance with NFPA 13. When pipe is insulated, insulation shall pass continuously through sleeve with 3/4-inch clearance between insulation and sleeve.
- B. Interior Wall Sleeves:
 - 1. Pack with fiberglass insulation.
 - 2. Terminate sleeve flush with face of wall unless indicated otherwise.
- C. Below-Grade Exterior Wall Sleeves: Sleeves shall be large enough to allow for Link seal and made watertight. Install link seal and size based on pipe and sleeve. Secure sleeves against displacement.
- D. Above-Grade Exterior Wall Sleeves: Similar to interior wall sleeves, except caulk outside with sealant.
- E. Sleeves Through Floors:
 - 1. Floor sleeves shall extend 1 1/2 inch above finished floor, except waste stacks using carriers shall have sleeve flush with floor.
 - 2. Do not support pipes by resting pipe clamps on floor sleeves. Provide supplementary members so pipes are floor-supported.
 - 3. Make penetrations watertight by sealing gap between sleeve and the floor with floor penetration sealant as specified in Part 2.
- F. Sleeves Through Fire-Rated Floors: Install the same as sleeves through floors, except:
 - 1. Make penetrations through floor watertight by sealing gap between sleeve and floor with floor penetration sealant as specified in Part 2, and
 - 2. Provide firestopping system both inside and outside of sleeve as specified in Section 078400 and in accordance with the recommendations of FM Global.
- G. Sleeves Through Fire-Rated Walls: Provide firestopping system as specified in Section 078400 and in accordance with the recommendations of FM Global.
- H. On-Grade Floor Sleeves: Same as for below-grade exterior wall sleeves, except caulked from inside.
- I. Sleeves Through Roof: Extend 8 inches above roof.

3.5 INSTALLATION ADJACENT TO BAGGAGE HANDLING SYSTEM (BHS)

- A. Where possible, do not install plumbing above conveyors or catwalks. If in the opinion of the Contractor a pipe or conduit must be located above a conveyor or catwalk, request permission from the Port and do not proceed unless and until permission is granted. Where such permission is granted, install the item as high as possible above the conveyor or catwalk. Prior to installing items above or within 4 feet of any conveyor or catwalk component, coordinate the location in the field with the Port's baggage handling system manager. When crossing above a conveyor or catwalk, install pressurized pipe tight to the structure and ceiling deck even if the installation creates vertical bends in the piping. If installing above the conveyor, the bottom of any item shall never be less than 34 inches above the conveyor bed.
- B. Do not support pipe, fixtures, equipment, etc., from the BHS equipment or its supporting structure.

3.6 FIRESTOPPING

- A. Comply with the requirements of Section 078400.
- B. Provide fire-rated assemblies at all penetrations of 1 hour or more.

3.7 CLEANING

- A. Clean plumbing equipment, fixtures and piping of stampings and markings (except those required by codes), iron cuttings, and other refuse.
- B. Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

3.8 EQUIPMENT PROTECTION

- A. Keep plumbing pipe and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect plumbing piping, conduit, fixtures, equipment, and apparatus against dirty water, chemical, or mechanical damage both before and after installation. Restore damaged or contaminated piping, fixtures, equipment, or apparatus to original conditions or replace at no additional cost to the Port.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.

3.9 ACCESSIBILITY

- A. Conveniently locate control panels, hardware and devices, valves, thermometers, gauges, cleanout fittings, and other equipment or specialties requiring frequent reading, adjustments, inspection, repairs, or removal and replacement.

- B. Install thermometers and gauges to be easily read from floors, platforms, and walkways.
- C. Provide access panels in linear metal, wood slat, gypsum board, or other hard ceilings and walls to permit convenient access isolation, emergency shut-off, and other valves.

3.10 FLOOR, WALL AND CEILING PLATES

- A. Install plates on piping passing through finished walls, floors, ceilings, partitions and plaster furrings. Plates shall completely cover opening around pipe and duct.
- B. Secure wall and ceiling plates to pipe, insulation, or structure.
- C. Plates shall not penetrate insulation vapor barriers.
- D. Plates are not required in mechanical rooms or unfinished spaces.

3.11 ELECTRICAL EQUIPMENT

- A. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in the dedicated electrical space around electrical equipment.
- B. The area above the dedicated electrical space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks, or breaks in such foreign systems.
- C. Protect outdoor electrical equipment from accidental spillage or leakage from piping systems.

3.12 EQUIPMENT CONNECTIONS

- A. Make final connections to equipment in accordance with manufacturer's instructions, shop drawings, and as indicated.
- B. Piping:
 - 1. Connections shall include hot and cold water, fuel and gas, compressed air, sanitary waste and vent, roof and overflow roof drains, and liquid grease.
 - 2. Provide easily accessible unions and gate valves in all piping at equipment, waste traps, and any other fittings required for complete installation.
 - 3. Piping connections shall be independently supported to prevent undue strain on equipment.

3.13 PAINTING

- A. Comply with the requirements of Section 099100.
- B. Equipment Rooms and Finished Areas:
 - 1. Insulation: Not painted.
 - 2. Miscellaneous Iron Work, Structural Steel Stands, Uninsulated Tanks, Equipment Bases: Paint one coat of black enamel.

3. Steel Valve Bodies and Bonnets: Paint one coat of black enamel.
 4. Brass Valve Bodies: Not painted.
 5. Equipment Without Factory Finish: Paint one coat of grey machinery enamel. Do not paint nameplates.
 6. Hangers and Uninsulated Piping: Not painted.
- C. Concealed Spaces (above ceilings, not visible):
1. Insulation: Not painted.
 2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Valve Bodies and Bonnets: Not painted.
- D. Exterior Black Steel: Wire brush and apply two coats of rust-inhibiting primer and one coat of grey exterior machinery enamel.

3.14 POWER-ACTUATED FASTENERS

- A. Power-actuated fasteners are not allowed.

3.15 ADJUSTING AND CLEANING

- A. Before operating equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made properly and that recommended lubricants have been used.
- B. Use particular care in lubricating bearings to avoid blowing out seals from over-lubrication. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment or replace with new equipment as directed by the Port.

END OF SECTION 220500

SECTION 220519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes water meters, water-flow meters, natural gas meters, thermometers, and pressure gauges.

1.2 REFERENCES

- A. AWWA: American Water Works Association.

1.3 SUBMITTALS

- A. For the following items, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; operation and maintenance manuals; and as-constructed drawings.
 - 1. Water flow meters: Include graph of output signal versus gpm for each device.

PART 2 - PRODUCTS

2.1 THERMOMETERS, WATER

- A. Acceptable Manufacturers: Ashcroft, Weiss, Terice, Marshalltown, or equal.
- B. Description: Direct drive 5-inch dial type, stainless steel case, separable sockets, stem length to penetrate minimum of half pipe diameter, adjustable face, extension necks where required to clear insulation.
- C. Range:

<u>System</u>	<u>Temperature (°F)</u>	<u>Graduations (°F)</u>
Domestic Cold Water	25-125	1
Domestic Hot Water	30-180	2

2.2 PRESSURE GAUGES

- A. Acceptable Manufacturers: Marsh, Ashcroft, Weiss, Terice, or equal.
- B. Description: 4-1/2-inch dial, molded black polypropylene turret case.

C.	Range:		
	<u>System</u>	<u>Pressure (psi)</u>	<u>Graduations (psi)</u>
	Domestic Cold Water	0-160	1
	Compressed Air	0-160	2

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Provide thermometers, and pressure gauges where shown on the drawings.
- B. Install all devices as required and as recommended by the equipment manufacturer.
- C. Extend all connections, wells, cocks, or gauges to a minimum of 1 inch beyond insulation thickness of the various systems.
- D. Locate all instruments so that they may be conveniently read at eye level or easily viewed and read from the floor or from the most likely viewing area, e.g., platform, catwalk, etc.
- E. Install instruments over 6'-6" above floor, to be viewed from the floor, with face at 30 degrees to horizontal.

3.2 INSTALLATION - PRESSURE GAUGES

- A. Provide instrument gauge cock at inlets.
- B. Locate pressure gauge taps for measuring pressure drop or increase across pumps, coils, etc., as close to the device as possible.

3.3 TESTING

- A. Check out, start up, and test items specified herein.

END OF SECTION 220519

SECTION 220523 – GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes valves, balancing valves, pressure-reducing valves, specialty valves, safety shutoff valves, pressure relief/bypass valves, and water relief valves.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220553, Identification for Plumbing Piping and Equipment.

1.3 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI Z21.15: Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
 - 2. ANSI Z21.80: Line Pressure Regulators.
- B. ASME: American Society of Mechanical Engineers
 - 1. ASME B16.44: Manually Operated Metallic Gas Valves for Use in House Piping Systems Up to 5 psi.
 - 2. ASME BPVC Section IV: Rules for Construction of Heating Boilers.
- C. CGA: Compressed Gas Association.
 - 1. CGA 91-002.
- D. MSS: Manufacturers Standardization Society.

1.4 SUBMITTALS

- A. Submit product data, shop drawings, and maintenance data for products specified in this section.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All instances of each valve type shall be of one manufacturer.
- B. All, ball, butterfly, and check valves shall meet MSS standards.

- C. Bronze ball, and check valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Valves at insulated piping: Valves shall have 2-inch steam extensions and the following features:
 - 1. Ball Valves: Shall have extended operating handle of non-thermal-conductive materials, protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, and memory stops that are fully adjustable after insulation is applied, Nibco Nib-seal, or equal, handle extensions.
 - 2. Butterfly valves: Shall have extended necks.

2.2 CHECK VALVES

- A. Acceptable Manufacturers:
 - 1. Swing Check: Crane, Hammond, Apollo, Nibco, or equal.
- B. Horizontal Bronze Swing Check: Bronze body, bronze-mounted, screwed, TFE disc, 150 psi SWP, 300 psi CWP, Nibco T-443-Y. With soldered ends, Nibco S-433-Y.
- C. Horizontal Iron Swing Check: Iron body, bronze-mounted, flanged, regrinding bronze disc and seat ring, 125 psi SWP, 200 psi CWP, Nibco F-918-B.

2.3 BALL VALVES

- A. Acceptable Manufacturers: Hammond, Apollo, Crane, Flow Design, Nibco, or equal.
- B. Bronze Ball: Bronze body, brass ball, threaded, with handle, teflon seat, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, 600 psi CWP, 150 psi SWP, Nibco T-585-70. With soldered ends, Nibco S-585-70.

2.4 BALANCING VALVES

- A. Acceptable Manufacturers: Armstrong, Bell and Gossett, DeZurik, Flow Design Accusetter, Taco, Tour & Andersen, Watts, or equal.
- B. Domestic Hot Water Return: Balanced memory/shutoff valves, bronze body, brass ball, calibrated plate, integral pointer, suitable for tight shut-off, memory stops, soldered ends, 175 psi water, Watts CSB-41.

2.5 SPECIALTY VALVES

- A. Drain Valves and Manual Air Vents: Bronze ball valve, garden hose end, brass cap and chain 3/4-inch size, bronze cast body, chrome-plated full port ball, threaded, with handle, Teflon seat, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, 600 psi CWP, Nibco T-585-70-HC or equal.
- B. Gauge Cocks: Brass, tee handle, male to female, 200 psi working pressure, 1/4-inch, Apollo 41 series, or equal.

2.6 WATER RELIEF VALVES

- A. Acceptable Manufacturers: Armstrong, B&G, Cash Acme, Consolidated Kunkle, or equal.
- B. Description: Bronze or steel body, stainless steel or bronze trim, pressure settings to 160 psi at 250°F, in accordance with Section IV of ASME BPVC code, size in accordance with the manufacturer's recommendations based on code, setting as indicated, Kunkle Fig. 137.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide valves at connections to equipment where shown or required for equipment isolation.
- B. Install all valves accessible and same size as connected piping.
- C. Provide separate support for valves where necessary.
- D. Grooved type valve end connections may be used in lieu of flanged on services where mechanical pipe couplings and fittings are specified.
- E. Provide drain valves in all low points in the piping system, at coils and equipment and as indicated.

3.2 APPLIED LOCATIONS

- A. In piping 2 inches and smaller, domestic hot and cold water, industrial cold water.
 - 1. Bronze swing check.
 - 2. Ball valve.
- B. In piping 2 1/2 inches and larger, domestic hot and cold water, industrial cold water.
 - 1. Iron swing check.
- C. Calibrated balancing valves 3 inches and smaller, on domestic hot water where indicated on the drawings.
- D. Check valves on vertical discharge of sump pumps, and sewerage ejector pumps, iron swing check with outside weight and lever. Mount in piping at 45-degree angle.
- E. Provide gauge cock for all pressure gauges.

3.3 DRAIN VALVES AND MANUAL AIR VENTS

- A. Install at high points, low points, and as shown on the drawings, for proper venting and draining of hydronic systems.
- B. Insulate valves in cold water systems to prevent condensation.

3.4 VALVE IDENTIFICATION

- A. Identify valves to indicate their function and system served.

3.5 WATER RELIEF VALVES

- A. Water Relief Valves: Install where indicated and in accordance with the manufacturer's instructions. Pipe discharge to nearest floor drain using Schedule 40 steel pipe.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the following:
 - 1. Hangers, supports, and anchors for plumbing equipment, tanks, and piping systems.
 - 2. Supplementary steel for support or attachment of plumbing tanks, equipment, and piping to general construction elements of the project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220545, Seismic Restraints for Plumbing Piping and Equipment.
- B. Section 220548, Vibration and Seismic Controls for Plumbing Piping and Equipment.

1.3 REFERENCES

- A. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers.
 - 1. ASHRAE Chapter 41: Absorption, Cooling, Heating, and Refrigeration Equipment.
- B. CISPI: Cast Iron Soil Pipe Institute.
- C. OMSC: Oregon Mechanical Specialty Code. OPSC: Oregon Plumbing Specialty Code.
- D. OSSC: OREGON Structural Specialty Code.

1.4 SUBMITTALS

- A. Product Data: Submit product data for products specified herein.
- B. Shop Drawings:
 - 1. Submit shop drawings of Contractor-fabricated piping support structures, pipe racks, and anchors.
 - 2. Suspended Piping: Submit shop drawings of piping indicating point loads and support locations, along with applicable details keyed to layouts.
 - 3. Support Frames, Piping, Tank, and Equipment Supports, and Anchorage: Submit shop drawings indicating point loads and support locations, along with engineers' calculations and details keyed to the layouts pertaining to supports, support frames, and anchorages.

4. Supplementary Steel: Submit shop drawings showing details of fabrication and installation. Indicate materials, thicknesses, gauges, sizes, dimensions, methods of joining and fastening, welds, finishes, details of reinforcement and embedment, attachments, anchorages, miscellaneous metal items incidental to basic fabrication shown, provisions for work of other trades, and other pertinent information. Submit structural calculations for necessary supplementary steel for supports, anchors, and attachment of equipment, and pipes to general construction. Calculations shall be prepared and stamped by a registered professional structural engineer licensed in the state of Oregon.
5. As-Constructed Drawings and Data: Submit as-constructed data and as-constructed drawings.

PART 2 - PRODUCTS

2.1 SUPPORTS AND ANCHORAGE

- A. Provide pipe and equipment hangers and supports in accordance with the following:
 1. When supports and anchorages for tanks, equipment, conduit, and piping are not shown on the drawings, the Contractor shall be responsible for their design.
 2. Supports and anchorages shall resist forces due to hydraulic testing and seismic forces as specified in the OSSC for the ground motion accelerations corresponding to the project location.
 3. Supports and anchorages shall not introduce stresses in the piping caused by thermal expansion or contraction.
 4. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. The following engineered support systems shall be designed, detailed, and bear the seal of a registered professional structural engineer licensed in the state of Oregon:
 1. Supports, floor and roof-mounted tanks, and supports for suspended tanks and equipment.
 2. Support frames, such as water closet and urinal carriers, pipe racks or stanchions, for piping and equipment which provide support from below.
 3. Tank, equipment and piping support frame anchorage to supporting slab or structure.

2.2 SUPPORTS, GENERAL

- A. Acceptable Manufacturers: B-Line Systems, Anvil, Powerstrut and Kinline, Superstrut, Unistrut, or equal.
- B. Fabricate support members from welded standard structural shapes, pipe, and plate. Carry the necessary rollers, hangers, and accessories as required. Piping less than 4-inch pipe size may be supported from or by prefabricated roll-formed channels as specified in this section with necessary accessories to adequately support piping system.
- C. Supports and Accessories: Preformed roll-formed channels and accessories with matching compatible accessories as shown, as specified, and as required.
- D. Dissimilar Metal Protection: Cush-a-Strip, Hydra-Zorb cushions, or equal.

2.3 PIPE ATTACHMENTS

- A. Acceptable Manufacturers: B-Line Systems, Elcen, Anvil, Michigan Hanger, Superstrut, Tolco, or equal.
- B. Clamps: Superstrut Series 700 through 702.
- C. Insulated Horizontal Steel Piping:
 - 1. Hot and Cold Water, 2 Inches and Under: Anvil 65 with Fig. 167 shield.
 - 2. Cold Water, Over 2 Inches: Anvil Fig. 260 with Fig. 167 shield.
 - 3. Other, 2 Inches and Under: Anvil Fig. 65 with Fig. 167 shield.
 - 4. Other, Over 2 Inches: Anvil Fig. 260 with Fig. 167 shield.
- D. Uninsulated Horizontal Steel Piping:
 - 1. 2 Inches and Under: Anvil Fig. 65.
 - 2. Over 2 Inches: Anvil Fig. 260.
- E. Insulated Horizontal Copper Piping:
 - 1. Hot and Cold Water, 2 Inches and Under: Anvil Fig. 65 with Fig. 167 shield.
 - 2. Hot and Cold Water, Over 2 Inches: Anvil 260 with Fig. 167 shield.
- F. Uninsulated Horizontal Copper Piping:
 - 1. 2 Inches and Under: Anvil Fig. CT65 or CT69.
 - 2. Over 2 Inches: Anvil Fig. CT65.
- G. Horizontal Cast Iron Pipe: Anvil Fig. 260.
- H. Riser Clamps, Steel and Cast-Iron Pipe: 3/4-inch to 20-inch, Anvil Fig. 261.
- I. Riser Clamps, Copper Pipe: Anvil Fig. CT-121.

2.4 PIPE RACKS

- A. Acceptable Manufacturers: Kin-Line, Superstrut, Uni-Strut, or equal.
- B. Supports and Accessories: Preformed roll-formed channels and accessories with electrochromate or equal finish and matching compatible accessories as shown, as specified, and as required.

2.5 PROTECTION SHIELDS

- A. Select protection shields based on actual outside diameter of pipe plus insulation. Use protection shields at hanger or roller assemblies on cold water piping, where hangers are installed around insulation, and on both sides of clamps or U-bolts where installed around insulations. Use Anvil Fig. 167 or equal.

2.6 BUILDING ATTACHMENTS

- A. Acceptable Manufacturers: B-Line Systems, Elcen, Anvil, Superstrut, Tolco, or equal.

- B. Beam Hangers:
 - 1. Beam Clamps: Anvil Fig. 218, adjustable malleable iron beam clamp, or Fig. 292, adjustable forged steel beam clamp.
 - 2. C-Type Clamps: Anvil Fig. 93. Sized for required rod to support load being carried.
 - 3. Welded: Anvil Fig. 66. Sized for required rod to support load being carried.
- C. Inserts:
 - 1. Malleable iron or steel inserts, Superstrut M-732CB or S. Inserts sized for required rod to support load being carried.
 - 2. Malleable iron or steel inserts, Grinnell, Fig. 152. Inserts sized for required rod to support load being carried.
- D. Expansion Plugs: Similar and equal to Phillips “red-head” self-drilling flush shell, selected for safety factor of 4.

2.7 PIPE ANCHORS

- A. Fabricate from steel plate as detailed (hot water).

PART 3 - EXECUTION

3.1 HANGERS AND SUPPORTS

- A. General:
 - 1. Install all support systems as detailed and in accordance with manufacturer’s recommendations. Provide pipe racks, pipe stands, trapeze hangers, etc., as required and as detailed on the drawings.
 - 2. Provide adjustable hangers complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., for all pipes, except where specified otherwise.
 - 3. Size hangers to clear insulation for piping services conveying liquids less than 70°F.
 - 4. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods. Do not use tape for isolation.
 - 5. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
 - 6. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
 - 7. Install cast iron piping in accordance with CISPI standards.
 - 8. Install piping systems in accordance with OSPSC standards.
- B. Vertical Piping:
 - 1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved by the Port.
 - 2. Riser clamps shall be directly under fitting or welded to pipe.
 - 3. Risers shall be supported at each floor of penetration.

4. Provide structural steel supports at the base of pipe risers. Size supports to carry all forces exerted by piping system when systems are in operation.
- C. Horizontal Piping:
1. On all insulated piping, provide insulation protection shields at all roller locations.
 2. Cold and Hot Piping Systems:
 - a. Install hangers outside of insulation.
 - b. On piping 1-1/2-inch and larger, provide insulation protection shields at each hanger location.
- D. Trapeze Hangers: Multiple pipe runs where indicated shall be supported on channels with rust resistant finish. Provide all necessary supporting steel.
1. Channels: Unistrut with electro-chromate finish, or equal.
- E. Hanger Spacing: Provide hangers at minimum spacing in accordance with Chapter 41ASHRAE Guide and as follows:
1. Steel Pipe, Copper Tubing: For straight runs of horizontal piping with no concentrated loads such as valves, flanges, expansion joints, or other components. Sections of piping with concentrated loads shall be considered carefully and installed with appropriate spacing and rod size for the given situation.

<u>Pipe Size</u>	Max. Span	Max. Span	<u>Rod Size</u>
	<u>Steel</u>	<u>Copper</u>	
1" and smaller	7 feet	5 feet	3/8"
1-1/4" to 2"	8 feet	8 feet	3/8"
2-1/2" to 3"	11 feet	9 feet	1/2"
4" to 5"	14 feet	10 feet	1/2"
6"	17 feet	12 feet	5/8"
8" or larger	19 feet	14 feet	7/8"

2. Service: Domestic cold water, hot water, recirculating hot water, non-portable water, and other pressurized systems.
- F. Plumbing Piping: For plumbing piping not specified above, support in accordance with OSPSC requirements.
- G. Insulation Protection:
1. Where piping is suspended from insulation, provide 16-gauge galvanized steel protection shields, 12 inches long and under piping insulation at all points of suspension.
 2. Band shields firmly to insulation to prevent slippage.
- H. Building Attachments:
1. Where possible, support all piping and equipment from structural members, beams, and joists.
 2. Provide structural steel angles, channels, or other members to support piping and equipment where structural members do not occur as required for proper support.
 3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points or provide web reinforcing as required.
 4. Provide transverse and longitudinal bracing on piping at 75-foot intervals, 40-foot intervals for domestic cold water, and to provide a stabilized piping system. Bracing shall not introduce stresses in the piping system caused by thermal expansion or contraction.

5. Do not fasten or attach to unfilled steel roof deck structure.
 6. Attach to concrete-filled steel floor deck structure for loads up to 400 pounds. Loads larger than 400 pounds shall be designed per code. Submit structural calculations stamped and signed by a structural engineer licensed in the State of Oregon showing that the concrete-filled floor deck has sufficient capacity to support the load at the points of anchorage.
- I. Pipe Racks:
1. General: Provide racks as shown with additional elements to adequately support piping.
 2. Coordination: Where mechanical piping, tubing, etc., and electrical conduit, wiremold, wireways, etc., follow common routings, coordinate routing. Allow sufficient clearance to adequately operate, access, and maintain all devices without dismantling racks.
- J. General: Support all piping within 2 feet of change of direction on both sides of fitting.

END OF SECTION 220529

SECTION 220545 - SEISMIC RESTRAINTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes seismic restraints for piping, conduit, tanks, and equipment, including clamps, rods, channels, struts, anchor bolts, nuts, and accessories.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220529, Hangers and Supports for Plumbing Piping and Equipment.

1.3 REFERENCES

- A. AISC: American Institute of Steel Construction.
 - 1. AISC Steel Construction Manual.
- B. ASTM: American Society for Testing and Materials.
 - 1. ASTM A36: Standard Specification for Carbon Structural Steel.
- C. AWS: American Welding Society.
 - 1. AWS D1.1: Structural Welding Code – Steel.
- D. OSSC: Oregon Structural Specialty Code.

1.4 SUBMITTALS

- A. Product Data: Submit product data for products specified herein.
- B. Shop Drawings: Submit shop drawings complying with the requirements of the Quality Assurance article of this section. Shop drawings shall be stamped and signed by a professional structural engineer licensed in the state of Oregon.
- C. Calculations: Submit seismic calculations indicating restraint loadings resulting from the design seismic forces presented in the Quality Assurance article of this section. Include proper anchorage details and when applicable include consideration of the types of concrete. Calculations shall be stamped and signed by a professional structural engineer licensed in the state of Oregon.
- D. Certifications: Submit certification of seismic restraint's and building structural member's capability to safely accept loads resulting from seismic forces calculated in the previous paragraph. Tests in three planes clearly showing ultimate strength and appropriate safety factors, performed by independent laboratories, stamped, and signed by a professional structural engineer licensed in the state of Oregon or calculations by a professional structural engineer licensed in the state of Oregon are acceptable.

1.5 QUALITY ASSURANCE

- A. The seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure shall be designed to resist the total design seismic force prescribed in the OSSC.
 - 1. Floor- or roof-mounted equipment.
 - 2. Suspended or wall-mounted equipment.
 - 3. Vibration-isolated equipment.
 - 4. Gas or other potentially hazardous or life-safety piping systems 1 inch or larger throughout the building.
 - 5. Piping 1 1/4 inches nominal diameter and larger located in mechanical equipment rooms.
 - 6. Piping 2 1/2 inches nominal diameter and larger.
 - 7. Electrical conduit 2 1/2 inches trade size and larger.
- B. Except for those which would individually require bracing, pipes, and conduit supported by a trapeze need not be braced if connections to the pipe/duct/conduit or directional changes do not restrict movement of the trapeze. If this flexibility is not provided, require bracing when the combined operating weight of all elements supported by the trapeze is 10 pounds per foot or greater.
- C. All seismic restraints, including anchors to building structure, shall be designed by a registered professional structural engineer licensed in the state of Oregon. Include:
 - 1. Number, size, capacity, and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure. For units weighing greater than 2500 pounds, or curbs more than 10 feet long, provide substantiating calculations the curb can accept the prescribed seismic forces.
 - 2. Number, size, capacity, and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations, test data, or California OSHPD approval number verifying the horizontal and vertical ratings of the seismic restraint devices.
 - 3. Number, size, capacity, and location of braces and anchors for suspended piping, ductwork, conduit, and cable trays on as-built plan drawings.
 - a. Select a single seismic restraint system pre-designed to meet the requirements of the OSSC such as the 1999 Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork and Electrical Systems.
 - b. Details or designs from separate seismic restraint guidelines are not acceptable. Installation not addressed by the selected system shall be designed, detailed, and submitted alone with the as-built plan drawings.
 - c. Maximum seismic loads shall be indicated on drawings at each brace location. Drawings shall bear the stamp and signature of the registered professional structural engineer licensed in the state of Oregon who designed the layout of the braces.
- D. Supports, Hangers, and Anchors: Comply with the requirements of Section 220529 except anchor (expansion) bolts used for connection Level 3 shall have expansion anchor capacities equal to 50 percent of the ICC research report values.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Seismic Bracing: Steel fabrication, in accordance with AISC Steel Construction Manual, with structural steel shapes of ASTM A36 steel. Welding shall be in accordance with AWS D1.1. Design and sizes shall be as required. Fastenings, bracing, and assembly shall be selected by a professional structural engineer licensed in the state of Oregon. Design calculations shall show that the maximum stress in any structural steel member will not exceed 18,000 psi.
- B. Channel type elements shall be No. 12 gauge formed steel; 1 5/8-inch square prime painted or chromate dip finish. Use spring-in nuts with grooves.
- C. Bolting accessories shall be machine bolts with semi-finished nuts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment and tanks shall be braced or anchored to conform to the requirements listed under the Quality Assurance article of this section.
- B. Seismically brace piping to conform to the requirements listed under the Quality Assurance article of this section.
- C. Provide pipeline seismic flexible connectors where piping crosses building earthquake joints. Arrange piping and connectors for the amount of motion required. Provide vent and drain valves for all liquid filled systems.
- D. Powder-actuated inserts are not allowed.
- E. Attach seismic restraints to structural members of the building which are capable of withstanding the design load of the seismic restraint. Ensure load capacity of the structural members is greater than or equal to the capacity of the seismic restraint.
- F. Seismic restraints shall not introduce stresses in piping caused by thermal expansion or contraction.

END OF SECTION 220545

SECTION 220548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes isolation of plumbing equipment and piping.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220529, Hangers and Supports for Plumbing Piping and Equipment.
- B. Section 220545, Seismic Restraints for Plumbing Piping and Equipment.

1.3 REFERENCES

- A. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers.

1.4 GUIDELINES

- A. Seismic Restraint: Conform with the requirements of Section 220545 and additional requirements specified herein for seismic restraint of vibration isolated equipment and piping.
- B. Values for calculating seismic design forces shall be as described in Section 220545.

1.5 SUBMITTALS

- A. Shop Drawings: Submit shop drawings showing complete details of construction for steel and concrete bases including:
 - 1. Equipment mounting holes.
 - 2. Dimensions.
 - 3. Isolation selected for each support point.
 - 4. Details of mounting brackets for isolator.
 - 5. Weight distribution for each isolator.
 - 6. Details of seismic snubbers.
 - 7. Code number assigned to each isolator.
- B. Product Data: Submit product data and calculation sheets for isolators, showing:
 - 1. Size, type, load and deflection of each required isolator.
 - 2. Percent of vibration transmitted based on the lowest disturbing frequency of the equipment.
- C. Installation Procedures: Submit procedures for setting and adjusting isolation devices.

- D. Package Equipment Calculations: Where buses, isolators and other equipment specified in this section are provided as part of packaged equipment, submit calculations certifying compliance with this section.
- E. Installation Report: Submit installation report as specified in Part 3 of this section.
- F. Structural Certifications: Submit calculations stamped by a registered professional structural engineer licensed in the state of Oregon certifying mounting attachment points for isolators and seismic restraints will withstand forces calculated from values presented in Section 220545.
- G. Shop drawings and calculations shall be stamped by a registered professional structural engineer licensed in the state of Oregon.

1.6 QUALITY ASSURANCE

- A. Except for packaged equipment with integral isolators, a single manufacturer shall select and furnish all isolation required.
- B. Isolation performance requirements shall be as indicated on the drawings. All deflections indicated shall be minimum actual static deflections for specific equipment supported.
- C. Isolator Stability:
 - 1. Size springs of sufficient diameter to maintain stability of the equipment being supported with minimum horizontal to vertical stiffness ratio not less than 1:1. Spring diameters shall be not less than 0.8 of the compressed height at rated load.
 - 2. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection.
- D. Maximum Allowable Vibration Levels: Peak vibration velocities shall not exceed 0.08 in/sec. If operating vibration velocities exceed this criterion, the equipment shall be repaired or replaced at no added expense to the Port.

PART 2 - PRODUCTS

2.1 TYPE 1 - NEOPRENE WAFFLE PAD

- A. 1/4-inch-thick neoprene waffle pads with pattern repeating on 1/2-inch centers.
- B. Select Duro rating for maximum deflection at average load rating.
- C. Acceptable Manufacturers: Mason type "W," Amber-Booth, Consolidated Kinetics, or equal.

2.2 TYPE 2 - RESTRAINED DOUBLE DEFLECTION NEOPRENE

- A. Restrained double deflection neoprene mountings with minimum actual static deflection of 0.35 inches for equipment supported.

- B. Friction pad both top and bottom.
- C. Steel rails used above those mountings of equipment with overhang.
- D. Manufacturers: Mason type RCA, Amber-Booth, Consolidated Kinetics, or equal.

2.3 TYPE 4 - SPRINGS WITH RESTRAINTS

- A. Same as springs except seismic restraints shall be added.
- B. Seismic restraint an integral part of isolator.
- C. Isolator, snubber and base shall be rated to withstand a minimum 1G seismic force in all directions.
- D. Manufacturers: Mason type SLR with seismic restraints, Amber-Booth, Consolidated Kinetics, or equal.

2.4 TYPE 6 - ISOLATING HANGERS

- A. Combination rubber-in shear and steel spring isolators installed on the hanger rods.
- B. Isolators shall have the proper deflection to allow the piping to deflect as a unit with the pump isolators.
- C. Hangers designed for 30-degree angular movement.
- D. Minimum deflection shall be 1 inch.
- E. Manufacturers: Mason PC30N, Amber-Booth, Consolidated Kinetics, or equal.

2.5 SEISMIC RESTRAINTS

- A. Provide seismic restraints for all vibration isolated equipment, both supported and suspended, and all vibration isolated piping. Refer to Section 220529, Hangers and Supports for Plumbing Piping and Equipment; Section 220545, Seismic Restraints for Plumbing Piping and Equipment; for additional and specific requirements. The structural requirements for the restraints, including their attachment to the equipment or piping and the building structure, shall meet the following provisions:
 - 1. Supported Equipment:
 - a. The seismic restraints shall consist of interlocking steel members restrained by shock absorbent neoprene materials compounded to bridge bearing specifications. The elastomeric materials shall be replaceable and shall be a minimum 3/4-inch-thick. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch, nor more than 1/4 inch.
 - b. Each snubber shall be capable of restraint in all three mutually orthogonal directions.

- c. Submittals shall include load versus deflection curves up to 1/2 inch on the x, y and z planes. Tests shall be conducted in an independent laboratory or under the signed supervision of an independent registered engineer. The snubber assemblies shall be bolted to the test machine as the snubber is normally installed. Test reports shall certify that neither the neoprene elements nor the snubber body has sustained any obvious deformation after release of the load.
- 2. Suspended Equipment and Piping:
 - a. Cable Method: The seismic restraint shall consist of a combination of stranded steel aircraft cable and the specified vibration isolation hanger with an added nut and neoprene and steel washer. The cable resists lateral and downward motion. The modified vibration hanger resists upward motion.
 - b. Cable attachment details, cable size, and the neoprene and steel washers shall be sized by the manufacturer and shall be indicated in the shop drawings.
 - c. Provide detailed shop drawings for approval in sufficient time to allow structural attachment work to be incorporated into the normal work sequence.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not install any equipment or pipe which makes rigid contact with the building other than at points of support. "Building" includes slabs, beams, studs, walls, etc.
- B. The installation or use of vibration isolators shall not cause any change of position of equipment or piping which would result in stresses to piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be maintained in a rigid position during installation. The load shall not be transferred to the isolator until the installation is complete and under full operational load.

3.2 PREPARATION

- A. Treat all isolators, including springs, brackets, and housing, with a rustproof metal primer.
- B. Coat items exposed to weather with cadmium plating, galvanizing, or plastic coating.

3.3 INSTALLATION

- A. General:
 - 1. Install isolation where indicated on the drawings by type and location and where indicated below. For all other equipment with rotating parts or motors, isolation and minimum static deflections shall comply with the ASHRAE Handbook, HVAC Applications, Sound and Vibration Control.
 - 2. The assigned code number shall be marked on the isolators and bases to assure placement in the proper location.
 - 3. Anchor baseplates to floor. Rubber grommets and washers shall be provided to isolate the bolt from the base plate. Under no circumstances shall the isolation efficiency be destroyed when bolting the isolators to the floor.

- B. Isolation of Pipes:
 - 1. Provide isolating hanger supports for each piece of isolated equipment outside of mechanical rooms and where indicated. Isolators within 25 feet of equipment shall have a static deflection of 1 inch. Beyond 25 feet, isolators shall have a static deflection of 1/2 inch.
 - 2. Piping supported from floor shall be isolated with Type 1 isolators.

3.4 SEISMIC RESTRAINTS (VIBRATION ISOLATED EQUIPMENT AND PIPING)

- A. General: Install and adjust seismic restraints so that the equipment and piping vibration isolation is not degraded by the restraints.
- B. Supported Equipment:
 - 1. Each vibration isolation frame for supported equipment shall have a minimum of four seismic snubbers mounted as close as possible to the vibration isolators and/or the frame extremities.
 - 2. Care shall be taken so that a minimum 1/8-inch air gap in the seismic restraint snubber is preserved on all sides so that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation approved.
- C. Suspended Equipment and Piping-Cable Method:
 - 1. Install cables so that they do not carry any loads. Install with a minor amount of slack or sag.
 - 2. The uplift and downward restraint nuts and washers for the Type HST hangers shall be adjusted so that there is a minimum 1/4-inch clearance.
 - 3. Piping: All vibration isolated suspended piping 2 1/2 inches or larger, vibration isolated suspended piping in mechanical rooms 1 1/4 inches or larger, and vibration isolated suspended gas, hazardous, or life-safety piping 1 inch or larger shall be seismically restrained by the cable method.

3.5 ELECTRICAL COORDINATION

- A. All electrical connections to isolated equipment shall be made using flexible electrical conduit. No conduit clamps or hangers shall be used between the flexible conduit and equipment. Provide non-stressed loop in conduit, unrestrained in all directions.

3.6 FIELD QUALITY CONTROL

- A. Confirm that all isolation is installed correctly and submit report stating that isolators are installed as shown on shop drawings, isolators are free to work properly, and that installed deflections are as scheduled and as specified.

END OF SECTION 220548

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the identification of valves, piping, and equipment components of the mechanical systems to indicate their function and system served.

1.2 REFERENCES

- A. ANSI: American National Standards Institute.
 - 1. ANSI A13.1: Scheme for the Identification of Piping Systems.
- B. OSPSC: Oregon State Plumbing Specialty Code.

1.3 SUBMITTALS

- A. Product Data: For all products specified herein.
- B. Valve Tag Directory: Submit for approval prior to fabrication of valve tags.
- C. Equipment Nameplate Directory: Submit for approval prior to fabrication of labels.
- D. Include copy of valve tag and equipment nameplate directories in each set of operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 VALVE IDENTIFICATION

- A. Valve Tags:
 - 1. General: Identify valves with metal tags. Legends shall be stamped or embossed. Tags shall indicate the function of the valve and its normal operating position; for example:

PDX SARA	(SPECIFIC PROJECT IDENTIFIER)
56 HW	(NUMBER AND CONTENT OF PIPE)
ISOLATION	(VALVE FUNCTION)
NO	(NORMAL OPERATION POSITION)
 - 2. Size: Valve tags 2-inch diameter with 1/4-inch-high letters.
 - 3. Material: Use 0.050 or 0.064-inch brass tags.
 - 4. Automatic Valves and Regulating Valves: Use 1/16-inch-thick laminated 3-ply plastic, center ply white, outer ply red, "lamicoid," or equal. Form letters by exposing center ply.

5. Existing Buildings and Systems: Contact the Port for coordination with existing building tagging system and supplementary information required for any specific system before valve tagging begins.

- B. Valve Tag Directory: Include tag number, location, exposed or concealed, service, valve size, valve manufacturer, valve model number, tag material, and normal operating position of valve.

2.2 PIPING MARKERS

- A. Acceptable Manufacturers: Marking Systems, Inc. (MSI), Seton, W. H. Brady, or equal.
- B. Label pipes with all-vinyl, self-sticking labels or letters. For pipe covering sizes up to and including 3/4-inch outside diameter, select labels with 1/2-inch letters. For sizes from 3/4- to 2-inch outside diameter, 3/4-inch letters; above 2 inches outside diameter, 2-inch letters. The pipe markers shall be identified, and color coded as follows with black directional arrows.
 1. Grease waste is considered as all piping from concessions space up to the point of connection to an exterior grease interceptor, regardless of whether a point of use interceptor is installed.

SERVICE	PIPE MARKER	BACKGROUND COLOR
Nonpotable Cold Water	“NONPOTABLE COLD WATER DANGER – UNSAFE WATER”	Yellow
Cold Water	“DOMESTIC COLD WATER”*	Green
Tempered Water	“TEMPERED WATER”*	Yellow
Hot Water	“DOMESTIC HOT WATER SUPPLY”*	Yellow
	“DOMESTIC HOT WATER RETURN”*	Yellow
Sanitary Waste	“SANITARY WASTE”	Green

* - Directional arrow applied adjacent to pipe marker indicating direction of flow.

2.3 EQUIPMENT IDENTIFICATION

- A. Nameplates:
 1. Tag all pumps, air supply units, fans, converters, and miscellaneous items of mechanical equipment with engraved nameplates. Nameplates shall be 1/16-inch-thick, 3 by 5 laminated 3-ply phenolic plastic, center ply white, outer ply black. Form letters by exposing center ply.
 2. Identify unit with code number as shown on drawings and area served.
- B. Equipment Nameplate Directory: List pumps, air handlers, terminal units, and other equipment nameplates. Include Port- and Contractor-furnished equipment. List nameplate designation, manufacturer's model number, location of equipment, area served or function, disconnect location, and normal position of HOA switch.

PART 3 - EXECUTION

3.1 VALVE IDENTIFICATION

- A. Valve Tags:
 - 1. Attach to valve with a brass chain.
 - 2. Number valves per direction of the Port.
- B. Valve Tag Directory: Post final copy in operation and maintenance manual.
- C. Concealed Valves: Affix color coded "dot" to walls or ceilings wherever valves are concealed. Colors shall be as follows:
 - 1. Domestic CW Green
 - 2. Domestic HW Yellow
 - 3. Plumbing Cleanouts Black

3.2 PIPING MARKERS

- A. Unless recommendations of ANSI A13.1 are more stringent, apply labels or letters after completion of pipe cleaning, insulation, painting, or other similar work, as follows:
 - 1. Every 20 feet along continuous exposed lines.
 - 2. Every 10 feet along continuous concealed lines.
 - 3. Adjacent to each valve and stubout for future.
 - 4. Where pipe passes through a wall, into and out of concealed spaces.
 - 5. On each riser.
 - 6. On each leg of a "T."
 - 7. Locate conspicuously where visible.
- B. Further, apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above. Apply arrow labels indicating direction of flow.
- C. Spray a protective coating of clear epoxy over markers and arrows in corrosive atmosphere areas.
- D. Comply with OSPSC regarding identification of non-potable piping systems.

3.3 PIPING MARKERS ON EXISTING PIPING

- A. Remove existing "Sanitary," "Waste," and "Sanitary Waste" piping labels for all piping serving food and beverage concessions and relabel as "Grease Waste." Re-label between the point of connection to tenant fixtures and the exterior grease interceptor.

3.4 EQUIPMENT IDENTIFICATION

- A. Nameplates: Attach to prominent area of equipment, either with sheet metal screws, brass chain, or contact cement as applicable.

B. Nameplate Directory: Post final copy in operation and maintenance manual.

END OF SECTION 220553

SECTION 220590 – PRESSURE TESTING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes pressure testing of plumbing piping systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 221320, Vacuum Grease Waste Removal System.

1.3 SUBMITTALS

- A. Submit the following:
 - 1. Test plan and schedule: For testing of piping and ductwork systems.
 - 2. Test Reports:
 - a. Certificate of completion, inspection, and test by authority having jurisdiction on required piping systems.
 - b. Certificate of test approval by the Port on all systems.
 - c. The Port will record tests that it witnesses.

1.4 QUALITY ASSURANCE

- A. Code Compliance: Perform required tests in the presence of the authority having jurisdiction.
- B. Port Witness: Perform all tests in the presence of the Port.
- C. Simultaneous Testing: Test observations by the authority having jurisdiction and the Port need not occur simultaneously.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. Piping: Test prior to concealment, insulation being applied, and connection to equipment, fixtures, or specialties. Conduct tests with all valves 10 percent closed except for those used to isolate the test section.
- B. Leaks: Repair all leaks and retest until stipulated results are achieved.

- C. Notification: Advise the Port 48 hours in advance of each test. Failure to notify will require test to be rescheduled.
- D. Testing Equipment: Provide all necessary pumps, gauges, connections and similar items required to perform the tests.
- E. Pneumatic Leakage Testing: At the Contractor's option and as approved by the Port, pneumatic leakage testing prior to hydronic pressure testing or system filling is permitted with a maximum air pressure of 5 psig. This does not replace requirements for hydronic pressure testing at a higher pressure specified herein. Pneumatic testing of plastic piping is not permitted unless approved by the Port.

3.2 TESTING REQUIREMENTS

- A. Sanitary and Roof Drainage Systems: Test entire system or sections of system by closing all openings in piping except highest opening and filling system with water to point of overflow. If system is tested in sections, plug each opening except highest opening of section under test and fill each section with water, but none with less than 10-feet head of water. Keep water in system, or in portions under test, for at least 45 minutes before inspection starts. Test for two hours with no drop allowed. Locate and repair leaks.
- B. Piping: Test all piping as noted below, with no leaks or loss in pressure for time indicated. Repair or replace defective piping until tests are completed successfully.
- C. Confirm test pressure before proceeding with the work.

<u>System</u>	<u>Test Pressure</u>	<u>Test Medium</u>	<u>Test Duration</u>
Non-potable and potable water	100 psig	Hydrostatic Water	4 hours*

* - Test for 4 hours, minimum, or in accordance with the duration required in NFPA 54, whichever is more stringent.

END OF SECTION 220590

SECTION 220719 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes insulation for piping and equipment.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 099100, Painting.
- B. Section 220529, Hangers and Supports for Plumbing Piping and Equipment.

1.3 REFERENCES

- A. IBC: International Building Code.
 - 1. IBC Chapter 13: Energy Efficiency.
- B. UL: Underwriters Laboratories.
 - 1. UL 723: Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

- A. Product Data: For each type of insulation including density, conductivity, thickness, jacket, vapor barrier, flame spread, and smoke developed indexes.
- B. Shop Drawings: Detail the installation of insulation for the following:
 - 1. Removable covers for pump casings, accesses, etc.
 - 2. Expansion joints.
 - 3. Acoustical insulation including construction and installation of stainless-steel jacket.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Flame and Smoke Ratings: Installed composite flame spread not to exceed 25 and smoke developed not to exceed 50 as tested by UL 723.
 - 2. Energy Codes: IBC Chapter 13 shall govern where requirements for thickness exceeds thickness specified.
- B. Protection: Protect against dirt, water, chemical or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost to the Port.

- C. Source Quality Control:
 - 1. Service: Use insulation specifically manufactured for service specified.
 - 2. Labeling: Insulation labeled or stamped with brand name and number.
 - 3. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice, or other vermin: not react corrosively with equipment, piping, or ductwork; and be asbestos free.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All insulation shall be of one manufacturer.

2.2 PIPE INSULATION

- A. Fiberglass: Split sectional or snap-on type with 3.5 pcf density 0.23 per inch maximum thermal conductivity (K-factor) at 75 degrees F mean temperature, 500 degrees F minimum service rating and white, vapor barrier jacket with pressure sensitive closure system. Owens Corning Fiberglas Pipe Insulation SSL II or equal.
- B. Calcium Silicate: Sectional with 14 pcf nominal density, 0.42 per inch maximum K-factor at 200 degrees F mean temperature and 1200 degrees F minimum service rating. Pabco or equal.
- C. Elastomeric: Expanded closed cell, 0.27 per inch maximum K-factor at 75 degrees F mean temperature and 220 degrees F maximum service rating with fitting covers. Armstrong Armaflex II or equal.
- D. Acoustical: 2-inch thick 8 pcf density mineral wool.

2.3 ACCESSORIES

- A. Adhesives:
 - 1. Fiberglass: Johns Manville Zeston, Z-Glu, or equal.
 - 2. Calcium Silicate: Benjamin Foster 30-36 or equal.
 - 3. Elastomeric: Armstrong 520 or equal.
- B. Weld Pins: Duro-Dyne, with NC-1 nylon stop clips, or equal.
- C. Cements:
 - 1. Insulating: Ryder or equal.
 - 2. Heat Transfer: Johns Manville Zeston Z-20 or equal.
- D. Wire Mesh: 1-inch mesh with 20-gauge annealed steel wire.
- E. Pipe Fitting Covers: One-piece PVC insulated pipe fitting covers. Johns Manville Zeston, Ceel-Co, or equal.

- F. Grooved Coupling Insulation: One-piece PVC insulated fitting cover. Johns Manville Zeston, Ceel-Co, or equal.
- G. Insulation Protection Saddles: 12-inch long, 16-gauge steel. All piping with insulation shall be Anvil Fig. 167, galvanized, or equal.
- H. Mastic:
 - 1. Vapor Barrier: Design Polymerics 3040, or equal.
 - 2. Outdoor Mastic: Design Polymerics 3040, or equal.
- I. Metal Pipe Jacket: 0.016-inch-thick aluminum jacket with form-fitting covers, aluminum snap straps and sealant.
- J. Cloth Facing: Presized fiberglass cloth.
- K. Tapes: Pressure sensitive, weather resistant and for temperatures up to 150 degrees F. Zeston Z-tape or equal.
- L. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the PVC fitting covers, elastomeric, aluminum facing, Kraft paper, tapes, and adhesives.

PART 3 - EXECUTION

3.1 GENERAL

- A. Applicators: Applicators shall be employed by a firm that specializes in insulation work.
- B. Preparation: Surfaces of piping and equipment shall be clean, free of oil or dirt, and dry before insulation is applied.
- C. Stamps: Do not cover ASME stamps, UL labels, or similar stamps and labels.
- D. Any insulation that becomes damaged, water soaked, or stained shall be replaced at no additional cost to the Port.

3.2 PIPE AND EQUIPMENT INSULATION APPLIED LOCATIONS

- A. Insulate the following piping systems with glass fiber insulation, all-purpose jacket in thickness listed.

- B. Insulate piping in calcium silicate where indicated. Use same thickness as listed above for glass fiber insulation.

DESCRIPTION	DOMESTIC COLD WATER	DOMESTIC HOT AND TEMPERED WATER	NON-POTABLE WATER	LIQUID GREASE	VACUUM WASTE
Pipe Size < 1-1/2"	1/2	1	1/2	-	-
Pipe Size ≥ 1-1/2"	1	1-1/2	1	-	-

- The following piping is not insulated (except for where heat traced): domestic cold water exposed supplies, priming lines, vents and waste.
 - Trap priming lines and traps in unheated space, 1-inch over heat tape
 - At hangers and horizontal pipe supports, use calcium silicate hard packs.
- C. Insulation shall include all fittings, unions, flanges, mechanical couplings, valve bodies, valve bonnets, and piping through sleeves (except valve bonnets). Unions and flanges need not be insulated on the following systems:
- Domestic hot water, inside building.
- D. Insulate valves and irregular fittings with section of pipe insulation and insulating cement, securely fastened, and finished with 6 oz. canvas and Foster 30-36 or equal, lagging adhesive. The Contractor shall have the option on all flanges, valves, and strainers not requiring a vapor barrier to insulate with removable replaceable pads fabricated of 1-inch layer of Pittsburgh Corning Temp Mat, or equal, sandwiched between inner and outer layer of 8-ounce glass cloth, held together with stainless staples with sufficient stainless lacing hooks to hold pad firmly to flange or valve with minimum 3-inch overlap onto adjacent pipe insulation using 18-gauge stainless steel lacing wire.
- E. Expansion Joints and Flexible Connectors: Pipe insulation or block of same material and thickness as adjacent piping.

3.3 PIPING INSTALLATION

- A. General:
- Joints: Coat both sides of complete joining area with applicable adhesive.
 - Longitudinal Joints: Make joints on top or back of pipe to minimize visibility. Except for foam plastic, seal with closure system or 3-inch-wide tape.
 - Butt Joints: Butt tightly together and, except for foam plastic, seal with 3-inch-wide tape or butt straps.
 - Multiple Layered Insulation: Joints shall be staggered.
 - Access: Strainer and other items requiring service or maintenance with easily removable and replaceable section of insulation to provide access.
 - Voids: Fill all voids, chipped corners, and other openings with insulating cement or material compatible with insulating material. In insulation with vapor barrier, coat with vapor barrier mastic.
 - Heat Tracing: Where piping is shown or specified to be heat traced, bed heat tape into heat transfer cement with insulation over heat tape and cement. FG or FP not allowed.
 - Seal joints, seams, and fittings of metal watertight jackets at exterior locations.

- B. Fiberglass Insulation: Exterior insulation encased in metal jacket.
- C. Calcium Silicate Insulation:
 - 1. On systems with vapor barrier, coat complete with vapor barrier mastic.
 - 2. Cover with cloth facing secured with applicable adhesive.
 - 3. Exterior insulation encased in metal jacket.
- D. Elastomeric Insulation:
 - 1. Slit full length and snap around pipe.
 - 2. Make cuts perpendicular to insulating surface leaving no cut section exposed.
 - 3. Do not stretch insulation to cover joints or fittings.
 - 4. Seal joints with adhesive. Sealing joints with tape will not be allowed.
- E. Fittings: Install insulation on all fittings.
 - 1. On Elastomeric and Acoustical Insulation: Fittings covered with covers made up of mitered sections of insulation or with formed pipe fitting covers.
 - 2. In Other Insulation: Fittings covered with insulation to the same level of the adjoining insulation or fill with insulating cement. Finish with pipe fitting covers or cloth facing and tape.
- F. Unions, Flanges, Mechanical Joints, Valves, Etc.:
 - 1. General:
 - a. As specified for fittings.
 - b. Minimum thickness same as specified for piping.
 - 2. Unions: Build up insulation at least 1/2 inch beyond adjoining insulation.
 - 3. Flanges: With square corners. Where flanges are not insulated, terminate adjacent insulation so flange bolts can be removed.
 - 4. Flanged Valves: Insulation with square corners.
- G. Vapor Barrier Insulation:
 - 1. Piping which requires vapor barrier protection shall have a continuous vapor barrier, which shall not be pierced or broken, except inside of walls. The following piping systems require vapor barrier protection:
 - a. Domestic cold water.
 - b. Non-potable cold water.
 - 2. Insulation for pipe requiring vapor barrier protection 3/4 inch or smaller, insulation continuous through pipe hanger.
 - 3. For pipe 1 -inch and larger, 18-inch section of calcium silicate, same thickness as pipe insulation, with continuous vapor barrier jacket, at each hanger.
 - 4. For all piping, protect vapor barrier with pipe shield specified in Section 220529.
- H. Non-Vapor Barriered Insulation:
 - 1. Piping not requiring a vapor barrier shall be supported as specified above except at piping requiring roller hangers. Provide saddle as specified in Section 220529.
 - 2. On piping 3/4-inch and smaller, insulation may pass through hanger. Provide shield or rigid insulation at hanger.

3.4 EQUIPMENT INSTALLATION

- A. General: Install true and smooth. Insulation over curved surfaces shall conform to curves of surface.
 - 1. Access: Access, etc., that requires service, inspection, or maintenance shall be provided with covers or sections that are easily removable and replaceable. Reinforce openings in adjacent insulation with metal beading. In vapor barriered insulation, coat joints with vapor barrier mastic.
 - 2. Voids, Depressions, and Cavities: All voids, chipped corners, and other openings shall be filled with insulating cement or material compatible with insulating material.
 - 3. Vapor Barriered Insulation: Where insulation is specified to have a vapor barrier, the barrier shall not be pierced or broken.
 - a. Coat tears, etc., with vapor barrier mastic and patch with insulation facing or tape.
 - b. Staples shall be brush coated with vapor barrier coating.
 - c. Cover all raw edges coated with vapor barrier mastic, and seal cover to equipment surface.
 - 4. Non-Vapor Barriered Insulation:
 - a. Patch tears, etc. with insulation facing or tape.
 - b. Cover all raw edges and bevel neatly to the equipment surface.
 - 5. Multi-layered Insulation: Joints shall be staggered.
- B. Expansion Joints: Covered with larger size pipe insulation to allow full movement and be removable.

3.5 FIELD QUALITY CONTROL

- A. Field Test: Test and approve all systems prior to installation of insulation.
- B. Existing Insulation:
 - 1. Repair existing insulation damaged during construction.
 - 2. Make neat connections where new and existing insulation meet.
 - 3. Where existing piping or equipment is removed, cover existing surfaces neatly to match existing.

END OF SECTION 220719

SECTION 221100 - PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes piping, pipe fittings, and incidental related items as required for complete piping systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220500, Common Work Results for Plumbing
- B. Section 220529, Hangers and Supports for Plumbing Piping and Equipment
- C. Section 220545, Seismic Restraints for Plumbing Piping and Equipment
- D. Section 220548, Vibration and Seismic Control for Plumbing Piping and Equipment
- E. Section 220553, Identification for Plumbing Piping and Equipment
- F. Section 220590, Pressure Testing of Plumbing Systems

1.3 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI 61: Drinking Water System Components - Health Effects
 - 2. ANSI B16.1: Gray Iron Pipe Fittings and Flanged Fittings: Classes 25, 125, and 250
- B. ASME: American Society of Mechanical Engineers
 - 1. ASME A112.3.1: Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above- and Below Ground
- C. ASTM: American Society for Testing and Materials
 - 1. ASTM A36: Standard Specification for Carbon Structural Steel
 - 2. ASTM A47: Standard Specification for Ferritic Malleable Iron Castings
 - 3. ASTM A53 or A120: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 4. ASTM A74: Standard Specification for Cast Iron Soil Pipe and Fittings
 - 5. ASTM A183: Standard Specification for Carbon Steel Track Bolts and Nuts
 - 6. ASTM A234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
 - 7. ASTM A307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 - 8. ASTM A351: Standard Specification for Castings, Austenitic, for Pressure-Containing Parts

9. ASTM A403: Standard Specification for Wrought Austenitic Stainless-Steel Piping Fittings
 10. ASTM A536: Standard Specification for Ductile Iron Castings
 11. ASTM A666: Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar
 12. ASTM A743: Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application
 13. ASTM A744: Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service
 14. ASTM B75: Standard Specification for Seamless Copper Tube
 15. ASTM B88: Standard Specification for Seamless Copper Water Tube
 16. ASTM B584: Standard Specification for Copper Alloy Sand Castings for General Applications
 17. ASTM C564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
 18. ASTM D2000: Standard Classification System for Rubber Products in Automotive Applications
 19. ASTM D2513: Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
 20. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials
 21. ASTM F1673: Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems
- D. AWWA: American Water Works Association
1. AWWA C110: Ductile-Iron and Gray-Iron Fittings
 2. AWWA C151: Ductile Iron Pipe, Centrifugally Cast, for Water
 3. AWWA C209: Cold-Applied Tape Coatings for Steel Water Pipe and Fittings
 4. AWWA C214: Tape Coating Systems for the Exterior of Steel Water Pipelines
 5. AWWA C220: Stainless-Steel Pipe, 1/2 Inch and Larger
- E. CDA: Copper Development Association
1. CDA Copper Tube Handbook
- F. CISPI: Cast Iron Soil Pipe Institute
1. CISPI Standard 301: Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
- G. IAPMO: The International Association of Plumbing and Mechanical Officials
1. IAPMO IGC 304: Flexible Expansion Joints for DWV and Sewer Piping Systems
- H. ISO: International Organization for Standardization
1. ISO 9001: Quality management systems - Requirements
- I. OSPC: Oregon Specialty Plumbing Code
- J. UL: Underwriters Laboratories
1. UL 723: Standard for Test for Surface Burning Characteristics of Building Materials

1.4 SUBMITTALS

- A. Product Data: For all products specified herein. Submit a schedule of services and a list of related plumbing materials and fittings.
- B. Shop Drawings: For plumbing systems layout. Coordinate with the work of other divisions and existing facilities, systems, equipment, and components.
- C. Test Reports and Certificates:
 - 1. Certificates of inspections and pipe tests.
 - 2. Submit bacteriological samples to a certified laboratory to test that the water is suitable for drinking. The laboratory's certificate stating purity of water shall be submitted to the Port.
- D. Other: Certified welders' certificates.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Piping material and installation shall meet requirements of the local plumbing, fire, and building codes and serving utility requirements.
 - 2. Provide chlorination of domestic cold and hot water piping in accordance with county and state health requirements.
- B. Pipe Cleaning: Should any pipe be plugged or should foaming of water systems occur, disconnect piping, reclean, and reconnect with no additional cost to the Port.
- C. Correct any damage to the building or systems resulting from failure to properly clean the system with no additional cost to the Port.

PART 2 - PRODUCTS

2.1 CAST IRON SOIL PIPE, SERVICE WEIGHT

- A. General: A code-approved hubless system in accordance with Cast Iron Soil Pipe Institute Standard 301.
- B. Pipe and Fittings: Service weight hubless cast iron in accordance with ASTM A74. AB&I, True Spun, Tyler, or equal.
- C. Gaskets: Compression type in accordance with ASTM C564.
- D. Couplings:
 - 1. Above Grade: Band type coupling consisting of stainless steel clamp and corrugated shield assemblies, with a neoprene sealing sleeve and fittings in accordance with AWWA C110.
 - 2. Buried: Clamp-All 125 or Husky 24-gauge 304 stainless steel hubless type clamp and shield assemblies with neoprene sealing gaskets (ASTM C564).

- E. Service:
 - 1. Sanitary soil and waste to 5 feet outside building line (excluding kitchen sanitary and grease waste).
 - 2. Vent piping 2 inches and above.

2.2 GALVANIZED STEEL PIPE

- A. Pipe: Schedule 40 in accordance with ASTM A120.
- B. Fittings: 150-pound screwed galvanized malleable iron on 2 inches and below. Mechanical couplings as herein specified on 2 1/2 inches and above.
- C. Service:
 - 1. Miscellaneous indirect waste piping.
 - 2. At the Contractor's option, waste and vent piping 1 1/2 inches and under, above grade.
 - 3. Safety and relief valve discharge.

2.3 COPPER PIPE

- A. Pipe: Hard drawn copper tubing, Class L or K, ASTM B88.
- B. Fittings: Wrought copper, 150 psi, solder joint type, Chase, Revere, Mueller, or equal. At the Contractor's option, a system using mechanically extracted collars in main with branch line inserted to not obstruct flow may be used on domestic water piping above ground, similar to T-drill.
- C. Service:
 - 1. Domestic hot and cold water piping above ground (Type L, hard drawn) on piping 4 inches and smaller.
 - 2. Trap priming lines above ground (Type L, hard drawn).
 - 3. Industrial cold water, non-potable cold and hot water above grade (Type L) on piping 4 inches and smaller.
 - 4. Miscellaneous drains and overflows.

2.4 UNIONS

- A. Unions shall be 150 psi malleable iron or brass, brass to iron seat, ground joint, black or galvanized to match pipe. 200 psi WOG bronze, ground joint, solder type for copper tubing. Use of dielectric unions is not permitted.

2.5 DIELECTRIC NIPPLE

- A. Iron body with zinc plated external coating, 150 psi, plastic dielectric coating on inside of nipple, and NPT x NPT connections. Grooved ends are not permitted.

2.6 SOLDER AND BRAZE ROD

- A. Copper Piping and Joints: Dyna-Flow by J.W. Harris Co. Inc., Westinghouse Phos-Copper, or equal.
- B. Valves, Cast Fittings, or Bronze Fittings: Harris Stay-Silv-15, Handy & Harmon Sil-Fos, or equal.
- C. Water Piping: All-State 430 with Duzall Flux, Engelhard Silvabrite with Engelhard General Purpose Flux, J.W. Harris Co. Stay-Safe 50 with Stay-Clean Flux or equal, on 3 inches and smaller. On larger pipe, use Type "A" solder.

2.7 FLEXIBLE CONNECTORS

- A. Expansion Joint for Domestic Water Piping: Metraflex Metraloop, or equal, UL classified for use in drinking water classifications in accordance with ANSI/National Sanitary Foundation 61 standard, bronze hose and braid with copper sweat ends.
- B. Expansion Joint for Sanitary Waste Piping: Metraflex Pooploop no hub connection, or equal, UL classified for use in sanitary waste classifications in accordance with IAPMO IGC 304 standard, stainless steel hose and braid with stub ends.

2.8 PIPING, HANGERS, SUPPORTS, ANCHORAGE, AND SEISMIC RESTRAINTS

- A. Conform to the requirements of Section 220529, Section 220545, and Section 220548.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measurements, Lines, and Levels:
 - 1. Check dimensions at the building site and establish lines and levels for the work specified in this section.
 - 2. Establish all inverts, slopes and manhole elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with the drawings and specifications.
 - 3. Use established grid and area lines for locating trenches in relation to buildings and boundaries.

3.2 PIPING INSTALLATION

- A. Install unions in all non-flanged piping connections to apparatus and adjacent to all screwed valves, traps, and appurtenances requiring removal for servicing, located so that piping may be disconnected without disturbing the general system.
- B. Install all piping to vent and drain.
- C. Support all piping independently so that its weight is not carried by the equipment.
- D. Run piping clear of tube cleaning or removal/replacement access area on coils, etc.
- E. Dielectric Fittings: Provide dielectric couplings, unions or flanges between dissimilar metals. Fittings shall be suitable for the pressure and temperature to be encountered.
- F. Expansion Joints/Seismic Connectors: Install where piping crosses building expansion joints and where indicated on drawings. Install in accordance with the manufacturer's instructions.
- G. No-Hub Couplings: Install in accordance with the manufacturer's instructions.
- H. See Section 220500 if work is above baggage conveyor or catwalk.

3.3 PIPING JOINTS

- A. Join pipe and fittings using methods and materials recommended by the manufacturer, in accordance with standard practice and applicable codes. Cleaning, cutting, reaming, grooving, etc., shall be done with proper tools and equipment. Hacksaw pipe cutting is prohibited. Peening of welds to stop leaks is not permitted.
- B. Copper Piping:
 - 1. Soldered Joints: Cut pipe evenly with cutter, ream to full inside diameter; end of pipe and inside of fitting thoroughly cleaned and polished. Joints shall be uniformly heated, and capillary space completely filled with solder, leaving full bead around entire circumference.
 - 2. Brazed Joints: All joints using mechanically extracted collars shall be brazed in accordance with the Copper Development Association's Copper Tube Handbook using B-cup series filler metal. Soft solder joints will not be accepted.
- C. Do not install couplings in floor, wall, or grade beam sleeves.

3.4 ADJUSTING AND CLEANING

- A. General:
 - 1. Clean interior of all piping before installation.
 - 2. Flush sediment out of all piping systems with a minimum velocity of 5 to 6 FPS.
 - 3. Prepare system for adjusting and balancing. If any system components, including control valves, balancing valves, automatic flow control valves, strainers, or other valves and specialties have sediment present, remove, clean and replace damaged or worn components.

B. Domestic Water Chlorination:

1. Chlorination of domestic cold and hot water piping shall be in accordance with county and state health requirements.
2. Upon completion of all tests and necessary replacements, disinfect all domestic water piping. Chlorination shall be accomplished by personnel of firm licensed to do this type of work.
3. The system shall be charged with a chlorine solution of at least 50 PPM residual chlorine. Evenly distribute the solution throughout the system. The strong chlorine solution shall remain in the system for a minimum of 24 hours. The strength of the solution shall be confirmed at over 10 PPM at the end of the 24-hour period.

END OF SECTION 221100

SECTION 221120 - PLUMBING PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes sump pumps and in-line pumps.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220500, Common Work Results for Plumbing
- B. Section 220520, Piping Specialties for Plumbing Piping
- C. Section 220523, General Duty Valves for Plumbing Piping
- D. Section 220529, Hangers and Supports for Plumbing Piping and Equipment
- E. Section 220545, Seismic Restraints for Plumbing Piping and Equipment
- F. Section 220548, Vibration and Seismic Controls for Plumbing Piping and Equipment
- G. Section 220553, Identification for Plumbing Piping and Equipment
- H. Section 221100, Plumbing Piping

1.3 SUBMITTALS

- A. For each item specified herein, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.
 - 1. Include with product data for each pump: performance curves, motor data, operating weights, and pressure ratings.
 - 2. Include control information and wiring diagram for packaged equipment.

1.4 QUALITY ASSURANCE

- A. Pump impellers shall not be greater than minimum impeller size plus 90 percent of the difference between the maximum and minimum impeller size for pump selected.
- B. Motor shall be non-overloading under all operating conditions.

PART 2 - PRODUCTS

2.1 IN-LINE CIRCULATING PUMP

- A. Acceptable Manufacturers: Armstrong, Bell & Gossett, Grundfos, Paco, Taco, or pre-bid approved equal.
- B. Description:
 - 1. Pipe-mounted, integral centrifugal pump and resiliently mounted motor.
 - 2. Flexible coupling between pump and motor.
 - 3. Mechanical shaft seals.
 - 4. Bronze fitted or stainless-steel impeller.
 - 5. Rising head characteristics with decrease in volume.
 - 6. Drip-proof construction.

PART 3 - EXECUTION

3.1 IN-LINE CIRCULATING PUMP INSTALLATION

- A. Motor horizontally or vertically depending on normal design of pump.
- B. Provide convenient access to oil cups for servicing and as required by the manufacturer.
- C. Provide flexible connections, strainers, check valve, and shut-off valves on suction and discharge of pumps.
- D. Lubricate in accordance with the manufacturer's instructions before operation.
- E. Support and isolate circulators.

3.2 FIELD TESTING

- A. Sump Pump: After installation is complete, conduct a test of the system as follows:
 - 1. Operate complete pump sequence to assure proper operation of pumps with respect to fluid level in sumps.
 - 2. Confirm proper operation of lead lag sequencing.
 - 3. Confirm operation of both remote and local alarm devices.

END OF SECTION 221120

SECTION 223000 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes backflow preventers.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220500, Common Work Results for Plumbing
- B. Section 220523, General Duty Valves for Plumbing Piping
- C. Section 220529, Hangers and Supports for Plumbing Piping and Equipment
- D. Section 220545, Seismic Restraints for Plumbing Piping and Equipment
- E. Section 220553, Identification for Plumbing Piping and Equipment
- F. Section 221100, Plumbing Piping

1.3 REFERENCES

- A. FDA: Food and Drug Administration
- B. OSPSC: Oregon State Plumbing Specialty Code

1.4 SUBMITTALS

- A. For each item specified herein, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.

PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

- A. Acceptable Manufacturers: Febco, Watts, or pre-bid approved equal.
- B. Reduced Pressure Type:
 - 1. 2-Inch Size and Smaller: Screwed ends with bubble-tight ball valves, bronze main valve body and cover, bronze main valve with stainless steel 316 trim and four test cocks. Maximum working pressure of 150 psi unless scheduled.

- C. Vacuum Breakers:
 - 1. Atmospheric Type (AVB): 1/2-inch through 2-inch size, all brass body, non-spilling type, 150 psig working pressure with maximum temperature of 140 degrees F. Rough brass finish.

PART 3 - EXECUTION

3.1 BACKFLOW PREVENTERS

- A. Install at height and location suitable for testing purposes by the local governing authority.
- B. Provide funnel drain below reduced pressure backflow device for collecting periodic discharge and testing purposes. Pipe indirect waste from funnel drain to floor drain or to a location as noted on the drawings. Discharge indirect waste above floor drain utilizing a 1-inch air gap.

3.2 TESTING

- A. Check out, start up, and test the following items:
 - 1. Backflow preventers.

END OF SECTION 223000

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes plumbing fixtures, fixture trim, drainage products, and miscellaneous plumbing items.

1.2 REFERENCES

- A. ADAG: Americans with Disabilities Act Guidelines
- B. ANSI: American National Standards Institute
 - 1. ANSI A112.19.3: Stainless Steel Plumbing Fixtures
 - 2. ANSI Z358: Emergency Eyewash and Shower Equipment

1.3 SUBMITTALS

- A. For each item specified herein, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.
- B. For each item specified below, submit commissioning plans and schedules; checkout, startup, operational, functional and final acceptance test plans, procedures, checklists, and reports; systems manuals; and operation and maintenance training plans.
 - 1. Sensor operated faucets.
 - 2. Sensor operated flush valves.
 - 3. Electric water cooler.
 - 4. Mixing valves.

PART 2 - PRODUCTS

2.1 FIXTURE TRIM

- A. Supply Kits: Lead free, chrome-plated brass supply stop vales with full turn brass stem, no plastic, and chrome-plated risers and flange. McGuire LF series or equal.
- B. Traps: For floor drains, provide coated cast iron P-trap; recessed, screw jointed, or bell and spigot.
 - 1. For other fixtures, provide 17-gauge, chrome plated tubing P-traps with solder bushings.

2.2 SEALANT

- A. Use Dap Kwik Seal or equal. Color shall be as selected by the Port.

2.3 PLUMBING FIXTURES

- A. Acceptable Manufacturers: As listed below or pre-bid approved equal.
- B. WC-1 Water Closet (Wall Hung):
 - 1. Vitreous china, wall hung, elongated, Sloan Tec hydrophobic antimicrobial glaze, siphon jet action, 1-1/2-inch top spud. Sloan ST-2459-STG.
 - 2. Diaphragm type flush valve polished chrome finish, Sanigard handle, 1.1 GPF. Sloan Royal 111-1.1-SG.
 - 3. White open front seat. Olsonite 95 SS, comparable Bemis or Beneke, comfort curve elongated open front seat less cover.
 - 4. Chair Carrier: Provide J.R. Smith Series 200 with M-40 water closet anchor for additional support, M-51 anchor foot for single carriers.
- C. WC-2 Water Closet (Wall Hung, ADA): Same as WC-1, except ADA mounting height.
- D. U-1 Urinal (Wall Hung, Electronic Sensor):
 - 1. Wall hung, 3/4-inch top spud. Sloan SU-1009-STG.
 - 2. Hybrid piston/diaphragm operated type flush valve, polished chrome finish, four AA battery operated solenoid, manual push button override, 0.5 GPF. Hydrotek HE8200.
 - 3. Floor-mounted urinal support. J.R. Smith Series 600.
- E. U-2 Urinal (Wall, Electronic Sensor, ADA): Same as U-1, except ADA mounting height.
- F. L-1 Lavatory (Stainless steel undermount Sink, Electronic Sensor):
 - 1. 18-gauge, 20 by 15 1/2 by 5 1/2 inches deep, oval undercounter-mounted 18-8 seamless die-drawn stainless steel lavatory. Fully coated underside insulated for sound and to reduce condensation. Conforms to ANSI A112.19.3. Unit supplied with undermount clips less fasteners, Just Manufacturing, J115 FS grid strainer. Just Manufacturing UOIRADA1521A55-J
 - 2. Sensor operated faucet for tempered water, 1/2 GPM vandal-proof aerator, 8-inch trim plate, self-contained battery. Chicago HyTronic, 116.598.AB.1T faucet, E66VPJKABCP aerator.
- G. Exposed Waste and Supply Piping Insulation Kits: Insulation kit for exposed supplies and waste piping below ADA lavatories and ADA sinks. McGuire Prowrap or comparable Truebro product.

2.4 DRAINAGE PRODUCTS

- A. Acceptable Manufacturers: As listed below or pre-bid approved equal.
- B. HB-1 Hose Bibb (Cold Water): Single sink fitting in rough brass finish, 3/4-inch hose outlet, fixed lever handle, E-27 vacuum breaker. Chicago No. 7.

- C. FD-1 Floor Drain (Toilet Room, finished floor, general area drain): With nickel bronze grate. J.R. Smith, Fig. 2005-A square 2005-B round.
- D. WCO Wall Cleanout: J.R. Smith Figure 4530.
- E. FCO Floor Cleanout: J.R. Smith Figure 4040FC-U.
- F. Priming Valves: Electronic trap priming manifold including, but not limited to, atmospheric vacuum breaker, pre-set 24-hour clock, manual override, 120V solenoid valve, calibrated manifold for equal water distribution, and 3/4" water hammer arrestor. Components shall be preinstalled in stainless steel cabinet with access door. Precision Plumbing Products, Inc.
 - 1. 1 to 4 Drains: PPP MP-500.
 - 2. 5 or More Drains: PPP – PTS 4-12 Prime Time.
- G. Shock Arrestor: Stainless steel construction, bellows design. J.R. Smith Hydrotrol.

PART 3 - EXECUTION

3.1 FIXTURE TRIM

- A. Provide plumbing fixture trim where applicable on fixtures.
- B. Provide rough-in and final piping connection to fixtures. Carefully review all construction documents to assure that all fixtures are provided with necessary services for a complete operating system.
- C. Rigidly secure rough-in piping, carriers and supports, and other service piping to structure.

3.2 PLUMBING FIXTURES

- A. Americans with Disabilities Act: Those fixtures indicated by “ADA” shall comply with and be installed in accordance with ADAG. Where applicable building code requirements are more stringent than ADAG guidelines, follow building code requirements.
- B. Mounting Heights: All fixtures shall be standard rough-in catalogued heights unless shown otherwise on the drawings.
- C. Water Supplies: When both hot and cold water to a fixture is required, connect the hot on the left and the cold on the right.
- D. Floor-Mounted Supports and Chair Carriers: Secure floor-mounted supports and chair carriers to slab with 1/2-inch bolts, minimum. Install supports and carriers in accordance with the manufacturer’s instructions.
- E. Lavatories: Provide insulation kits on exposed hot water and waste piping beneath lavatories.

- F. Lavatories with electronic sensors and urinals with automatic flushing system:
 - 1. Install lavatory and urinal sensors, wiring and piping as recommended by the manufacturer.
 - 2. Mount wiring box to bottom of countertop for total concealment. Coordinate with Division 26 for transformer and receptacle locations.
 - 3. Provide vandal proof screws on wiring boxes for lavatories and sensor boxes for urinals.
 - 4. Test and adjust electronic sensors and retest as needed to provide reliable trouble-free operation.
- G. Floor Drain:
 - 1. Set top flush with finished floor.
 - 2. Provide membrane clamp where required.
- H. Floor Sink:
 - 1. Set floor sink in drain adhesive/sealant specified in Part 2.
 - 2. Fill void between floor sink body and opening in floor with non-shrink grout.
 - 3. Floor Sink Retrofit Liner: Install per manufacturer's requirements.
- I. Cleanout: Cover set flush with finished surface.
- J. Water Coolers:
 - 1. Water-bearing materials shall comply with the Safe Drinking Water Act of 1988. The waterway system of the unit shall be manufactured of copper components and other completely lead-free materials.
 - 2. Water cooler refrigerants shall be non-CFC.
- K. Shock Arresters: Provide per manufacturer's recommendation as shown on drawings by PDI, whichever is more stringent. Install shut off valve to isolate shock arrester for future maintenance. Valve shall normally be in the open position.
- L. Mop Sinks: Mount mop hanger above mop sink basin. When reduced pressure backflow preventers are provided in janitor's rooms, mount above mop sink on adjacent wall from mop hanger.
- M. Mixing Valve MV-1: Install in accordance with the manufacturer's instructions.

3.3 PRIMING VALVES

- A. Floor drain traps shall be primed from priming valves with 3/8-inch copper pipe or PEX, as specified.
- B. Where priming valves are installed in finished rooms, conceal in wall and provide access panel.
- C. Coordinate locations of electronic trap primer stations with the Port.
- D. Coordinate locations of electronic trap primer stations to obtain 120V service.

3.4 PLUMBING VENTS

- A. Provide vents to outdoors for fixtures requiring plumbing vents according to code and as indicated.

3.5 TESTING

- A. Check out, start up, and test the following items:
 - 1. Sensor operated faucets.
 - 2. Sensor operated flush valves.
 - 3. Electric water coolers.

END OF SECTION 224000

SECTION 230500 – COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The intent of the Division 23 specifications and the accompanying drawings is to provide complete and workable systems as shown, specified and required by applicable codes. Include all work specified in Division 23 and shown on the accompanying drawings.
- B. The drawings that accompany the Division 23 specifications are diagrammatic. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Follow the drawings as closely as is practical to do so and install additional bends, offsets and elbows where required by local conditions from measurements taken at the building, subject to approval, and at no additional cost to the Port.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 017329, Cutting and Patching
- B. Section 024119, Selective Interior Demolition
- C. Section 078400, Firestopping
- D. Section 083100, Access Doors and Panels
- E. Section 099100, Painting

1.3 REFERENCES

- A. FM Global
- B. NEMA: National Electrical Manufacturers Association
 - 1. NEMA MG1: Motors and Generators
- C. OR-OSHA: Oregon Occupational Safety and Health Administration

1.4 SUBMITTALS

- A. General:
 - 1. Comply with the requirements of Section 013300 and the additional requirements specified herein.

B. Shop Drawings:

1. The contract drawings indicate the general layout of the piping, ductwork and various items of equipment. Coordination with other trades and with field conditions is required. For this purpose, submit shop drawings of all installations not detailed on the contract drawings, and of all changes to the contract drawings.
2. Shop drawings shall be new drawings prepared by the Contractor and shall not be reproductions or tracings of the contract drawings. Overlay drawings with shop drawings of other trades and check for conflicts. Shop drawings shall be the same size as the contract drawings with title blocks similar to the contract drawings. Shop drawings shall identify the related contract drawing number or related reference drawing. Shop drawings shall be fully dimensioned, including both plan and elevation dimensions. Do not use shop drawings to make scope changes.
3. At a minimum, include the following:
 - a. Complete floor plans with sheet metal and mechanical piping to a minimum of 1/8" = 1'-0" scale.
 - b. HVAC Sheet metal and mechanical piping of mechanical and fan rooms to a minimum of 1/4" = 1'-0" scale.
 - c. Sections of congested areas to a minimum of 1/4" = 1'-0" scale.
 - d. Fabricated equipment to a minimum of 1/4" = 1'-0" scale.
 - e. Controls and instrumentation to scale and drawing sizes to suit controls supplier.
4. Submit shop drawings for review as required by the contract documents. Additional shop drawings may be requested when it appears that coordination issues are not being resolved in the field, or when there is a question as to whether contract documents are being complied with or the design intent is being met.

C. Product Data:

1. Submit product data for review on all scheduled pieces of equipment, equipment requiring electrical connections or connections by other trades, and as required by the contract documents. Include manufacturer's detailed shop drawings, specifications, and data sheets. Data sheets shall include capacities, RPM, BHP, pressure drop, design and operating pressures, temperatures and similar data. Manufacturer's abbreviations or codes are not acceptable.
2. List the name of the motor manufacturer and service factor for each piece of equipment.
3. Indicate equipment operating weights including bases and weight distribution at support points.
4. In the case of equipment specified by specific catalog number, such as wiring devices, time switches, valves, etc., a statement of conformance will suffice.

D. Operation and Maintenance Data:

1. Submit operation and maintenance data for review on all scheduled pieces of equipment, and as required by the contract documents.

E. Commissioning Documentation:

1. Submit commissioning plans, schedules, and related documentation in accordance with the contract documents.

1.5 QUALITY ASSURANCE

- A. Materials and equipment shall be new. Work shall be of good quality, free of faults and defects.

- B. All equipment shall fit in the space provided.
- C. Systems shall be built and installed to deliver their full rated capacity at the efficiency for which they were designed.
- D. Systems shall operate at full capacity without objectionable noise or vibration.
- E. Materials and Equipment:
 - 1. Each piece of equipment provided shall meet all detailed requirements of the drawings and specifications and shall be suitable for the installation.
 - 2. Where two or more units of the same class of equipment are provided, use products of the same manufacturer; component parts of the entire system need not be products of the same manufacturer.
- F. Workmanship:
 - 1. Install all materials in a neat and workmanlike manner.
 - 2. Follow manufacturer's directions. If they are in conflict with the contract documents, obtain clarification before starting work.
- G. Cutting and Patching:
 - 1. Cutting, patching and repairing for the proper installation and completion of the work specified in this division, including plastering, masonry work, concrete work, carpentry work, firestopping, and painting, shall be performed by skilled craftsmen of each respective trade in conformance with the appropriate division of work. Additional openings required in building construction shall be made by drilling or cutting.
 - 2. Fill holes which are cut oversize so that a tight fit is obtained around the objects passing through.
 - 3. Do not pierce beams or columns without permission of the Port and then only as directed.
 - 4. New or existing work that is cut or damaged shall be restored to its original condition. Where alterations disturb existing finishes, the surfaces shall be repaired, refinished, and left in condition existing prior to commencement of work.

1.6 PROJECT CONDITIONS

- A. Coordinate exact requirements governed by actual work conditions. Check all information and report any discrepancies before fabricating work. Report changes in time to avoid unnecessary work.
- B. Comply with the requirements of Section 017000, Execution Requirements, for investigation prior to penetration of floor slabs.

1.7 PROVISIONS FOR LARGE EQUIPMENT

- A. Make provisions for the necessary openings in the building to allow for admittance of all equipment.

PART 2 - PRODUCTS

2.1 ACCESS PANELS

- A. Provide access panels where indicated and where required to access valves, fire/smoke dampers, balancing dampers, and other appurtenances requiring operation, service, or maintenance. Review locations prior to installation. Comply with the requirements of Section 083100.

2.2 PIPE AND DUCT SLEEVES

- A. Interior Wall and Floor Sleeves: 18-gauge galvanized steel.
- B. Exterior Wall Sleeves: Cast iron.
- C. On-Grade Floor Sleeves: Cast iron.

2.3 FLOOR, WALL, AND CEILING PLATES

- A. Provide stamped split-type plates as follows:
 - 1. Floor Plates: Cast brass, chromium plated.
 - 2. Wall and Ceiling Plates: Spun aluminum.

2.4 SEALANT

- A. General Purpose: Tremco Dymeric Sealant or equal.
- B. Floor Penetration Sealant: Hydro Ban by Laticrete., or pre-bid approved equal.
- C. Firestop Sealant: See Section 078400.

2.5 MACHINERY GUARDS

- A. Provide guards for protection on all rotating and moving parts of equipment. Provide guards for all metal fan drives and motor pulleys, even if they are enclosed in a metal cabinet.
- B. Design guards so they do not restrict air flow at fan inlets resulting in reduced capacity.
- C. Provide shaft holes in guards for easy use of tachometers at pulley centers. Guards shall be easily removable for pulley adjustment or for removal and changing of belts.
- D. Guards shall meet OR-OSHA requirements including back plates.
- E. Provide inlet and outlet screens on all fans in plenums or where exposed to personnel.

2.6 ELECTRICAL EQUIPMENT

- A. General: All equipment and installed work shall be as specified under Division 26, Electrical.
- B. Motors:
 - 1. Motors shall be furnished as integral part of driven equipment. Motors shall be built to NEMA standards for the service intended. The motors shall be rated for the voltage specified, suitable for operation within the range of 10 percent above to 10 percent below the specified voltage. Energy efficient motors shall be Century E-plus, Baldor Super E, Westinghouse Life Line, General Electric Energy Saver, Toshiba, or equal.
 - 2. Designed for a synchronous speed as scheduled.
 - 3. Motors 1/2 hp and Larger: 3-phase, 60 cycles, 460V, service factor of 1.15, unless specifically noted otherwise.
 - 4. Motors 1/3 hp and Below: 1-phase, 60 cycle ac, 115V unless specifically noted otherwise, complete with integral thermal protection.
 - 5. Have built-in thermal overload protection or be protected externally with separate thermal overload devices with low-voltage release or lockout. Hermetically sealed motors shall have quick trip devices.
 - 6. Motors controlled by variable speed drives shall be inverter duty rated and shall have Class F insulation or better. Motors shall be able to withstand repeated voltage peaks of 1600 volts with rise times of 0.1 microseconds and greater, in accordance with NEMA Standard MG1, Part 31.
 - 7. Life expectancy of bearings shall exceed 100,000 hours of direct couple and 40,000 hours with belt.
 - 8. Motors served from variable frequency drives shall be equipped with a shaft grounding system utilizing brush grounding kits to provide a path for current to flow between the shaft and the motor frame.
 - 9. Frequency drive manufacturers shall provide necessary filters and line reactor type equipment to protect motors from excessive voltage spikes that may exceed insulation requirements of NEMA MG1, Part 31. Use SGS or equal.
 - 10. Motors shall have a three-year warranty.
- C. Starters: See Division 26, Electrical. Starters shall be suitable for performing the control functions required, with the exception of self-contained equipment and where the starters are furnished as part of the control package.
- D. Equipment Wiring: Interconnecting wiring within or on a piece of mechanical equipment shall be provided with the equipment unless shown otherwise on the drawings. This does not include the wiring of motors, starters and controllers specified in Division 26, Electrical.
- E. Control Wiring: All control wiring for mechanical equipment shall be as specified in Section 230900.

PART 3 - EXECUTION

3.1 DEMOLITION AND SALVAGE

- A. Prior to any demolition activities, coordinate safe-off of live utilities with the Port.

- B. Remove or relocate ductwork, piping, control wiring, devices and equipment encountered in existing areas affected by this work as indicated on the drawings.
- C. Protect equipment identified to be salvaged. Remove salvaged equipment prior to demolition of adjacent services. Arrange with the Port for storage and return of salvaged equipment.
- D. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations. Prior to demolition, verify that demolished services will not affect the operation of existing systems that are to remain and notify the Port.
- E. Demolition Service/System Requirements:
 - 1. Locate, identify, disconnect, and seal or cap off indicated mechanical systems serving areas to be selectively demolished.
 - 2. Demolish all service back to nearest active main or point of future connection as indicated. Verify with Port extent of demolition prior to proceeding if extent is not clear.
 - 3. The Port will arrange to shut off indicated services/systems when requested by the Contractor.
 - 4. If services/systems are required to be removed, relocated, or abandoned: Before proceeding with selective demolition, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 5. Remove all accessories associated with removed utilities including supports, hangers, braces, clips, etc., in their entirety.
 - 6. Patch penetrations of walls and floors related to demolished services restoring existing fire separations, assembly ratings, and waterproofing membranes.

3.2 REFRIGERANT MANAGEMENT REQUIREMENTS

- A. Comply with Section 015719, Environmental Construction Controls.

3.3 SYSTEM WATER DISPOSAL

- A. Do not drain water from systems treated with chemicals, such as heating hot water, chilled water, and stem systems into the sanitary or storm sewers without written approval from the Port.

3.4 ACCESS PANELS

- A. Install in accordance with manufacturer's recommendations, coordinated with architectural features. Review intended locations with the Port prior to installation.

3.5 SLEEVES

- A. General:
 - 1. Lay out work prior to concrete forming. Do all cutting and patching required. Reinforce sleeves to prevent collapse during forming and pouring.
 - 2. Sleeve all core-drilled penetrations unless detailed otherwise on the drawings.

3. Sleeves shall be large enough to allow clearance around pipe in accordance with NFPA 13. When pipe is insulated, insulation shall pass continuously through sleeve with 3/4-inch clearance between insulation and sleeve.
 - B. Interior Wall Sleeves:
 1. Pack with fiberglass insulation.
 2. Terminate sleeve flush with face of wall unless indicated otherwise.
 - C. Above-Grade Exterior Wall Sleeves: Similar to interior wall sleeves, except caulk outside with sealant.
 - D. Sleeves Through Floors:
 1. Extend 1 1/2 inch above finished floor, except waste stacks using carriers shall have sleeve flush with floor.
 2. Do not support pipes by resting pipe clamps on floor sleeves. Provide supplementary members so pipes are floor-supported.
 3. Make penetrations watertight by sealing gap between sleeve and the floor with floor penetration sealant as specified in Part 2.
 - E. Sleeves Through Fire-Rated Floors: Install the same as sleeves through floors, except:
 1. Make penetrations through floor watertight by sealing gap between sleeve and floor with floor penetration sealant as specified in Part 2, and
 2. Provide firestopping system both inside and outside of sleeve as specified in Section 078400 and in accordance with the recommendations of FM Global.
 - F. Sleeves Through Fire-Rated Walls:
 1. Provide firestopping system as specified in Section 078400 and in accordance with the recommendations of FM Global.
 - G. Sleeves Through Roof: Extend 8 inches above roof.
 - H. Sleeves specified or indicated at fire/smoke damper penetrations shall take precedence over this article.
- 3.6 FIRESTOPPING
- A. Comply with the requirements of Section 078400.
 - B. Provide fire-rated assemblies at all penetrations of 1 hour or more.
- 3.7 CLEANING
- A. Clean HVAC equipment, piping and ductwork of stampings and markings (except those required by codes), iron cuttings, and other refuse.
 - B. Clean scratched or marred painted surfaces of rust or other foreign matter and paint with matching color industrial enamel, except as otherwise noted.

3.8 EQUIPMENT PROTECTION

- A. Keep HVAC pipe, ductwork and conduit openings closed by means of plugs or caps to prevent the entrance of foreign matter. Protect HVAC piping, conduit, ductwork, and equipment against dirty water, chemical, or mechanical damage both before and after installation. Restore damaged or contaminated piping, conduit, and equipment to original conditions or replace at no additional cost to the Port.
- B. Protect bright finished shafts, bearing housings, and similar items until in service. No rust will be permitted.
- C. Cover or otherwise suitably protect equipment and materials stored on the job site.
- D. Provide filters at all openings in operating systems on return or exhaust ductwork.

3.9 ACCESSIBILITY

- A. Conveniently locate variable and constant volume boxes, control panels, hardware and devices, valves, thermometers, gauges, and other equipment or specialties requiring frequent reading, adjustments, inspection, repairs, or removal and replacement.
- B. Install thermometers and gauges to be easily read from floors, platforms, and walkways.
- C. Provide 36 inches clear access space on each side of variable and constant volume terminal units containing control valves, actuators, electrical disconnect, and DDC controls. Coordinate with other trades the locating of light fixtures, fire sprinkler piping, as well as other equipment, piping, and conduit to avoid obstructing access to serviceable components of terminal units. Provide access panels in linear metal, wood slat, gypsum board, or other hard ceilings to permit convenient access to terminal units.
- D. Provide access panels in linear metal, wood slat, gypsum board, or other hard ceilings and walls to permit convenient access to fire/smoke dampers, and isolation, emergency shut-off, and other valves.

3.10 FLOOR, WALL AND CEILING PLATES

- A. Install plates on HVAC piping and ductwork passing through finished walls, floors, ceilings, partitions and plaster furrings. Plates shall completely cover opening around pipe and duct.
- B. Secure wall and ceiling plates to pipe, insulation, or structure.
- C. Plates shall not penetrate insulation vapor barriers.
- D. Plates are not required in mechanical rooms or unfinished spaces.

3.11 ELECTRICAL EQUIPMENT

- A. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in the dedicated electrical space around electrical equipment.
- B. The area above the dedicated electrical space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks, or breaks in such foreign systems.
- C. Unions in mechanical piping shall not be installed in dedicated electrical or IT spaces, or above or below ceilings.
- D. Low point drains in mechanical piping shall not be installed in dedicated electrical or IT spaces, or above or below ceilings. If this cannot be avoided, the low point drain connection shall be extended outside of the electrical or IT space.
- E. Protect outdoor electrical equipment from accidental spillage or leakage from piping systems.

3.12 EQUIPMENT CONNECTIONS

- A. Make final connections to equipment in accordance with manufacturer's instructions, shop drawings, and as indicated.
- B. Piping:
 - 1. Connections shall include heating hot water.
 - 2. Provide easily accessible unions and gate valves in all piping at equipment, steam drip trap assemblies, and any other fittings required for complete installation.
 - 3. Piping connections shall be independently supported to prevent undue strain on equipment.

3.13 PAINTING

- A. Comply with the requirements of Section 099100.
- B. Equipment Rooms and Finished Areas:
 - 1. Insulation: Not painted.
 - 2. Miscellaneous Iron Work, Structural Steel Stands, Uninsulated Tanks, Equipment Bases: Paint one coat of black enamel.
 - 3. Steel Valve Bodies and Bonnets: Paint one coat of black enamel.
 - 4. Brass Valve Bodies: Not painted.
 - 5. Equipment Without Factory Finish: Paint one coat of grey machinery enamel. Do not paint nameplates.
 - 6. Grilles, Diffusers, Registers: Paint sheet metal and visible ductwork behind grilles, diffusers, and registers flat black.
 - 7. Galvanized Ductwork: Not painted.
 - 8. Hangers and Uninsulated Piping: Not painted.
- C. Concealed Spaces (above ceilings, not visible):
 - 1. Insulation: Not painted.

2. Hangers, Uninsulated Piping, Miscellaneous Iron Work, Valve Bodies and Bonnets: Not painted.
- D. Exterior Black Steel: Wire brush and apply two coats of rust-inhibiting primer and one coat of grey exterior machinery enamel.
- E. Roof Mounted Equipment: Paint two coats of exterior machinery enamel. Color as selected by the Port.

3.14 POWER-ACTUATED FASTENERS

- A. Power-actuated fasteners are not allowed.

3.15 ADJUSTING AND CLEANING

- A. Before operating equipment or systems, make thorough check to determine that systems have been flushed and cleaned as required and equipment has been properly installed, lubricated, and serviced. Check factory instructions to see that installations have been made properly and that recommended lubricants have been used.
- B. Use particular care in lubricating bearings to avoid blowing out seals from over-lubrication. Check equipment for damage that may have occurred during shipment, after delivery, or during installation. Repair damaged equipment or replace with new equipment as directed by the Port.

3.16 COMMISSIONING

- A. Complete all phases of work so the system, equipment, and components can be checked out, started, calibrated, operationally tested, adjusted, balanced, functionally tested, and otherwise commissioned. Complete systems, including all subsystems, so they are fully functional.
- B. Perform commissioning as specified in the technical sections, and this section. Unless specified otherwise in the technical sections, provide factory startup services for the following items of equipment:
 1. Air handling equipment.
 2. Heating equipment.
 3. Cooling equipment.
 4. Special purpose equipment.
 5. Pumps.
- C. Participation in Commissioning:
 1. Provide skilled technicians to checkout, startup, calibrate, and test systems, equipment, and components.
- D. Resolution of Deficiencies:
 1. Corrective work shall be completed to permit timely completion of the commissioning process.

END OF SECTION 230500

SECTION 230519 - METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes water meters, water-flow meters, thermometers, and pressure gauges.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230523, General Duty Valves for HVAC Piping

1.3 REFERENCES

- A. AWWA: American Water Works Association

1.4 SUBMITTALS

- A. For each item specified herein, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; operation and maintenance manuals; and as-constructed drawings.
1. Water flow meters: Include graph of output signal versus gpm for each device.
- B. For each item specified herein, submit commissioning plans and schedules; checkout, start up, operational, functional and final acceptance test plans, procedures, checklists, and reports; and operation and maintenance training plans.

PART 2 - PRODUCTS

2.1 THERMOMETERS, WATER

- A. Acceptable Manufacturers: Ashcroft, Weiss, Trerice, Marshalltown-Tempco inc., or equal.
- B. Description: Direct drive 4 1/2-inch dial type, stainless steel case, separable sockets, stem length to penetrate minimum of half pipe diameter, adjustable face, extension necks where required to clear insulation.
- C. Range:

<u>System</u>	<u>Temperature °F</u>	<u>Graduations (°F)</u>
Heating water	30-240	1

2.2 THERMOMETERS, AIR

- A. Acceptable Manufacturers: Ashcroft, Weiss, Trerice, Marshalltown, or equal.
- B. Description: Direct drive 4 1/2-inch dial type, stainless steel case, separable sockets, stem length to penetrate a minimum of 12-inch, duct flange, adjustable dial face.
- C. Range: 25 degrees F to 125 degrees F range with 1 degree F divisions.

2.3 WATER METERS

- A. Acceptable Manufacturers: Badger, Sparling, or equal.
- B. Description:
 - 1. Disc type meter, bronze split casing, magnetic drive.
 - 2. Heavy duty gear train, completely sealed, circular meter, totalize in cubic feet with sweep hand.
 - 3. Comply with AWWA performance standards.

2.4 PRESSURE GAUGES

- A. Acceptable Manufacturers: Marsh, Ashcroft, Weiss, Trerice, or equal.
- B. Description: 4 1/2-inch dial, molded black polypropylene turret case.
- C. Range:

<u>System</u>	<u>Pressure (psi)</u>	<u>Graduations (psi)</u>
Heating Water	0-100	1

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Provide water meters, thermometers, and pressure gauges where shown on the drawings.
- B. Install all devices as required and as recommended by the equipment manufacturer.
- C. Extend all connections, wells, cocks, or gauges to a minimum of 1 inch beyond insulation thickness of the various systems.
- D. Locate all instruments so that they may be conveniently read at eye level or easily viewed and read from the floor or from the most likely viewing area, e.g., platform, catwalk, etc.
- E. Install instruments over 6'-6" above floor, to be viewed from the floor, with face at 30 degrees to horizontal.

3.2 INSTALLATION - PRESSURE GAUGES

- A. Provide instrument gauge cock at inlets.
- B. Locate pressure gauge taps for measuring pressure drop or increase across pumps, coils, etc., as close to the device as possible.

3.3 COMMISSIONING

- A. Commission items specified herein.

3.4 TESTING

- A. Check out, start up, and test items specified herein.

END OF SECTION 230519

SECTION 230520 - PIPING SPECIALTIES FOR HVAC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes piping specialties for HVAC piping systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230529, Hangers and Supports for HVAC Piping and Equipment
- B. Section 230545, Seismic Restraints for HVAC Piping and Equipment
- C. Section 230553, Identification for HVAC Piping and Equipment
- D. Section 230719, HVAC Insulation
- E. Division 26, Electrical

1.3 REFERENCES

- A. ASME: American Society of Mechanical Engineers
 - 1. ASME BPVC: Boiler and Pressure Vessel Code for Unfired Vessels
- B. IEEE: Institute of Electrical and Electronics Engineers
 - 1. IEEE Bulletin 515: Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Industrial Applications
- C. NEC: National Electric Code

1.4 SUBMITTALS

- A. For each item specified herein, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.
- B. For the following items, submit commissioning plans and schedules; checkout, start up, operational, functional and final acceptance test plans, procedures, checklists, and reports; and operation and maintenance training plans.
 - 1. Heat trace cables and accessories.
 - a. Provide calculations for heat trace cable, including power requirements and points of connection.

PART 2 - PRODUCTS

2.1 SYSTEM SPECIALTIES

- A. Automatic Air Vents:
 - 1. Acceptable Manufacturers: Amtrol, Armstrong, Spirax/Sarco, or equal.
 - 2. Description: Water main type, cast brass body, built-in check valve, 1/8-inch I.P.S. top tapping for moisture discharge, 3/4-inch size, 150 psi operating pressure.
- B. Pressure/Temperature Test Plug:
 - 1. Acceptable Manufacturers: Petersen Engineering, Inc., Terice Flow Design, or equal.
 - 2. General: 1/2-inch N.P.T. fitting to receive either a temperature or pressure probe 1/8-inch o.d., fitted with a color coded and marked cap with gasket.
 - 3. Material: Solid brass with valve core of Nordel.
 - 4. Rating: Minimum 300 psig at 275 degrees F.
 - 5. Gauges and Thermometers: Provide two pressure gauge adapters with 1/8-inch o.d. probe and two 5-inch stem pocket test thermometers, 25-125 degrees F for chilled water, 40-240 degrees F for heating water.

2.2 STRAINERS

- A. Acceptable Manufacturers:
 - 1. Armstrong, Spirax/Sarco, Steamflo, Mueller, or equal.
 - 2. For grooved coupling systems: Victaulic Series 732 or equal.
- B. Wye Pattern:
 - 1. Bronze: Bronze body, 2-inch and below screwed, 250 psi, 1/16-inch perforated type 304 stainless steel screen.
 - 2. Cast Iron: Cast iron body, 2-inch and below screwed, 2 1/2-inch and above flanged, 125 psi, 1/16-inch perforated type 304 stainless steel screen.
 - 3. Cast Iron, High Pressure: Cast iron body, 2-inch and below screwed, 2 1/2-inch and above flanged, 250 psi, 1/16-inch perforated type 304 stainless steel screen.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Automatic Air Vents:
 - 1. Install automatic air vents at high points where air can collect in water systems where indicated. Route drain lines from vent to nearest floor drain.
 - 2. Install 3/4-inch globe shut-off valve ahead of air vent.
 - 3. Insulate to prevent condensation on chilled water systems.
- B. Test Plugs:
 - 1. Install where indicated and in accordance with the manufacturer's recommendations.
 - 2. Insulate to prevent condensation on chilled water systems.

C. Strainer:

1. Provide valved blow off for each strainer of same size as plugs with maximum size of 1 1/2-inch. Pipe blow-off full size and terminate over floor drains.
2. Insulate strainer as specified in Section 230719.
3. Insulate blow off valve to prevent condensation on chilled water systems.
4. Applied Locations: Cast iron wye, chilled and heating water.

3.2 COMMISSIONING

A. Commission the following items:

1. Heat trace cables and accessories.

3.3 TESTING

A. Check out, start up, and test the following items:

1. Heat trace cables and accessories.

END OF SECTION 230520

SECTION 230523 – GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes valves, balancing valves, pressure-reducing valves, specialty valves, safety shutoff valves, pressure relief/bypass valves, and water relief valves.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 220553, Identification for Plumbing Piping and Equipment

1.3 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI Z21.15: Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves
 - 2. ANSI Z21.80: Line Pressure Regulators
- B. ASME: American Society of Mechanical Engineers
 - 1. ASME B16.44: Manually Operated Metallic Gas Valves for Use in House Piping Systems Up to 5 psi
 - 2. ASME BPVC Section IV: Rules for Construction of Heating Boilers
- C. CGA: Compressed Gas Association
 - 1. CGA 91-002
- D. MSS: Manufacturers Standardization Society

1.4 SUBMITTALS

- A. Submit product data, shop drawings, and maintenance data for products specified in this section.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All instances of each valve type shall be of one manufacturer.
- B. All gate, globe, ball, butterfly, and check valves shall meet MSS standards.

- C. Bronze gate, globe, ball, and check valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- D. Full lug and grooved butterfly valves shall be suitable for bi-directional dead end service at full rated pressure without use or need of a downstream-flange.
- E. Valves at insulated piping: Valves shall have 2-inch steam extensions and the following features:
 - 1. Gate Valves: Rising-stem type.
 - 2. Ball Valves: Shall have extended operating handle of non-thermal-conductive materials, protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, and memory stops that are fully adjustable after insulation is applied, Nibco Nib-seal, or equal, handle extensions.
 - 3. Butterfly valves: Shall have extended necks.

2.2 GATE VALVES

- A. Acceptable Manufacturers: Crane, Hammond, Apollo, Nibco, or equal.
- B. Bronze Gate: Bronze body, bronze trim, screwed, bronze screwed bonnet, copper-silicone bronze rising stem, solid wedge, malleable iron h/w 150 psi SWP, 300 psi CWP, Nibco T-134. With soldered ends, Nibco S-134.
- C. Iron Gate, OS&Y: Cast iron body, bronze trim, flanged, OS and Y pattern, solid wedge, 125 psi SWP, 200 psi CWP, Nibco F-617-O.

2.3 GLOBE VALVES

- A. Acceptable Manufacturers: Crane, Hammond, Apollo, Nibco, or equal.
- B. Bronze Globe and Angle Globe: Bronze body, bronze-mounted, screwed, bronze union bonnet, copper-silicone bronze rising stem, TFE disc, malleable iron h/w, 150 psi SWP, 300 psi CWP Nibco T-235-Y (globe) or T-335-Y (angle). With soldered ends, Nibco S-235-Y (globe).
- C. Iron Globe: Iron body, bronze-mounted, flanged, OS and Y pattern, bronze disc, 125 psi SWP, 200 psi CWP Nibco F-718-B.

2.4 CHECK VALVES

- A. Acceptable Manufacturers:
 - 1. Swing Check: Crane, Hammond, Apollo, Nibco, or equal.
 - 2. Silent Check: Apollo, Metraflex, Mueller, Nibco, or equal.
- B. Horizontal Bronze Swing Check: Bronze body, bronze-mounted, screwed, TFE disc, 150 psi SWP, 300 psi CWP, Nibco T-443-Y. With soldered ends, Nibco S-433-Y.
- C. Horizontal Iron Swing Check: Iron body, bronze-mounted, flanged, regrinding bronze disc and seat ring, 125 psi SWP, 200 psi CWP, Nibco F-918-B.

- D. Vertical and Silent Check Valves: Iron body, stainless steel spring, wafer type, globe style, to fit class 125 flanges, 200 psi CWP, Nibco W-910-B, with flanged ends, Nibco F-910-B. To fit class 250 flanges, 400 psi CWP, Nibco W-960-B, with flanged ends, Nibco F-960-B.
- E. Iron Swing Check with Outside Lever and Weight: Iron body, bronze mounted, flanged, regrinding bronze disc and seat ring, 125 psi SWP, 200 psi CWP, with adjustable outside lever and weight, Nibco F-918-BLW.

2.5 BALL VALVES

- A. Acceptable Manufacturers: Hammond, Apollo, Crane, Flow Design, Nibco, or equal.
- B. Bronze Ball: Bronze body, brass ball, threaded, with handle, teflon seat, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, 600 psi CWP, 150 psi SWP, Nibco T-585-70. With soldered ends, Nibco S-585-70.

2.6 BUTTERFLY VALVES

- A. Acceptable Manufacturers: Apollo, Hammond, Keystone, Nibco, Victaulic, or equal.
- B. Ductile iron body, aluminum-bronze disc and one-piece stainless steel shaft, copper bushing, with lever handle and locking feature on valves 6 inches and smaller, gear operator on valves 8 inches and larger; treaded lug or grooved end type, EPDM liner or disc, 200 psi CWP, Nibco LD 2000 (lug style), Nibco GD-4765 (grooved ends). Do not use fasteners and pins to attach stem to disc.

2.7 SPECIALTY VALVES

- A. Drain Valves and Manual Air Vents: Bronze ball valve, garden hose end, brass cap and chain 3/4-inch size, bronze cast body, chrome-plated full port ball, threaded, with handle, Teflon seat, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, 600 psi CWP, Nibco T-585-70-HC or equal.
- B. Gauge Cocks: Brass, tee handle, male to female, 200 psi working pressure, 1/4-inch, Apollo 41 series, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide valves at connections to equipment where shown or required for equipment isolation.
- B. Install all valves accessible and same size as connected piping.
- C. Provide separate support for valves where necessary.

- D. Grooved type valve end connections may be used in lieu of flanged on services where mechanical pipe couplings and fittings are specified.
- E. Provide drain valves in all low points in the piping system, at coils and equipment and as indicated.

3.2 APPLIED LOCATIONS

- A. In piping 2 inches and smaller, domestic hot and cold water, industrial cold water.
 - 1. Bronze gate.
 - 2. Bronze swing check.
 - 3. Ball valve.
- B. Calibrated balancing valves 3 inches and smaller, on domestic hot water where indicated on the drawings.
- C. Check valves on vertical discharge of sump pumps, and sewerage ejector pumps, iron swing check with outside weight and lever. Mount in piping at 45-degree angle.
- D. Provide gauge cock for all pressure gauges.

3.3 DRAIN VALVES AND MANUAL AIR VENTS

- A. Install at high points, low points, and as shown on the drawings, for proper venting and draining of hydronic systems.
- B. Insulate valves in cold water systems to prevent condensation.

3.4 VALVE IDENTIFICATION

- A. Identify valves to indicate their function and system served.

3.5 CHAIN OPERATORS

- A. Gate valves in equipment rooms or fan rooms used for equipment or coil isolation and more than 8 feet above floor shall be installed with stem horizontal and equipped with chain wheels and chains extending to 6 feet above floor.

3.6 WATER PRESSURE REDUCING VALVE ASSEMBLY (DOMESTIC WATER, PRIMARY SERVICE)

- A. Install where indicated and in accordance with the manufacturer's instructions.
- B. Two valve assembly with smaller valve approximately 33 percent of the total larger valve approximately 67 percent of the total demand. See schedule on drawings for GPM flow rates and pressure settings of valves.

3.7 WATER PRESSURE REDUCING VALVES (DOMESTIC WATER, SECONDARY SERVICE)

- A. Install where indicated and in accordance with the manufacturer's instructions.
- B. Provide dielectric union and bronze ball shut-off valve immediately upstream.

3.8 WATER RELIEF VALVES

- A. Water Relief Valves: Install where indicated and in accordance with the manufacturer's instructions. Pipe discharge to nearest floor drain using Schedule 40 steel pipe.

3.9 PRESSURE RELIEVE/BYPASS VALVES

- A. Install where indicated and in accordance with the manufacturer's instructions. Adjust to required pressure to maintain required flow rates throughout system.

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the following:
 - 1. Hangers, supports, and anchors for equipment, tanks, ductwork, and piping systems.
 - 2. Supplementary steel for support or attachment of tanks, equipment's, ductwork, and piping to general construction elements of the project.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230545, Seismic Restraints for HVAC Piping and Equipment

1.3 REFERENCES

- A. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers
 - 1. ASHRAE Chapter 41: Absorption, Cooling, Heating, and Refrigeration Equipment
- B. ASTM: American Society for Testing and Materials
 - 1. ASTM A36: Standard Specification for Carbon Structural Steel
- C. OSSC: Oregon Structural Specialty Code
- D. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association

1.4 SUBMITTALS

- A. Product Data: For all products specified herein.
- B. Shop Drawings:
 - 1. Submit shop drawings of Contractor-fabricated piping support structures, pipe racks, and anchors.
 - 2. Suspended Piping and Ductwork: Indicate point loads and support locations, along with applicable details keyed to layouts.
 - 3. Support Frames, Piping, Tank, and Equipment Supports, and Anchorage: Indicate point loads and support locations, along with engineers' calculations and details keyed to the layouts pertaining to supports, support frames, and anchorages.

4. Supplementary Steel: Show details of fabrication and installation. Indicate materials, thicknesses, gauges, sizes, dimensions, methods of joining and fastening, welds, finishes, details of reinforcement and embedment, attachments, anchorages, miscellaneous metal items incidental to basic fabrication shown, provisions for work of other trades, and other pertinent information. Submit structural calculations for necessary supplementary steel for supports, anchors, and attachment of equipment, pipes, and ducts to general construction. Calculations shall be prepared and stamped by a registered professional structural engineer licensed in the state of Oregon.
5. As-Constructed Drawings and Data.

1.5 QUALITY ASSURANCE

- A. Supports and hangers for piping systems subject to expansion and contraction shall be chosen with careful consideration. The hanger support type selection depends on the directions in which the piping system will expand.

PART 2 - PRODUCTS

2.1 SUPPORTS AND ANCHORAGE

- A. Provide pipe and equipment hangers and supports in accordance with the following:
 1. When supports and anchorages for tanks, equipment, conduit, piping, and ductwork are not shown on the drawings, the Contractor shall be responsible for their design.
 2. Supports and anchorages shall resist forces due to hydraulic testing and seismic forces as specified in the OSSC for the ground motion accelerations corresponding to the project location. Design exterior equipment, ducts, and piping to resist wind loads.
 3. Supports and anchorages shall not introduce stresses in the piping caused by thermal expansion or contraction.
 4. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. The following engineered support systems shall be designed, detailed, and bear the seal of a registered professional structural engineer licensed in the state of Oregon:
 1. Supports, floor and roof-mounted tanks, and supports for suspended tanks and equipment.
 2. Support frames, such as pipe racks or stanchions, for piping and equipment which provide support from below.
 3. Tank, equipment, and piping support frame anchorage to supporting slab or structure.
 4. Roof-mounted equipment curbs and supports, including attachments to structure.

2.2 SUPPORTS, GENERAL

- A. Acceptable Manufacturers: B-Line Systems, Anvil, Powerstrut and Kinline, Superstrut, Unistrut, or equal.

- B. Fabricate support members from welded standard structural shapes, pipe, and plate. Carry the necessary rollers, hangers, and accessories as required. Piping less than 4-inch pipe size may be supported from or by prefabricated roll-formed channels as specified in this section with necessary accessories to adequately support piping system.
- C. Supports and Accessories: Preformed roll-formed channels and accessories with matching compatible accessories as shown, as specified, and as required.
- D. Dissimilar Metal Protection: Cush-a-Strip, Hydra-Zorb cushions, or equal.
- E. Attachments to roof and floor decks to support dead loads are not allowed except as described in Part 3. Attachments to decks to support transient loads shall consider the effects of deck deflection.
- F. All exterior materials shall be hot-dip galvanized or stainless steel.
- G. Lateral Load Design Criteria:
 - 1. Seismic:
 - a. $S_{DS} = 0.81$.
 - b. $I_P = 1.0$.
 - 2. Wind:
 - a. 20 mph basic wind speed (ultimate design).
 - b. Exposure C.

2.3 PIPE ATTACHMENTS

- A. Acceptable Manufacturers: B-Line Systems, Elcen, Anvil, Michigan Hanger, Superstrut, Telco, or equal.
- B. Clamps: Superstrut Series 700 through 702.
- C. Insulated Horizontal Steel Piping:
 - 1. Chilled Water, 2 Inches and Under: Anvil 65 with Fig. 167 shield.
 - 2. Chilled, Over 2 Inches: Anvil Fig. 260 with Fig. 167 shield.
 - 3. Other, 2 Inches and Under: Anvil Fig. 65 with Fig. 167 shield.
 - 4. Other, Over 2 Inches: Anvil Fig. 260 with Fig. 167 shield.
- D. Uninsulated Horizontal Steel Piping:
 - 1. 2 Inches and Under: Anvil Fig. 65.
 - 2. Over 2 Inches: Anvil Fig. 260.
- E. Insulated Horizontal Copper Piping:
 - 1. Chilled Water, 2 Inches and Under: Anvil Fig. 65 with Fig. 167 shield.
 - 2. Chilled Water, Over 2 Inches: Anvil 260 with Fig. 167 shield.
- F. Uninsulated Horizontal Copper Piping:
 - 1. 2 Inches and Under: Anvil Fig. CT65, CT69.
 - 2. Over 2 Inches: Anvil Fig. CT65.
- G. Riser Clamps, Steel and Cast-Iron Pipe: 3/4-inch to 20-inch, Anvil Fig. 261.

- H. Riser Clamps, Copper Pipe: Anvil Fig. CT-121.

2.4 PIPE ROLLERS

- A. Supported: Anvil Fig. 274, pipe roll chair, adjustable; or equivalent product by B-Line Systems, Elcen, Superstrut, Telco, or equal.
- B. Supported: Superstrut C728H, pipe roller, aluminum wheels, steel brackets, or equivalent product by B-Line Systems, Elcen, Anvil, Telco, or equal.
- C. Suspended: Anvil Fig. 171 or Fig. 177 adjustable pipe roller; or equivalent product by B-Line Systems, Elcen, Superstrut, Telco, or equal.

2.5 PIPE RACKS

- A. Acceptable Manufacturers: Kin-Line, Superstrut, Uni-Strut, or equal.
- B. Supports and Accessories: Preformed roll-formed channels and accessories with electrochromate or equal finish and matching compatible accessories as shown, as specified, and as required.

2.6 PROTECTION SHIELDS

- A. Select protection shields based on actual outside diameter of pipe plus insulation. Use protection shields at hanger or roller assemblies on chilled or cold-water piping, where hangers are installed around insulation, and on both sides of clamps or U-bolts where installed around insulation. Use Anvil Fig. 167, or equal.

2.7 BUILDING ATTACHMENTS

- A. Acceptable Manufacturers: B-Line Systems, Elcen, Anvil, Superstrut, Telco, or equal.
- B. Beam Hangers – Beam Clamps: Anvil Fig. 218, adjustable malleable iron beam clamp, or Fig. 228, adjustable forged steel beam clamp.
- C. Beam Hangers – C-Type Clamps: Anvil Fig. 93. Sized for required rod to support load being carried.
- D. Beam Hangers – Welded: Anvil Fig. 66. Sized for required rod to support load being carried.
- E. Inserts:
 - 1. Malleable iron or steel inserts, Superstrut M-732CB or S. Inserts sized for required rod to support load being carried.
 - 2. Malleable iron or steel inserts, Grinnell, Fig. 152. Inserts sized for required rod to support load being carried.
- F. Expansion Plugs: Similar and equal to Phillips “red-head” self-drilling flush shell, selected for safety factor of 4.

2.8 PIPE ANCHORS

- A. Fabricate from steel plate as detailed (steam, condensate, pumped condensate, and hot water).
- B. Insulated Pipe Anchors (Chilled Water):
 - 1. Acceptable Manufacturers: Pipe Shields Inc., Rilco, or pre-bid approved equal.
 - 2. Insulated pipe anchors shall maintain vapor barrier and a positive axial, lateral, and vertical stop.
 - a. Steel Inner Thrust Plates: Welded attachments, material shall be compatible with pipe, shipped loose.
 - b. Structural Inserts: High-density calcium silicate, compressive strength 600 psi minimum. Asbestos-free treated with water repellent.
 - c. Jackets: Galvanized steel.
 - d. Steel Straps Base and Outer Thrust Plates: Carbon steel.
 - e. Fasteners: Cadmium plated.
 - 3. The anchor shall bear the piping system design load. Pipe Shields models C4000 through C4300.

2.9 ROOF-MOUNTED EQUIPMENT SUPPORT

- A. Acceptable Manufacturers: Greenheck – GES, or pre-bid approved equal.
- B. Welded aluminum or galvanized steel construction suitable for use on insulated (GESR) or non-insulated (GESS) flat roof decks, wood nailer, engineered to support gravity and seismic loads of supported equipment. Account for roof slope to provide level mounting surface for equipment.

PART 3 - EXECUTION

3.1 HANGERS AND SUPPORTS

- A. General:
 - 1. Install all support systems as detailed and in accordance with manufacturer's recommendations. Provide pipe racks, pipe stands, trapeze hangers, etc., as required and as detailed on the drawings.
 - 2. Provide adjustable hangers complete with inserts, adjusters, bolts, nuts, swivels, all-thread rods, etc., for all pipes, except where specified otherwise.
 - 3. Size hangers to clear insulation for piping services conveying liquids less than 70°F.
 - 4. Support fire protection piping independently of other piping.
 - 5. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods. Do not use tape for isolation.
 - 6. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
 - 7. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
 - 8. Install piping systems in accordance with SMACNA standards.

- B. Vertical Piping:
1. Support with U-clamps fastened to wall to hold piping away from wall unless otherwise approved.
 2. Riser clamps shall be directly under fitting or welded to pipe.
 3. Risers shall be supported at each floor of penetration.
 4. Provide structural steel supports at the base of pipe risers. Size supports to carry all forces exerted by piping system when systems are in operation.
- C. Horizontal Piping:
1. On all insulated piping, provide insulation protection shields at all roller locations.
 2. Cold and Hot Piping Systems:
 - a. Install hangers outside of insulation.
 - b. On all piping, provide insulation protection shields at each hanger location.
- D. Trapeze Hangers: Multiple pipe runs where indicated shall be supported on channels with rust resistant finish. Provide all necessary supporting steel.
1. Channels: Unistrut with electro-chromate finish, or equal.
- E. Hanger Spacing: Provide hangers at minimum spacing in accordance with Chapter 41, ASHRAE Guide and as follows:
1. Steel Pipe, Copper Tubing: For straight runs of horizontal piping with no concentrated loads such as valves, flanges, expansion joints, or other components. Sections of piping with concentrated loads will have to be considered carefully and a determination made as to appropriate spacing and rod size for the given situation.

<u>Pipe Size</u>	<u>Max. Span</u>	<u>Max. Span</u>	<u>Rod Size</u>
	<u>Steel</u>	<u>Copper</u>	
1" and smaller	7 feet	5 feet	3/8"
1-1/4" to 2"	8 feet	8 feet	3/8"

2. Maximum Rod Load: Below are maximum loads for hanger rods based on Chapter 41 of ASHRAE Guide and as follows for ASTM A36, with a safety factor of 5.

<u>Nominal Rod Diameter</u>	<u>Load</u>
3/8"	610 pounds
1/2"	1,130 pounds
5/8"	1,810 pounds
3/4"	2,710 pounds
7/8"	3,770 pounds
1"	4,960 pounds
1 1/4"	8,000 pounds
1 1/2"	11,630 pounds

- F. Insulation Protection:
1. Where piping is suspended from insulation, provide 16-gauge galvanized steel protection shields, 12 inches long.
 2. Where pipe clamps are installed on insulated piping, provide 16-gauge galvanized steel protection shields, 12 inches long on both sides of insulated pipe.
 3. Band shields firmly to insulation to prevent slippage.

G. Building Attachments:

1. Where possible, support all piping and equipment from structural members, beams, and joists.
2. Provide structural steel angles, channels, or other members to support piping and equipment where structural members do not occur as required for proper support.
3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points or provide web reinforcing as required.
4. Provide transverse and longitudinal bracing on piping at 75-foot intervals to provide a stabilized piping system. Bracing shall not introduce stresses in the piping system caused by thermal expansion or contraction.
5. Do not fasten or attach to unfilled steel roof deck structure.
6. Attach to concrete-filled steel floor deck structure for loads up to 400 pounds. Loads larger than 400 pounds shall be designed per code. Submit structural calculations stamped and signed by a structural engineer licensed in the State of Oregon showing that the concrete-filled floor deck has sufficient capacity to support the load at the points of anchorage.

H. Pipe Racks:

1. General: Provide racks as shown with additional elements to adequately support piping.
2. Coordination: Where mechanical piping, tubing, etc., and electrical conduit, wiremold, wireways, etc., follow common routings, coordinate routing. Allow sufficient clearance to adequately operate, access, and maintain all devices without dismantling racks.

I. General: Support all piping within 2 feet of change of direction on both sides of fitting.

J. Insulated Pipe Anchors: Apply a wet coat of vapor barrier on all butt joints and seal the joints with a minimum of 3-inch-wide vapor barrier tape or band.

K. Roof-Mounted Equipment Supports: Select appropriate model for insulated or uninsulated roof deck. Install in accordance with manufacturer's instructions. Account for roof slope to provide level mounting service for equipment.

END OF SECTION 230529

SECTION 230545 - SEISMIC RESTRAINTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes seismic restraints for piping, ductwork, conduit, tanks, and equipment, including clamps, rods, channels, struts, anchor bolts, nuts, and accessories.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230529, Hangers and Supports for HVAC Piping and Equipment

1.3 REFERENCES

- A. AISC: American Institute of Steel Construction
 - 1. AISC Steel Construction Manual
- B. ASTM: American Society for Testing and Materials
 - 1. ASTM A36: Standard Specification for Carbon Structural Steel
- C. AWS: American Welding Society
 - 1. AWS D1.1: Structural Welding Code – Steel
- D. OSSC: Oregon Structural Specialty Code

1.4 SUBMITTALS

- A. Product Data: For all products specified herein.
- B. Shop Drawings: Comply with the requirements of the Quality Assurance article of this section. Shop drawings shall be stamped and signed by a professional structural engineer licensed in the state of Oregon.
- C. Calculations: Seismic calculations indicating restraint loadings resulting from the design seismic forces presented in the Quality Assurance article of this section. Include proper anchorage details and when applicable, include consideration of the types of concrete. Calculations shall be stamped and signed by a professional structural engineer licensed in the state of Oregon.
- D. Certifications: Certification of seismic restraint's and building structural member's capability to safely accept loads resulting from seismic forces calculated in the previous paragraph. Tests in three planes clearly showing ultimate strength and appropriate safety factors, performed by independent laboratories, stamped, and signed by a professional structural engineer licensed in the state of Oregon or calculations by a professional structural engineer licensed in the state of Oregon are acceptable.

1.5 QUALITY ASSURANCE

- A. The seismic restraint and anchorage of permanent equipment and associated systems listed below to building structure shall be designed to resist the total design seismic force prescribed in the OSSC.
1. Floor- or roof-mounted equipment.
 2. Suspended or wall-mounted equipment.
 3. Vibration-isolated equipment.
 4. Potentially hazardous or life-safety piping systems 1 inch or larger throughout the building.
 5. Piping 1 1/4 inches nominal diameter and larger located in mechanical equipment rooms.
 6. Piping 2 1/2 inches nominal diameter and larger.
 7. Ductwork 6 square feet and larger in cross sectional area.
 8. Round ductwork 28 inches in diameter and larger.
 9. Electrical conduit 2 1/2 inches trade size and larger.
 10. Any piece of equipment that is not floor mounted with a weight greater than or equal to 25 pounds.
- B. Except for those which would individually require bracing, pipes, ducts, and conduit supported by a trapeze need not be braced if connections to the pipe/duct/conduit or directional changes do not restrict movement of the trapeze. If this flexibility is not provided, bracing shall be required when the combined operating weight of all elements supported by the trapeze is 10 pounds per foot or greater.
- C. All seismic restraints, including anchors to building structure, shall be designed by a registered professional structural engineer licensed in the state of Oregon. Design shall include:
1. Number, size, capacity, and location of anchors for floor- or roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure. For units weighing greater than 2500 pounds, or curbs more than 10 feet long, provide calculations substantiating that the curb can accept the prescribed seismic forces.
 2. Number, size, capacity, and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations and test reports verifying the horizontal and vertical ratings of the seismic restraint devices.
 3. Number, size, capacity, and location of braces and anchors for suspended piping, ductwork, conduit, and cable trays on as-built plan drawings.
 - a. Select a single seismic restraint system pre-designed to meet the requirements of the OSSC such as the 1999 Mason Industries Seismic Restraint Guidelines for Suspended Piping, Ductwork and Electrical Systems.
 - b. Details or designs from separate seismic restraint guidelines are not acceptable. Installation not addressed by the selected system shall be designed, detailed, and submitted alone with the as-built plan drawings.
 - c. Indicate maximum seismic loads on the drawings at each brace location. Drawings shall bear the stamp and signature of the registered professional structural engineer licensed in the state of Oregon who designed the layout of the braces.
- D. Supports, Hangers, and Anchors: Comply with the requirements of Section 230529 except anchor (expansion) bolts used for connection Level 3 shall have expansion anchor capacities equal to 50 percent of the ICC research report values.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Seismic Bracing: Steel fabrication, in accordance with AISC Steel Construction Manual, with structural steel shapes of ASTM A36 steel. Weld in accordance with AWS D1.1. Design and sizes shall be as required. Fastenings, bracing, and assembly shall be selected by a professional structural engineer licensed in the state of Oregon. Design calculations shall show that the maximum stress in any structural steel member will not exceed 18,000 psi.
- B. Channel type elements shall be No. 12 gauge formed steel; 1 5/8-inch square prime painted or chromate dip finish. Use spring-in nuts with grooves.
- C. Bolting accessories shall be machine bolts with semi-finished nuts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment and tanks shall be braced or anchored to conform to the requirements listed under the Quality Assurance article of this section.
- B. Ductwork and piping shall be seismically braced to conform to the requirements listed under the Quality Assurance article of this section.
- C. Provide pipeline seismic flexible connectors where piping crosses building earthquake joints. Arrange piping and connectors for the amount of motion required. Provide vent and drain valves for all liquid filled systems.
- D. Provide ductwork seismic flexible connectors where ductwork crosses building earthquake joints. Arrange ductwork and connectors for the amount of motion required.
- E. Attach seismic restraints to structural members of the building which are capable of withstanding the design load of the seismic restraint. Ensure load capacity of the structural members is greater than or equal to the capacity of the seismic restraint.
- F. Seismic restraints shall not introduce stresses in piping caused by thermal expansion or contraction.

END OF SECTION 230545

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes isolation of mechanical equipment, piping, and ductwork.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230529, Hangers and Supports for HVAC Piping and Equipment
- B. Section 230545, Seismic Restraints for HVAC Piping and Equipment
- C. Section 233113, Low Pressure Ductwork
- D. Section 233114, Medium Pressure Ductwork

1.3 REFERENCES

- A. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers

1.4 GUIDELINES

- A. Seismic Restraint: Conform with the requirements of Section 230545 and additional requirements specified herein for seismic restraint of vibration isolated equipment, ductwork, and piping.
- B. Values for calculating seismic design forces shall be as described in Section 230545.

1.5 SUBMITTALS

- A. Shop Drawings: Submit shop drawings showing complete details of construction for steel and concrete bases including:
 - 1. Equipment mounting holes.
 - 2. Dimensions.
 - 3. Isolation selected for each support point.
 - 4. Details of mounting brackets for isolator.
 - 5. Weight distribution for each isolator.
 - 6. Details of seismic snubbers.
 - 7. Code number assigned to each isolator.

- B. Product Data: Submit product data and calculation sheets for isolators, showing:
 - 1. Size, type, load and deflection of each required isolator.
 - 2. Percent of vibration transmitted based on the lowest disturbing frequency of the equipment.
- C. Installation Procedures: Submit procedures for setting and adjusting isolation devices.
- D. Package Equipment Calculations: Where buses, isolators and other equipment specified in this section are provided as part of packaged equipment, submit calculations certifying compliance with this section.
- E. Installation Report: Submit installation report as specified in Part 3 of this section.
- F. Structural Certifications: Submit calculations stamped and signed by a registered professional structural engineer licensed in the state of Oregon certifying mounting attachment points for isolators and seismic restraints will withstand forces calculated from values presented in Section 230545.
- G. Shop drawings and calculations shall be stamped and signed by a registered professional structural engineer licensed in the state of Oregon.

1.6 QUALITY ASSURANCE

- A. Except for packaged equipment with integral isolators, a single manufacturer shall select and furnish all isolation required.
- B. Isolation performance requirements shall be as indicated on the drawings. All deflections indicated shall be minimum actual static deflections for specific equipment supported.
- C. Isolator Stability:
 - 1. Size springs of sufficient diameter to maintain stability of the equipment being supported with minimum horizontal to vertical stiffness ratio not less than 1:1. Spring diameters shall be not less than 0.8 of the compressed height at rated load.
 - 2. Springs shall have a minimum additional travel to solid equal to 50 percent of the rated deflection.
- D. Maximum Allowable Vibration Levels: Peak vibration velocities shall not exceed 0.08 in/sec. If operating vibration velocities exceed this criteria, the equipment shall be repaired or replaced at no additional cost to the Port until approval of the equipment is given by the Port.

PART 2 - PRODUCTS

2.1 TYPE B AND C - STRUCTURAL AND CONCRETE BASES WITH SPRINGS

- A. Integral structural steel or concrete base; rectangular or tee shaped as required.
- B. All perimeter members shall be WF beams with minimum depth equal to 8 percent of longest span of base between vibration isolators.

- C. Fan Bases: Mason WFSL with external height saving brackets, or equal.
- D. Manufacturers: Mason as indicated, Kinetics Noise Control, or equal.

2.2 TYPE 6 - ISOLATING HANGERS

- A. Combination rubber-in shear and steel spring isolators installed on the hanger rods.
- B. Isolators shall have the proper deflection to allow the piping to deflect as a unit with the pump isolators.
- C. Hangers designed for 30-degree angular movement.
- D. Minimum deflection shall be 1 inch.
- E. Manufacturers: Mason PC30N, Kinetics Noise Control, or equal.

2.3 SEISMIC RESTRAINTS

- A. Provide seismic restraints for all vibration isolated equipment, both supported and suspended, and all vibration isolated ductwork and piping. Refer to Section 230529, Section 230545, Section 233113, and Section 233114 for additional and specific requirements. The structural requirements for the restraints, including their attachment to the equipment or piping and the building structure, shall meet the following provisions:
 - 1. Supported Equipment:
 - a. The seismic restraints shall consist of interlocking steel members restrained by shock absorbent neoprene materials compounded to bridge bearing specifications. The elastomeric materials shall be replaceable and shall be a minimum 3/4-inch-thick. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch, nor more than 1/4 inch.
 - b. Each snubber shall be capable of restraint in all three mutually orthogonal directions.
 - c. Submittals shall include load versus deflection curves up to 1/2 inch on the x, y and z planes. Conduct tests in an independent laboratory or under the signed supervision of an independent registered engineer. The snubber assemblies shall be bolted to the test machine as the snubber is normally installed. Test reports shall certify that neither the neoprene elements nor the snubber body has sustained any obvious deformation after release of the load.
 - 2. Suspended Equipment, Ductwork, and Piping:
 - a. Cable Method: The seismic restraint shall consist of a combination of stranded steel aircraft cable and the specified vibration isolation hanger with an added nut and neoprene and steel washer. The cable resists lateral and downward motion. The modified vibration hanger resists upward motion.
 - b. Cable attachment details, cable size, and the neoprene and steel washers shall be sized by the manufacturer and shall be indicated in the shop drawings.
 - c. Provide detailed shop drawings for approval in sufficient time to allow structural attachment work to be incorporated into the normal work sequence.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not install any equipment, duct, or pipe which makes rigid contact with the building other than at points of support. "Building" includes slabs, beams, studs, walls, etc.
- B. The installation or use of vibration isolators shall not cause any change of position of equipment or piping which would result in stresses to piping connections or misalignment of shafts or bearings. In order to meet this objective, equipment and piping shall be maintained in a rigid position during installation. Do not transfer the load to the isolator until the installation is complete and under full operational load.

3.2 PREPARATION

- A. Treat all isolators, including springs, brackets, and housing, with a rustproof metal primer.
- B. Coat items exposed to weather with cadmium plating, galvanizing, or plastic coating.

3.3 INSTALLATION

- A. General:
 - 1. Install isolation where indicated on the drawings by type and location and where indicated below. For all other equipment with rotating parts or motors, isolation and minimum static deflections shall comply with the ASHRAE Handbook, HVAC Applications, Sound and Vibration Control.
 - 2. Mark the assigned code number on the isolators and bases to assure placement in the proper location.
 - 3. Anchor baseplates to floor. Provide rubber grommets and washers to isolate the bolt from the base plate. Under no circumstances shall the isolation efficiency be destroyed when bolting the isolators to the floor.
- B. Isolation of Pipe and Ductwork:
 - 1. Install isolating hangers on all ductwork, hot and chilled water piping connected to air handling units or other rotating equipment in mechanical rooms and within 40 feet of equipment. Provide isolating hanger supports for each piece of isolated equipment outside of mechanical rooms and where indicated. Isolators within 25 feet of equipment shall have a static deflection of 1 inch. Beyond 25 feet, isolators shall have a static deflection of 1/2-inch.
 - 2. Ductwork or piping supported from floor shall be isolated with Type 1 isolators.

3.4 SEISMIC RESTRAINTS (VIBRATION ISOLATED EQUIPMENT, DUCTWORK AND PIPING)

- A. General: Install and adjust seismic restraints so that the equipment and piping vibration isolation is not degraded by the restraints.

B. Supported Equipment:

1. Each vibration isolation frame for supported equipment shall have a minimum of four seismic snubbers mounted as close as possible to the vibration isolators and/or the frame extremities.
2. Take care so that a minimum 1/8-inch air gap in the seismic restraint snubber is preserved on all sides so that the vibration isolation potential of the isolator is not compromised. This requires that the final snubber adjustment be completed after the vibration isolators are properly installed and the installation is approved.

C. Suspended Equipment, Ductwork, and Piping-Cable Method:

1. Install cables so that they do not carry any load. Install with a minimum amount of slack or sag.
2. The uplift and downward restraint nuts and washers for the Type HST hangers shall be adjusted so that there is a minimum 1/4-inch clearance.
3. Ductwork: All vibration isolated rectangular or oval ductwork with area of 6 square feet or greater and all vibration isolated round ductwork 28 inches diameter and larger shall be seismically restrained by the cable method.
4. Piping: All vibration isolated suspended piping 2-1/2 inches or larger, vibration isolated suspended piping in mechanical rooms 1-1/4 inches or larger, and vibration isolated suspended gas, hazardous, or life-safety piping 1 inch or larger shall be seismically restrained by the cable method.

3.5 ELECTRICAL COORDINATION

- A. Make all electrical connections to isolated equipment using flexible electrical conduit. Do not use conduit clamps or hangers between the flexible conduit and equipment. Provide non-stressed loop in conduit, unrestrained in all directions.

3.6 FIELD QUALITY CONTROL

- A. Confirm that all isolation is installed correctly and submit report stating that isolators are installed as shown on shop drawings, isolators are free to work properly, and that installed deflections are as scheduled and as specified.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the identification of valves, piping, and equipment components of the mechanical systems to indicate their function and system served.

1.2 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI A13.1: Scheme for the Identification of Piping Systems

1.3 SUBMITTALS

- A. Product Data: For all products specified herein.
- B. Valve Tag Directory: Submit for approval prior to fabrication of valve tags.
- C. Equipment Nameplate Directory: Submit for approval prior to fabrication of labels.
- D. Include copy of valve tag and equipment nameplate directories in each set of operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 VALVE IDENTIFICATION

- A. Valve Tags:
 - 1. General: Identify valves with metal tags. Legends shall be stamped or embossed. Tags shall indicate the function of the valve and its normal operating position; for example:

PDX SARA	(PROJECT SPECIFIC IDENTIFIER)
56 HW	(NUMBER AND CONTENT OF PIPE)
ISOLATION	(VALVE FUNCTION)
NO	(NORMAL OPERATION POSITION)
 - 2. Size: Valve tags 2-inch diameter with 1/4-inch-high letters.
 - 3. Material: Use 0.050 or 0.064-inch brass tags.
 - 4. Automatic Valves and Regulating Valves: Use 1/16-inch-thick laminated 3-ply plastic, center ply white, outer ply red, "lamicoid" or equal. Form letters by exposing center ply.

5. Existing Buildings and Systems: Contact the Port for coordination with existing building tagging system and supplementary information required for any specific system before valve tagging begins.

- B. Valve Tag Directory: Include tag number, location, exposed or concealed, service, valve size, valve manufacturer, valve model number, tag material, and normal operating position of valve.

2.2 PIPING MARKERS

- A. Acceptable Manufacturers: Brady, Seton, Marking Systems, Inc. (MSI), or equal.
- B. Label pipes with all-vinyl, self-sticking labels or letters. For pipe covering sizes up to and including 3/4-inch outside diameter, select labels with 1/2-inch letters. For sizes from 3/4- to 2-inch outside diameter, 3/4-inch letters; above 2 inches outside diameter, 2-inch letters. The pipe markers shall be identified and color coded as follows with black directional arrows. Labels with green background shall use white letters and arrows.

SERVICE	PIPE MARKER	BACKGROUND COLOR
Heating Water	“HEATING WATER SUPPLY” *	Yellow
	“HEATING WATER RETURN”	Yellow
Non-Potable Water	“NON-POTABLE WATER”	Yellow
Drain	“DRAIN”	Green

* Directional arrow applied adjacent to pipe marker indicating direction of flow.

2.3 EQUIPMENT IDENTIFICATION

- A. Nameplates:
1. Tag all pumps, air supply units, fans, converters, air terminal units, and miscellaneous items of mechanical equipment with engraved nameplates. Nameplates shall be 1/16-inch-thick, 3 x 5 laminated 3-ply phenolic plastic, center ply white, outer ply black. Form letters by exposing center ply.
 2. Identify unit with code number as shown on the drawings and the area served.
- B. Equipment Nameplate Directory: List pumps, air handlers, terminal units, and other equipment nameplates. Include Port- and Contractor-furnished equipment. List nameplate designation, manufacturer's model number, location of equipment, area served or function, disconnect location, and normal position of HOA switch.

PART 3 - EXECUTION

3.1 VALVE IDENTIFICATION

- A. Valve Tags:
1. Attach to valve with a brass chain.

2. Number valves per direction of the Port.
- B. Valve Tag Directory: Post final copy in operation and maintenance manual.
- C. Concealed Valves: Affix color coded “dot” to walls or ceilings wherever valves are concealed. Colors shall be as follows:
 1. HVAC = Blue

3.2 PIPING MARKERS

- A. Unless recommendations of ANSI A13.1 are more stringent, apply labels or letters after completion of pipe cleaning, insulation, painting, or other similar work, as follows:
 1. Every 20 feet along continuous exposed lines.
 2. Every 10 feet along continuous concealed lines.
 3. Adjacent to each valve and stubout for future.
 4. Where pipe passes through a wall, into and out of concealed spaces.
 5. On each riser.
 6. On each leg of a “T.”
 7. Locate conspicuously where visible.
- B. Further, apply labels or letters to lower quarters of the pipe on horizontal runs where view is not obstructed or on the upper quarters when pipe is normally viewed from above. Apply arrow labels indicating direction of flow.
- C. Spray a protective coating of clear epoxy over markers and arrows in corrosive atmosphere areas.

3.3 EQUIPMENT IDENTIFICATION

- A. Nameplates: Attach to prominent area of equipment, either with sheet metal screws, brass chain, or contact cement as applicable.
- B. Nameplate Directory: Post final copy in operation and maintenance manual.
- C. HVAC Equipment Installed Above T-Bar Ceiling: Label T-bar grid with mechanical equipment identifier as shown on the drawings. Use label maker with peel and stick labels, white background, and black lettering.

3.4 TERMINAL UNITS

- A. In addition to nameplates, mark all terminal units with a grease pencil so that the markings can be easily read from the most likely viewing position (e.g., catwalk, through the ceiling below, etc.). Markings shall be the unit number as directed by the Port.
- B. Label each thermostat cover with associated terminal unit identifier on an inconspicuous location. Use label maker with peel and stick labels, white background, and black lettering.

- C. Terminal Units Installed Above Access Ceiling: Label T-bar with terminal unit identifier as shown on the drawings. Use label maker with peel and stick labels, white background, and black lettering.

END OF SECTION 230553

SECTION 230590 - PRESSURE TESTING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes pressure testing of piping and ductwork systems.

1.2 SUBMITTALS

- A. Submit the following:
 - 1. Test plan and schedule: For piping and ductwork systems.
 - 2. Test Reports:
 - a. Certificate of completion, inspection, and test by authority having jurisdiction on required piping systems.
 - b. Certificate of test approval to the Port on all systems.
 - 3. Coordinate with commissioning plan and schedule.

1.3 QUALITY ASSURANCE

- A. Code Compliance: Perform required tests in the presence of the authority having jurisdiction.
- B. Port Witness: Perform all tests in the presence of the Port.
- C. Simultaneous Testing: Test observations by the authority having jurisdiction and the Port need not occur simultaneously.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL

- A. Piping: Test prior to concealment, insulation being applied, and connection to equipment, fixtures, or specialties.
- B. Ductwork: Test prior to connection to equipment and before applying insulation.
- C. Leaks: Repair all leaks and retest until stipulated results are achieved.
- D. Notification: Provide the Port 48 hours' notice in advance of each test. Failure to so notify will require test to be rescheduled.

- E. Testing Equipment: Provide all necessary pumps, gauges, connections and similar items required to perform the tests.
- F. Pneumatic Leakage Testing: At the Contractor's option and as approved by the Port, pneumatic leakage testing prior to hydronic pressure testing or system filling is permitted with a maximum air pressure of 5 psig. This does not replace requirements for hydronic pressure testing at a higher pressure specified herein. Pneumatic testing of plastic piping is not permitted unless approved by the Port.

3.2 TESTING REQUIREMENTS

- A. Medium Pressure Ductwork:
 - 1. Test all square duct systems and 50 percent of oval and spiral duct systems at 4-inch static pressure, using a testing machine.
 - 2. Maximum allowable leakage percentage is defined as CFM air leakage per cubic foot volume of duct section tested. This is not percentage of design air flow. Leakage shall not be greater than 10 percent of duct volume per minute.
- B. Piping: Test all piping as noted below, with no leaks or loss in pressure for time indicated. Repair or replace defective piping until tests are completed successfully:

System	Test Pressure	Test Medium	Test Duration
Heating water	150 psig	water	4 hours

END OF SECTION 230590

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes adjustment, testing, and balancing of air systems, hydronic systems, and miscellaneous mechanical equipment.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230900, Instrumentation and Controls for HVAC

1.3 REFERENCES

- A. AABC: Associated Air Balance Council
- B. NEBB: National Environmental Balancing Bureau

1.4 SUBMITTALS

- A. Submit the following:
 - 1. Balancing Log: Include all air and water outlets, actual field-measured air and water volume and percentage of design volumes. Provide drawings identifying locations of all outlets.
 - 2. Equipment Data Sheets: Indicate actual equipment performance, model numbers, bearing and belt data, motor nameplate data, and final balanced motor data.
 - 3. Additional Data: Submit all additional data as provided by AABC or NEBB Standard forms.
 - 4. Instrument Certification: When requested, submit certificate of calibration for all equipment to be used.
 - 5. Adjustment and Balancing Plan and Schedule.
 - a. Coordinate with commissioning plan and schedule.

1.5 QUALITY ASSURANCE

- A. Acceptable Testing, Adjustment, and Balancing Firms: Northwest Engineering Services, or pre-bid approved equal.
- B. Acceptable Testing, Adjustment, and Balancing Firms: Northwest Engineering Services, no substitution.

- C. Industry Standards: Testing, adjustment, and balancing shall be conducted in a manner recognized by the AABC or NEBB and recorded on forms similar to those published by the AABC or NEBB.
- D. Instrument Certification: All instruments used shall be accurately calibrated and certified within six months of balancing and maintained in good working order.
- E. Test Observation: If requested, conduct tests in the presence of the Port.
- F. Pre-Balancing Conference: Prior to starting balancing, general techniques shall be reviewed with the Port.

1.6 PROJECT CONDITIONS

- A. Perform balancing on existing systems prior to any system revisions being made.
- B. Do not perform testing, adjusting, and balancing work until heating, ventilating, and air-conditioning equipment has been completely installed, operational testing of control system is complete, and hydronic systems have been cleaned and treated per requirements of Section 232500, HVAC Water Treatment.
- C. Conduct testing and balancing with clean filters in place. Verify that other related work regarding system cleaning has been completed prior to performing hydronic testing and balancing.

1.7 SIX-MONTH CALLBACK

- A. An addition to the requirements of the contract, within 6 months after completion of test and balance work, the Port, at its discretion, may request a recheck or resetting of any equipment or device listed in the test reports.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 AIR SYSTEMS

- A. General: Measurements shall be in accordance with recognized procedures and practices of the AABC or NEBB. Record on appropriate forms.
- B. Preliminary:
 - 1. Identify and list size, type, and manufacture of all equipment to be tested, including air outlets and inlets.
 - 2. Use manufacturer's ratings for equipment to make required calculations except where field test shows ratings to be impractical.

C. Execution:

1. Adjust fan speeds and motor drives for required air volume, within +5 percent maximum. Set speed to provide air volume at farthest run without excess static pressure. Provide additional sheaves and belts as required to accomplish speed adjustment.
2. Read and adjust air supply, return, and exhaust fan units to deliver design conditions at minimum O.S.A. and at 100 percent O.S.A.
3. Adjust all automatic dampers, outside air, return air, and exhaust dampers for design conditions.
4. Read static air pressure conditions on all air handling equipment, including filter and coil pressure drops, and total pressure across the fan. Use a Dwyer Series 400 air velocity meter, or equal, for final static pressures at equipment and where critical readings are required.
5. Measure temperature conditions across all outside air, return air, and exhaust dampers to check leakage.
6. Read and record motor data and amperage draw.
7. For variable volume systems, establish minimum static pressure required at sensing point to permit operation over entire VAV range.

D. Distribution:

1. Read and adjust all air outlets to design air volumes, within +10 percent maximum. Advise the Port if deficiencies are noted to enable proper corrective actions.
2. Evaluate all building and room pressure conditions to determine adequate supply and return air conditions.
3. Evaluate all building and room pressure conditions to determine adequate performance of the system to maintain temperatures without draft.
4. Perform multipoint pitot traverses to confirm instrumentation, shaft tightness, fan operation, etc. Pitot traverses shall be performed using a Dwyer Series 400 air velocity meter, or equal, only with applicable duct probe.
5. Mark all balancing dampers.

3.2 HYDRONIC SYSTEMS

A. General: Make measurements in accordance with recognized procedures and practices of the AABC or NEBB. Record on appropriate forms.

B. Preliminary:

1. List complete data of tested equipment and verify against contract documents.
2. Open all line valves to full open position, close coil by-pass stop valves, then set mixing control valve to full coil flow.
3. For each pump:
 - a. Verify rotation.
 - b. Test and record pump shutoff head.
 - c. Test and record pump wide-open head.
4. Verify proper water level in expansion tanks in system.
5. Verify that air vents in high points of water are properly installed and operating freely.

C. Central Equipment:

1. Verify all conditions at all coils for required performance at design conditions.
2. Verify conditions at all primary source equipment for performance of design conditions.

3. Read and record pump heads, motor data, and amperage draw.
- D. Distribution:
 1. Read and adjust water flow for design conditions.
 2. Set all memory stops and mark position of adjuster on balancing valves.
- E. Variable Flow Chilled and Heating Water Systems: Coordinate with control system installer and the Port to establish procedures for balancing coils and establishing control setpoints. Chilled water systems are extensions of the existing variable flow systems and shall be balanced with respect to those existing systems.

3.3 AUTOMATIC CONTROL SYSTEM

- A. In cooperation with control manufacturer's representative, set and adjust automatically operated devices to achieve required sequence of operations.
- B. Verify all controls for proper operation and calibration and list controls requiring adjustment by control system installer.

3.4 COORDINATION

- A. Coordinate work between balancing agency and other trades to ensure rapid completion of the work.
- B. Engage the balancing agency to assist with:
 1. Checkout, startup, calibration of instrumentation, and operational, functional, and final acceptance test plans, procedures, checklists and reports.
 2. Development of systems manuals.
 3. Development of operation and maintenance manuals and training plan.
 4. Development of commissioning plans and schedules.
- C. Deficiencies noted during the course of air balancing in the mechanical installation shall be promptly reported to the Port to allow corrective action to proceed.
- D. Provide periodic review of progress as requested.

END OF SECTION 230593

SECTION 230719 - HVAC INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes insulation for piping, ductwork, and equipment.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 099100, Painting
- B. Section 230529, Hangers and Supports for HVAC Piping and Equipment
- C. Section 233600, Air Terminal Units

1.3 REFERENCES

- A. ASTM: American Society for Testing and Materials
 - 1. Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 2. ASTM C1071: Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
 - 3. ASTM E119: Standard Test Methods for Fire Tests of Building Construction and Materials
- B. OEEC: Oregon Energy Efficiency Code

1.4 SUBMITTALS

- A. Product Data: For each type of insulation, including density, conductivity, thickness, jacket, vapor barrier and flame spread and smoke developed indexes.
- B. Shop Drawings: Detail installation of insulation for the following:
 - 1. Removable covers for pump casings, accesses, etc.
 - 2. Expansion joints.
 - 3. Acoustical insulation including construction and installation of stainless steel jacket.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Flame and Smoke Ratings: Installed composite flame spread not to exceed 25 and smoke developed not to exceed 50 as tested by UL 723.
 - 2. Energy Codes: Oregon Energy Efficiency Code shall govern where requirements for thickness exceeds thickness specified.

- B. Protection: Protect against dirt, water, chemical or mechanical damage before, during, and after installation. Repair or replace damaged insulation at no additional cost to the Port.
- C. Source Quality Control:
 - 1. Service: Use insulation specifically manufactured for service specified.
 - 2. Labeling: Insulation labeled or stamped with brand name and number.
 - 3. Insulation and accessories shall not provide any nutritional or bodily use to fungi, bacteria, insects, rats, mice or other vermin, shall not react corrosively with equipment, piping or ductwork and shall be asbestos free.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All insulation shall be of one manufacturer.

2.2 PIPE INSULATION

- A. Fiberglass: Split sectional or snap-on type with 3.5 pcf density 0.23 per inch maximum thermal conductivity (K-factor) at 75°F mean temperature, 500°F minimum service rating and white, vapor barrier jacket with pressure sensitive closure system. Owens Corning Fiberglas Pipe Insulation SSL II or equal.
- B. Calcium Silicate: Sectional with 14 pcf nominal density, 0.42 per inch maximum K-factor at 200°F mean temperature and 1200°F minimum service rating. Johns Manville Thermo 1200 or equal.
- C. Elastomeric: Expanded closed cell, 0.27 per inch maximum K-factor at 75°F mean temperature and 220°F maximum service rating with fitting covers. Armacell, or equal.
- D. Acoustical: 2-inch thick 8 pcf density mineral wool.

2.3 BLOCK INSULATION

- A. Calcium Silicate: 1 1/2-inch thick unless specified or shown otherwise with 14 pcf nominal density, 0.42 per inch maximum K-factor at 200°F mean temperature and 1200°F minimum service rating. Johns Manville Thermo 1200 or equal.
- B. Fiberglass: 1 1/2-inch thick unless specified or shown otherwise with 6 pcf nominal density, 0.23 per inch maximum K-factor at 75°F mean temperature and 450°F minimum service rating. CertainTeed commercial board, or equal.

2.4 BLANKET INSULATION

- A. Fiberglass: 1 1/2-inch thick unless specified or shown otherwise with 1.0 psf nominal density, 0.27 per inch maximum K-factor at 75°F mean temperature, 250°F minimum service rating. CertainTeed, Owens Corning, or equal, with facing as follows:
 - 1. Exposed: ASJ all purpose facing with white Kraft paper finish, or equal.
 - 2. Concealed with vapor barrier: FSK reinforced foil and paper, or equal.
 - 3. Concealed without vapor barrier: Facing not required.
- B. Elastomeric: 1-inch thick unless specified or shown otherwise, expanded closed cell sheets, 0.27 per inch maximum K-factor at 75°F mean temperature and 220°F maximum service rating. Armaflex or equal.

2.5 BOARD INSULATION

- A. Semi-Rigid Fiberglass: 1 1/2-inch thick unless specified or shown otherwise with 3.0 pcf density, 0.23 per inch maximum K-factor at 75°F mean temperature, 150°F minimum service rating and all purpose vapor barrier facing with white Kraft paper finish. CertainTeed commercial board with ASJ facing, or equal.
- B. Rigid Fiberglass: Same as semi-rigid except with 6.0 pcf density and 0.22 per inch maximum K-factor.

2.6 DUCT INSULATION, INTERNAL

- A. Description: 1-inch-thick fiberglass unless specified or shown otherwise, mat-faced or dual density acoustical blanket with 1.5 pcf density, 0.28 per inch K-factor at 75°F mean temperature and 250°F minimum service rating rated for velocities up to 4,000 FPM. CertainTeed ToughGard Duct Board, or equal.
- B. Acoustical Absorption Coefficients: With minimum NRC of 0.65 for 1-inch and 0.85 for 2-inch as tested in accordance with ASTM C423.
- C. Liner shall meet ASTM C1071.

2.7 TERMINAL UNIT ACOUSTICAL WRAP

- A. One pound per square foot density and barium sulfate loaded vinyl material with fiberglass reinforcing. Kinetics Noise Control Model No. KNM-100B or equal.

2.8 REFRACTORY DUCT INSULATION

- A. 1-inch-thick, 4 pcf density, flame spread and smoke developed ratings of zero, 2300°F service rating. Johns Manville Cerablanket or equal.

2.9 ACCESSORIES

- A. Adhesives:
 - 1. Fiberglass: Johns Manville Zeston or equal.
 - 2. Calcium Silicate: Foster 30-36 or equal.
 - 3. Elastomeric: Armstrong 520 or equal.
 - 4. Duct Insulation, Internal: Foster 85-20 or equal.
- B. Weld Pins: Duro-Dyne, with NC-1 nylon stop clips, or equal.
- C. Cements:
 - 1. Insulating: Ryder Insulation Inc. or equal.
 - 2. Heat Transfer: Johns Manville or equal.
- D. Wire Mesh: 1-inch mesh with 20-gauge annealed steel wire.
- E. Pipe Fitting Covers: One-piece PVC insulated pipe fitting covers. Johns Manville Zeston or equal.
- F. Grooved Coupling Insulation: One-piece PVC insulated fitting cover. Johns Manville Zeston or equal.
- G. Insulation Protection Saddles: 12-inch long, 16-gauge steel. All piping with insulation shall be Anvil Fig. 167, galvanized, or equal.
- H. Mastic:
 - 1. Vapor Barrier: Design Polymerics 3040 or equal.
 - 2. Outdoor Mastic: Design Polymerics 3040 or equal.
- I. I. Metal Pipe Jacket: 0.020-inch thick stainless steel jacket with form-fitting covers, stainless steel snap straps and sealant.
- J. Cloth Facing: Presized fiberglass cloth.
- K. Tapes: Pressure sensitive, weather resistant and for temperatures up to 150°F. Zeston Z-tape or equal.
- L. Paint: Ultraviolet resistant latex paint with special adherence capabilities to the PVC fitting covers, elastomeric, aluminum facing, Kraft paper, tapes, and adhesives. See Section 099100 for additional requirements.

PART 3 - EXECUTION

3.1 GENERAL

- A. Applicators: Applicators shall be employed by a firm that specializes in insulation work.
- B. Preparation: Surfaces of piping, equipment, and ductwork shall be clean, free of oil or dirt, and dry before insulation is applied.

- C. Stamps: ASME stamps, UL labels, and similar stamps and labels shall not be covered.
- D. Any insulation that becomes damaged, water soaked, or stained shall be replaced at no additional cost to the Port.

3.2 PIPE AND EQUIPMENT INSULATION APPLIED LOCATIONS

- A. For piping systems located in utility tunnels and in CUP, insulate with calcium silicate insulation, stainless steel metal jacket, in thickness listed.

B.

Pipe Size	Heating Water	Chilled Water	Low Pressure Steam	Medium and High Pressure Steam
≤ 1"	2"	2"	2"	4"
1-1/4"-2"	2"	2"	2"	4"
2-1/2"-3"	2-1/2"	2"	2-1/2"	5"
3-1/2"-4"	2-1/2"	2"	2-1/2"	5"
4-1/2"-5"	2-1/2"	2"	2-1/2"	5"
5-1/2"-6"	2-1/2"	2"	2-1/2"	6"
≥ 8"	3-1/2"	2"	3-1/2"	6"

- C. For locations other than the tunnels and CUP, insulate the piping systems with glass fiber insulation, all-purpose jacket in thickness listed below.

D.

Pipe Size	Heating Water	Chilled Water	See Note 1	Medium and High Pressure Steam
≤ 1"	1-1/2"	1"	2"	2-1/2"
1-1/4"-2"	1-1/2"	1-1/2"	2-1/2"	3"

- E. Insulation shall include all fittings, unions, flanges, mechanical couplings, valve bodies, valve bonnets, and piping through sleeves. Unions need not be insulated on the following systems:
 - 1. Hot water heating inside building.
- F. Valves and irregular fittings shall be insulated with section of pipe insulation and insulating cement, securely fastened, and finished with 6 oz. canvas and Foster 30-36, or equal, lagging adhesive.
- G. Expansion Joints and Flexible Connectors: Pipe insulation or block of same material and thickness as adjacent piping.

3.3 PIPING INSTALLATION

A. General:

1. Joints: Coat both sides of complete joining area with applicable adhesive.
 - a. Longitudinal Joints: Make joints on top or back of pipe to minimize visibility. Except for foam plastic, seal with closure system or 3-inch-wide tape.
 - b. Butt Joints: Butt tightly together and, except for foam plastic, seal with 3-inch-wide tape or butt straps.
 - c. Multiple Layered Insulation: Joints shall be staggered.
2. Access: Strainer and other items requiring service or maintenance with easily removable and replaceable section of insulation to provide access.
3. Voids: Fill all voids, chipped corners, and other openings with insulating cement or material compatible with insulating material. In insulation with vapor barrier, coat with vapor barrier mastic.
4. Heat Tracing: Where piping is shown or specified to be heat traced, bed heat tape into heat transfer cement with insulation over heat tape and cement. FG or FP not allowed.
5. Seal joints, seams, and fittings of metal watertight jackets at exterior locations.

B. Fiberglass Insulation: Exterior insulation encased in metal jacket.

C. Calcium Silicate Insulation:

1. On systems with vapor barrier, coat complete with vapor barrier mastic.
2. Cover with cloth facing secured with applicable adhesive.
3. Exterior insulation encased in metal jacket.

D. Elastomeric Insulation:

1. Slit full length and snap around pipe.
2. Make cuts perpendicular to insulating surface leaving no cut section exposed.
3. Do not stretch insulation to cover joints or fittings.
4. Seal joints with adhesive. Sealing joints with tape will not be allowed.

E. Fittings: Install insulation on all fittings.

1. On Elastomeric and Acoustical Insulation: Fittings covered with covers made up of mitered sections of insulation or with formed pipe fitting covers.
2. In Other Insulation: Fittings covered with insulation to the same level of the adjoining insulation or fill with insulating cement. Finish with pipe fitting covers or cloth facing and tape.

F. Unions, Flanges, Mechanical Joints, Valves, Etc:

1. General:
 - a. As specified for fittings.
 - b. Minimum thickness same as specified for piping.
2. Unions: Build up insulation at least 1/2 inch beyond adjoining insulation.
3. Flanges: Insulation with square corners.
4. Flanged Valves: Insulation with square corners.

G. Non-Vapor Barriered Insulation:

1. On piping 3/4 inches and smaller, insulation continuous through pipe hanger, with shield at each hanger.

2. On piping over 1 inch, 18-inch section of calcium silicate, same thickness as pipe insulation, at each hanger.
3. For all piping, insulation shall be protected with pipe shield specified in Section 230529.

3.4 EQUIPMENT INSTALLATION

- A. General: Install true and smooth. Insulation over curved surfaces shall conform to curves of surface.
 1. Access: Access, etc., that requires service, inspection, or maintenance shall be provided with covers or sections that are easily removable and replaceable. Reinforce openings in adjacent insulation with metal beading. In vapor barriered insulation, coat joints with vapor barrier mastic.
 2. Voids, Depressions, and Cavities: All voids, chipped corners, and other openings shall be filled with insulating cement or material compatible with insulating material.
 3. Vapor Barriered Insulation: Where insulation is specified to have a vapor barrier, the barrier shall not be pierced or broken.
 - a. Tears, etc., shall be coated with vapor barrier mastic and patched with insulation facing or tape.
 - b. Staples shall be brush coated with vapor barrier coating.
 - c. Cover all raw edges coated with vapor barrier mastic, and seal cover to equipment surface.
 4. Non-Vapor Barriered Insulation:
 - a. Tears, etc. shall be patched with insulation facing or tape.
 - b. Cover all raw edges and bevel neatly to the equipment surface.
 5. Multi-layered Insulation: Joints shall be staggered.
- B. Calcium Silicate and Fiberglass Block:
 1. Anchors: Lug nuts 10-gauge black annealed iron wire welded to metal surfaces.
 2. Banding: Block secured to surface with 1/2-inch wide stainless steel bands maximum 18 inches on center and secured to anchors.
 3. Insulating Cement: Block covered with insulating cement minimum thickness of 1/2-inch with smooth finish.
 4. Vapor Barriered System: On vapor barriered system, apply continuous coat of vapor barrier mastic.
 5. Finish: Finish with cloth facing secured with adhesive and lapped a minimum of 2 inches. Touch up defects with finishing cement.
- C. Elastomeric Blanket: Cut insulation to size, make corners with mitering cuts to preclude raw edges, continuously cement insulation to equipment with adhesive. Cement both surfaces of joints and butt tightly together and cover raw edges with two coats of adhesive.
- D. Expansion Joints: Covered with larger size pipe insulation to allow full movement and be removable.
- E. Ball Joints: Covered with larger size pipe insulation to allow full movement, ends turned back to pipe, coat with vapor barrier mastic on joints in vapor barriered system, and finished with cloth facing cemented to insulation with adhesive.

3.5 DUCT INSULATION APPLIED LOCATIONS

- A. General:
 - 1. All external insulation shall have continuous vapor barriers unless specifically noted otherwise.
 - 2. Internally lined ductwork need not be insulated.
- B. Medium Pressure Supply Ductwork:
 - 1. Exposed: Rectangular ductwork insulated with rigid fiberglass board. Round ductwork insulated with semi-rigid fiberglass board.
 - 2. Concealed: Insulated with fiberglass blanket.
- C. Low Pressure Supply Ductwork:
 - 1. Exposed: All exposed rectangular supply ductwork shall be internally lined, 1-inch thick.
 - 2. Concealed: Internally line the first 5 feet after terminal units. After the first 5 feet, externally wrap ductwork.
 - 3. Terminal units 2000 CFM and greater: As specified in Section 233600.
 - 4. Flex duct: Factory insulated.
- D. Return Air Ductwork/Plenums: Internally lined throughout, 1-inch thick.
- E. Exhaust Ductwork: Not insulated.
- F. Outside Air Ductwork/Plenums: Internally line, 2-inch-thick, unless external insulation is indicated.
- G. Blank Off Panels: Internally line with 2-inch-thick insulation.
- H. Ductwork at Exhaust Fans: Internally line 20 feet upstream and downstream of fans, including all branch ductwork within 20 feet, 1-inch thick.

3.6 DUCTWORK INSTALLATION

- A. General:
 - 1. Install insulation in accordance with the manufacturer's instructions.
 - 2. The vapor barrier shall be continuous. Tears, holes, staples, etc. shall be coated with vapor barrier mastic and patched with facing or tape. Joints between insulation and access shall be provided with vapor barrier mastic.
 - 3. Insulation at access panels shall be removable or attached to panel with edges of panel and opening reinforced with metal beading.
- B. External Blanket Insulation:
 - 1. Secure insulation to ductwork with 20-gauge snap wires 24 inches on center and at all joints.
 - 2. Lap joints and seams a minimum of 3 inches, and sealed with jacket tape.
- C. Board Insulation:
 - 1. Space rectangular ducts with weld pins a maximum of 18 inches on center in both directions.

2. All corners shall be made with joints; bending insulation around corners will not be allowed.
 3. All joints and seams shall be butted tight together.
 4. Butt joints with 3-inch-wide tape.
 5. Finish corners with 3-inch-wide tape.
- D. Internal Duct Liner:
1. The coated surface shall face air stream.
 2. Weld pins spaced maximum of 15 inches on center in both directions and within 2 inches of all corners and joints. Weld pins flush with liner surface.
 3. Complete duct surface coated with adhesive and insulation pressed tightly thereto.
 4. Edges at terminal points shall be provided with metal beading and heavily coated with adhesive.
 5. All joints and corners shall be heavily coated with adhesive.
 6. Damaged areas shall be replaced or heavily coated with adhesive.
- E. Plenums: Insulation on floors protected by wire mesh.
- F. Blank Off Panels: Insulation, enclosed with sheet metal on all sides. All joints with vapor barrier mastic and taped.
- G. Volume Dampers: Where volume dampers do not allow for continuous insulation, terminate insulation clear of handle sweep and finish edges to maintain vapor barrier and to prevent damage to the insulation.

3.7 TERMINAL UNIT ACOUSTICAL WRAP

- A. Install in accordance with the manufacturer's instructions on all variable and constant volume terminal units with maximum air volumes over 2000 cfm.

3.8 REFRACTORY DUCT INSULATION

- A. Install at beam penetrations as shown on the drawings.
- B. Adhere to duct with Foster 81-93, or equal. Secure with 16-gauge stainless steel wire bands at 3 inches on center.

3.9 DUCT ENCLOSURE - FIRE RATED

- A. Installation: Install in accordance with the manufacturer's instructions.
- B. Joints:
1. Attached boards shall be cemented and attached to one another. Mating surfaces shall be "buttered" with a 1/8-inch layer adhesive.
 2. Secure fiberglass type material with stainless steel banding (Type 304).

- C. Support: The duct enclosure may be hung from a conventional “trapeze” arrangement. Adequate support shall be provided at the bottom of vertical runs. On multi-story penetration, support with an angle iron collar attached to the duct.
- D. Expansion: Adequate clearance shall be provided at the end of all straight runs to allow for expansion of the metal duct inside the enclosure.

3.10 FIELD QUALITY CONTROL

- A. Field Test: All systems shall be tested and approved prior to installation of insulation.
- B. Existing Insulation:
 - 1. Repair existing insulation damaged during construction.
 - 2. Make neat connections where new and existing insulation meet.
 - 3. Where existing piping, ductwork, or equipment is removed, cover existing surfaces neatly to match existing.

END OF SECTION 230719

SECTION 230900 - INSTRUMENTATION AND CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide a complete building automation system (BAS) for all HVAC systems and other facility systems as shown in the contract documents.

1.1 RELATED WORK SPECIFIED ELSEWHERE

- B. Section 260519, Low-Voltage Electrical Power Conductors and Cables
- C. Section 260526, Grounding and Bonding for Electrical Systems
- D. Section 260529, Hangers and Supports for Electrical Systems
- E. Section 260533, Raceways and Boxes for Electrical Systems
- F. Section 260553, Identification for Electrical Systems
- G. Section 271000, Structured Cabling
- H. Section 284600, PDX Fire Detection and Alarm

1.2 SUBMITTALS

- A. Provide the following submittals for the work specified herein:
 - 1. Control Product Data: Fully describe all features and specifications for all products furnished. Data sheets shall be marked to indicate which specific model(s) or feature(s) will be furnished.
 - 2. Control Valve and Control Damper Schedules: Fully describe all features and functionality for control valves and control dampers furnished under this section including, but not limited to:
 - a. Valve or damper tag name.
 - b. Valve or damper size.
 - c. Pipe or duct size.
 - d. Valve end connections (e.g., NPT, union, sweat).
 - e. Damper mounting type (e.g., flanged/in-duct).
 - f. Valve or damper actuator voltage, spring or non-spring return type, and failure position (open/closed).
 - g. Valve body configuration, valve body ANSI class rating, design flow rate, valve Cv, pressure drop at full flow, minimum pressure required, and close-off pressure.
 - h. Damper blade operation (parallel/opposed), blade orientation (vertical/horizontal), blade edge and end seal types, bearing type, and SMACNA leakage rating.

3. Control System Shop Drawings: Include the following, at minimum:
 - a. Table of contents.
 - b. Symbol and wiring legend.
 - c. Metasys network installation details.
 - d. Network riser diagrams.
 - e. Control panel dimensioned layout drawings.
 - f. Bill(s) of material for all equipment furnished.
 - g. Mechanical, electrical, plumbing, and other controlled or monitored system flow diagrams.
 - h. Floorplan drawings showing the location of all control panels, power supplies (breaker panels and uninterruptible power supplies), and all sensors mounted in the space.
 - i. Written sequences of operation.
 - j. Point lists.
 - k. Wiring details.
4. User Interface Graphics: Where new user interface graphics are required, submit one sample of each type of graphic for approval. Graphic types include:
 - a. Navigational graphics that allow the user to select a building, an area of the building, or a floor/level.
 - b. Floorplan graphics displaying zone temperatures and other pertinent data.
 - c. Equipment graphics displaying a single piece of equipment (e.g., an air handling unit or a fan coil unit, and the control data associated with it).
 - d. System graphics displaying multiple pieces of equipment (e.g., a chiller plant, and the control data associated with it).
5. Startup and Functional Testing Plans:
 - a. Submit a startup plan for each new BAS controller. Include startup procedures and sample log sheets for point-to-point checkout and device calibration.
 - b. Submit a startup plan for each type of non-Johnson Controls equipment that is integrated with the BAS (e.g., variable frequency drives and chiller controllers furnished with BACnet communication). Include procedures to establish communication and to verify read/write capabilities and object mapping between systems.
 - c. Submit a detailed functional test plan for every mechanical, electrical, plumbing, or other system being controlled or monitored by the BAS. Include a description of the system being tested, a list of tag names for the equipment included in the system, the date/time that the testing is performed, and a list of all Port and Contractor representatives in attendance. Include any testing requirements or prerequisites such as weather conditions or support from other trades. Describe the detailed functional testing procedures and the expected test results. Include space to record the test results and a description of any deficiencies found. Include a field for the Port's and Contractor's representatives to sign off upon successful completion of the test.
6. Operation and Maintenance (O&M) Manual: Submit one electronic copy in PDF format, and two sets of printed manuals in 3-ring binders.
7. Record Documents: Include final versions of the following submittals incorporating all changes made during installation and commissioning, and marked "As-Constructed."
 - a. Control product data.
 - b. Control valve and control damper schedules.
 - c. Control system shop drawings.
 - d. Completed startup and functional testing plans.

8. System Operation: Describe system operating procedures including, but not limited to:
 - a. Graphics penetration method to display equipment, system, or floorplan graphics.
 - b. Methods to temporarily or permanently command or adjust control system analog and digital outputs.
 - c. Methods to configure standard reports and trend logs.
 - d. Methods to diagnose and resolve possible causes of equipment alarms, such as a high discharge air temperature or loss of airflow.
 - e. Methods to diagnose and resolve possible causes of control system alarms and errors, such as loss of communication.
 - f. A list of all user-adjustable setpoints, equipment operating schedules, alarm thresholds, and other parameters. Include the default value and the range over which the parameter may be adjusted (if limited). Describe the method for making adjustments, both on a temporary and permanent basis.
9. System Maintenance: Describe all hardware and software maintenance procedures that are either required or recommended by the manufacturer, including, but not limited to:
 - a. Instrument calibration.
 - b. Battery replacement.
 - c. Lubrication and adjustment of linkages.
 - d. Software backup, updates, and reloading.
10. Warranty Information: Provide a list of all products furnished hereunder. Include the warranty start and end dates and contact information for warranty claims.

1.3 QUALITY ASSURANCE

- A. BAS Systems Integrator:
 1. The BAS systems integrator shall be responsible for all submittals, programming, installation, startup, functional testing, and warranty.
- B. FCC Regulation:
 1. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.
- C. UL:
 1. Components shall be UL listed or recognized under the appropriate standard. These standards may include:
 - a. UL 864 for fire, smoke and process control systems, as required.
 - b. UL 873 for controllers and temperature indicating and regulating equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Acceptable BAS Manufacturer: Johnson Controls International plc (JCI), Milwaukie, Oregon branch office. No substitutions allowed. Branch installation manager: Matt Dunn (360) 597-5586 or (971) 865-1354.

2.2 SYSTEM DESCRIPTION

A. First-Tier Network:

1. The first-tier network includes the Metasys server and Secure Network Engines (SNEs).
2. First-tier devices communicate with each other via the Port's wide area network (WAN) over Ethernet/IP utilizing BACnet IP protocol. The Port will make network switch ports available in the nearest network room and will assign IP addresses for use by Johnson Controls. Refer to Division 27 for structured cabling requirements.
3. The Metasys server is existing and any upgrades that may be required will be provided by the Port.

B. Second-Tier Network:

1. SNEs provide supervisory control for devices connected via the second-tier network(s) using the ASHRAE BACnet MS/TP protocol over RS-485.

C. Web Browser Operator Interfaces:

1. The Metasys server supports multiple operator connections using a web browser.

2.3 CONTROL PANELS AND POWER SUPPLIES

A. Control, Communication, and Power Wiring:

1. General: Control, communication and power wiring shall be in accordance with the requirements of Divisions 26 and 27 and any applicable requirements of the manufacturer of products supplied hereunder. Plenum and tray-rated cabling may be used where approved by the Port.
2. Color Coding: Cable types shall be of a different color coding for easy identification and troubleshooting. Port standard color coding:
 - a. Analog Input Cable – Yellow
 - b. Analog Output Cable – Tan
 - c. Binary Input Cable – Orange
 - d. Binary Output Cable – Violet
 - e. 24 Vac Cable – Gray
 - f. General Purpose Cable – Natural

B. Control Panels:

1. Manufacturer: JCI ENx Series, Hoffman, or equal.
2. Panels shall be NEMA Type 1, 3, 3X, 4, 4X, or 12, rated for the installed environment.
3. Provide with lock and two keys, in locations that are not a locked Port-controlled room.

C. Power Supplies:

1. 120V/24V AC Transformers
2. Manufacturer: Functional Devices, JCI, or equal.
3. Uninterruptible Power Supplies
 - a. Manufacturer: JCI UPS PNL550-0, or equal.
 - b. Provide for each SNE.

2.4 CONTROL DEVICES

- A. General: Select all control devices in accordance with the manufacturer's recommendations and the application requirements for materials of construction, pressure ratings, power supply, signal types, accuracy, features, and other options.
- B. Analog Inputs:
 - 1. Airflow Stations and Probes, Duct-Mounted:
 - a. Manufacturer: Air Monitor or Onicon ELECTRA-flo, Ebtron, JCI AD-1272, or equal.
 - b. Provide sensing probes or arrays as recommended by the manufacturer for the application. Include airflow straightener, such as honeycomb cells, where recommended by the manufacturer to provide an accuracy of +/- 2% of reading.
 - 2. Conditioned Space Sensors:
 - a. Room temperature
 - b. Manufacturer: JCI NS8000 Series, or equal.
 - c. Sensors shall be white and have no display or setpoint adjustment unless otherwise shown on the drawings.
- C. Digital Inputs:
 - 1. Air Filter Differential Pressure Switch:
- D. Digital Outputs:
 - 1. Relays:
 - a. Manufacturer: Functional Devices, Veris or equal.
- E. Control Valve and Actuator Assemblies:
 - 1. General: Select Cv for pressure-dependent control valves based on design flow rate and allowable pressure drop. Assume 5 psid unless shown otherwise. Select valve actuator to achieve close-off pressure equal to the pump head. All valve actuators shall be electrically powered. Furnish actuators with spring return where sequences require a fail-safe position in an event of power failure. Non-spring return actuators are permissible where sequences require a normally open or closed position when controllers are in a normal operating mode. If no normal position is specified, actuators shall fail in last commanded position.
 - 2. Pressure-Independent Globe and Ball Valves, 1/2" – 2", With Modulating, Spring or Non-Spring Return Actuators:
 - a. Manufacturer: JCI VP140 Series, or equal.
- F. Control Dampers and Actuators:
 - 1. General: Damper size shall be as shown on drawings. Select blade operation (parallel or opposed) and blade orientation (horizontal or vertical) per the manufacturer's recommendations based on the application. For multi-section dampers, include all jack shafts and linkage necessary to provide coordinated operation of all dampers. Select damper actuator to provide torque required by the damper manufacturer. Furnish spring or non-spring return actuator, with end switches or position feedback potentiometer as required by the sequence of operation or drawings. Furnish actuators with spring return where sequences require a fail-safe position in an event of power failure. Non-spring return actuators are permissible where sequences require a normally open or closed position when controllers are in a normal operating mode. If no normal position is specified, actuators shall fail in last commanded position.

2. Aluminum, Low Leakage, Airfoil Blade Dampers:
 - a. Manufacturer: Ruskin CD-50, Tamco Series 1000, or equal.
3. Damper Actuators:
 - a. Modulating or Open/Closed, Spring or Non-Spring Return
 - b. Manufacturer: Belimo, JCI, or equal.

2.5 HVAC EQUIPMENT CONTROLLERS

- A. General: Select HVAC equipment controller based on the application requirements.
- B. Communicating Thermostats:
 1. Manufacturer: JCI TEC3000 Series, or equal.
 2. Provide with BACnet MS/TP communication for connection to SNE.
 3. Provide white finish.
- C. Variable Air Volume (VAV) Terminal Unit Controller:
 1. Manufacturer: JCI Model M4-CVM03050, no substitutions.

2.6 NETWORK ENGINES (SNE)

- A. General: Select network engines based on the number of control objects, the number of remote field buses required, and the number of BACnet MS/TP devices connected (JCI or third-party devices). Provide SNEs with a minimum of 10% spare capacity of control objects and BACnet MS/TP device connections (JCI or third party).
- B. Manufacturer: JCI SNE22002, SNE11002, SNE10502, no substitutions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wiring, Raceways, Control Panels, and Power Supplies:
 1. Wiring and Raceways: Control, communication, and power wiring shall be in accordance with the requirements of Divisions 26 and 27 and any applicable requirements of the manufacturer of products supplied hereunder. All wiring shall be installed in minimum 3/4-inch conduit. Label all wiring in control panels.
 2. Control Panels: Locate panels as shown on the drawings or near the equipment controlled, but not on the equipment itself. Provide an engraved nameplate with the panel or enclosure tag name on the exterior of all control panels and enclosures.
 3. Power Supplies: Obtain 120V AC power from spare circuits in emergency power panels. Coordinate with Division 26.
- B. Control Devices: Install in accordance with manufacturer's recommendations and requirements. Label all control devices per the tag name assigned in the shop drawings and the control valve and damper schedules. Refer to Section 230553 for valve tagging requirements.

3.2 SEQUENCES OF OPERATION

- A. All controls shall be accomplished by the DDC control system, unless otherwise noted.
- B. Variable Volume Air Terminal Unit with Reheat Coil:
 - 1. A space temperature sensor and occupancy sensor shall signal the DDC controller, which shall modulate the air damper between its cooling maximum, low minimum, and heating maximum CFM to maintain the required space temperature setpoint +/- occupied dead band.
 - 2. When the airflow has reached its scheduled minimum and the space temperature remains below setpoint, the hot water coil valve shall be modulated and the airflow increased to the heating airflow to maintain the required space temperature setpoint +/- occupied dead band.
 - 3. Terminal units with occupancy sensors shall adjust the temperature setpoint dead band based on occupancy. When occupied, use the occupied dead band. When unoccupied, use the unoccupied dead band. The occupied mode shall have a minimum duration time prior to switching to the unoccupied mode. There shall be no minimum duration time for the unoccupied mode.
 - 4. The occupancy sensor shall have an occupancy override button, which shall signal the DDC controller, which shall change the occupancy state to "occupied." Pushing the occupancy override button shall not switch the occupancy state to unoccupied.
 - 5. Space temperature setpoint, occupied dead band, unoccupied dead band, and occupied mode duration time shall be adjustable inputs.
- C. Loss of Power: The DDC controller shall sequence the restarting of all motors in the event of a loss of power to limit the current draw.
 - 1. An HWS and HWR temperature sensor shall signal the DDC controller.

3.3 STARTUP AND FUNCTIONAL TESTING

- A. Execute approved startup and functional test plans prior to substantial completion, unless otherwise approved by the Port. Provide all resources necessary, including labor, equipment, and means for accessing the equipment. Coordinate participation in startup and functional testing of the control system with other trades and equipment suppliers.
- B. Coordinate startup and functional testing with the commissioning process.

3.4 TRAINING

- A. Conduct two, 2-hour training courses for Port personnel in the operation and maintenance of the system. Utilize the approved O&M manual to deliver training. Include a site walk to familiarize staff with the locations of all control equipment. Training shall be coordinated to accommodate Port staff schedules.

3.5 WARRANTY

- A. Complete and submit any forms and startup records, and satisfy other requirements of the manufacturers of the equipment provided hereunder in order to initiate their product warranty.

END OF SECTION 230900

SECTION 232000 - HVAC PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes piping, pipe fittings, and incidental related items as required for complete piping systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230500, Common Work Results for HVAC
- B. Section 230529, Hangers and Supports for HVAC Piping and Equipment
- C. Section 230545, Seismic Restraints for HVAC Piping and Equipment
- D. Section 230548, Vibration, and Seismic Controls for HVAC Piping and Equipment
- E. Section 230553, Identification for HVAC Piping and Equipment
- F. Section 230590, Pressure Testing of HVAC Systems
- G. Section 230593, Testing, Adjusting, and Balancing
- H. Section 230719, HVAC Insulation

1.3 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI B16.1: Gray Iron Pipe Fittings and Flanged Fittings: Classes 25, 125, and 250
- B. ASTM: American Society for Testing and Materials
 - 1. ASTM A47: Standard Specification for Ferritic Malleable Iron Castings
 - 2. ASTM A53 or A120: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
 - 3. ASTM A135: Standard Specification for Electric-Resistance-Welded Steel Pipe
 - 4. ASTM A183: Standard Specification for Carbon Steel Track Bolts and Nuts
 - 5. ASTM A234: Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
 - 6. ASTM A307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 - 7. ASTM B88: Standard Specification for Seamless Copper Water Tube
 - 8. ASTM F876: Standard Specification for Crosslinked Polyethylene (PEX) Tubing

- C. AWWA: American Water Works Association
 - 1. AWWA C209: Cold-Applied Tape Coatings for Steel Water Pipe and Fittings
 - 2. AWWA C214: Tape Coating Systems for the Exterior of Steel Water Pipelines

1.4 SUBMITTALS

- A. Product Data: Submit product data for products specified herein.
- B. Shop Drawings: Submit shop drawings of HVAC systems layout, coordinated with the work of other divisions and existing facilities, systems, equipment, and components.
- C. Test Reports and Certificates: Submit certificates of inspections and pipe tests to the Port.
- D. Other: Submit certified welders' certificates.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Piping material and installation shall meet requirements of the local building codes and serving utility requirements.
- B. Pipe Cleaning: Should any pipe be plugged or should foaming of water systems occur, disconnect piping, reclean, and reconnect with no additional cost to the Port.
- C. Correct any damage to the building or systems resulting from failure to properly clean the system with no additional cost to the Port.

PART 2 - PRODUCTS

2.1 COPPER PIPE

- A. Pipe: Hard drawn copper tubing, Class L or K, ASTM B88.
- B. Fittings: Wrought copper, 150 psi, solder joint type, Chase, Revere, Mueller, or equal.
- C. Service:
 - 1. Industrial cold water above grade (Type L) on piping 4 inches and smaller.
 - 2. Chilled and heating water piping (Type L, hard drawn) up to and including 2 1/2 inches.

2.2 FLANGED JOINTS

- A. Flanges shall be cast iron or steel for screwed piping and forged steel welding neck for welded line sizes. Pressure rating and drilling shall match the apparatus, valve or fitting to which they are attached. Flanges shall be in accordance with ANSI B16.1; 150-pound for system pressures to 150 psig; 300-pound for system pressures 150 psig to 400 psig. Gaskets shall be 1/16-inch thick, Cranite or equal, ring type, coated with graphite and oil to facilitate making a tight joint. Make joint using American Standard hexagon head bolts, lock washers and nuts (in accordance with ASTM A307 GR.B) for service pressures to 150 psig; alloy steel stud bolts, lock washer and American Standard hexagon head nuts (in accordance with ASTM A307 GR.B) for service pressures 150 psig to 400 psig. Use length of bolt required for full nut engagement. Provide electro-cad plated bolts and nuts on cold and chilled water lines.

2.3 UNIONS

- A. Unions shall be 150 psi malleable iron or brass, brass to iron seat, ground joint, black or galvanized to match pipe. 200 psi WOG bronze, ground joint, solder type for copper tubing. Use of dielectric unions is not permitted.

2.4 DIELECTRIC NIPPLE

- A. Iron body with zinc plated external coating, 150 psi, plastic dielectric coating on inside of nipple, and NPT x NPT connections. Grooved ends are not permitted.

2.5 DIELECTRIC FLANGE

- A. Iron body with zinc plated coating and bronze body, 175 psi, Buna-N gasket for chilled water, optional EPDM gasket for hot water and any system with water above 150°F, bolted flange with bolt isolation gaskets and metal washers, and NPT iron pipe by soldered copper connections. Use Watts series 3100, or equal.

2.6 SOLDER

- A. Copper Piping and Joints: Westinghouse Phos-Copper, Dyna-Flow by J.W. Harris Co. Inc., or equal.
- B. Valves, Cast Fittings, or Bronze Fittings: Harris Stay-Silv-15, Handy & Harmon Sil-Fos, or equal.
- C. Water Piping: All-State 430 with Duzall Flux, Engelhard Silvabrite with Engelhard General Purpose Flux, J.W. Harris Co. Stay-Safe 50 with Stay-Clean Flux, or equal, on 3 inches and smaller. On larger pipe, use Type "A" solder.

2.7 FLEXIBLE CONNECTOR

- A. Expansion Joint/Seismic Connector:
 - 1. T304 stainless steel hose and braid, Schedule 40 radius elbows and 180° bend, flange or weld end Schedule 40 fittings. Metraflex Metraloop or equal.
 - 2. Accept differential support displacement without damaging pipe, equipment connections, or support connections.
- B. Flexible Connectors to Air Terminal Units
 - 1. T304 stainless steel hose and braid, Schedule 40, flange or weld end Schedule 40 fittings. Metraflex Hose and Braid or equal.
 - 2. Accept differential support displacement without damaging pipe, equipment connections, or support connections.

2.8 PIPING, HANGERS, SUPPORTS, ANCHORAGE, AND SEISMIC RESTRAINTS

- A. Conform to the requirements of Section 230529, Section 230545, and Section 230548.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measurements, Lines, and Levels:
 - 1. Check dimensions at the building site and establish lines and levels for the work specified in this section.
 - 2. Establish all inverts, slopes and manhole elevations by instrument, working from an established datum point. Provide elevation markers for use in determining slopes and elevations in accordance with the drawings and specifications.
 - 3. Use established grid and area lines for locating trenches in relation to buildings and boundaries.

3.2 PIPING INSTALLATION

- A. Piping installed in areas of relative inaccessibility or in areas where leakage could cause significant damage shall not use mechanical couplings. Piping in these areas shall be soldered or welded. Areas include enclosed vertical shafts, above IT rooms, above electrical rooms, above hard lid ceilings, and as indicated on the drawings.
- B. Install unions in all non-flanged or non-mechanical coupling piping connections to apparatus and adjacent to all screwed valves, traps, and appurtenances requiring removal for servicing, located so that piping may be disconnected without disturbing the general system.
- C. Mechanical Couplings:
 - 1. On systems using galvanized pipe and fittings, galvanize fittings at factory.
 - 2. Before assembly of couplings, lightly coat pipe ends and outside of gaskets with approved lubricant.

3. Pipe grooving shall be in accordance with manufacturer's specifications contained in latest published literature.
 4. Expansion and contraction allowance for chilled water piping: Allow 1/8 inch per coupling, with piping installed to allow 1/16-inch movement in either direction, and installation at 70 degrees F. Make appropriate adjustments when installing at other temperatures.
 5. Expansion and contraction allowance for pumped condensate piping: Allow 1/4 inch per coupling, with piping installed to allow 3/4 inch of expansion and installation at 40 degrees F. Make appropriate adjustments when installing at other temperatures.
- D. Install all piping to vent and drain.
- E. Support all piping independently so that its weight is not carried by the equipment.
- F. Run piping clear of tube cleaning or removal/replacement access area on coils, etc.
- G. Dielectric Fittings: Provide dielectric nipples or flanges between dissimilar metals. Fittings shall be suitable for the pressure and temperature to be encountered. Dielectric unions are not permitted. Only install dielectric flanges in areas that are easily accessible.
- H. Copper Grooved Piping System: Install in accordance with the manufacturer's latest published literature.
- I. Expansion Joints/Seismic Connectors: Install where piping crosses building expansion joints and where indicated on drawings. Install in accordance with the manufacturer's instructions.
- J. Flexible Connectors to Air Terminal Units: Install where piping connects to air terminal units and where indicated on drawings. Install in accordance with the manufacturer's instructions.

3.3 PIPING JOINTS

- A. Join pipe and fittings using methods and materials recommended by the manufacturer, in accordance with standard practice and applicable codes. Clean, cut, ream, groove, etc., with proper tools and equipment. Hacksaw pipe cutting is prohibited. Peening of welds to stop leaks is not permitted.
- B. Copper Piping:
1. Soldered Joints: Cut pipe evenly with cutter, ream to full inside diameter; end of pipe and inside of fitting thoroughly cleaned and polished. Joint shall be uniformly heated, and capillary space completely filled with solder, leaving full bead around entire circumference.
- C. Do not install couplings in floor, wall, or grade beam sleeves.

D. Steel Piping:

1. Screwed Joints: Cut pipes evenly with pipe cutter, and ream to full inside diameter, with all burrs and cuttings removed. Joints shall be made up with suitable lubricant or Teflon tape, applied to male threads only, leaving two threads bare. Tighten joints so not more than two threads are left showing. Make junctions between galvanized steel waste pipe and bell of cast iron pipe with tapped spigot or half coupling on steel pipe to form spigot end, and caulk.
2. Flanged Joints: Pressure rating of flanges shall match valve or fitting joined. Joint gaskets shall be coated with graphite and oil.

E. Welded Joints:

1. Preparation for Welding: Bevel piping on both ends before welding.
 - a. Use following weld spacing on all butt welds:

<u>Nominal Pipe Wall Thickness</u>	<u>Spacing</u>	<u>Bevel</u>
1/4" or less	1/8"	37 1/2"
Over 1/4", less than 3/4"	3/16"	27 1/2"

- b. Before welding, remove all corrosion products and foreign material from surfaces.
 2. Welded Joints: Joints shall be made by the arc-welding process using ASME certified welders. Port openings of fittings shall match the inside diameter of the pipe to which they are welded. Use full radius welding elbows for all turns; use welding tees for all tees. Use reducing fittings for size reduction. Weldolets may be used for branches up through one-half the pipe size of the main to which they are attached. Nipples will not be allowed.
 3. Welding Operation:
 - a. After deposition, clean each layer of weld metal to remove slag and scale by wire brushing or grinding. Chip where necessary to prepare for proper deposition of next layer.
 - b. Weld reinforcement no less than 1/16 inch nor more than 1/8 inch above normal surface of jointed sections. Reinforcement shall be crowned at center and tapered on each side to surfaces being joined. Exposed surface of weld shall be free of depressions below surface of jointed members.
 - c. Do not perform welding when temperature of base metal is lower than 0 degree F. Material to be welded during freezing temperatures shall be made warm and dry before welding is started. Metal shall be warm to the hand or approximately 60 degrees F.

F. Screwed Joints: Use Teflon tape or Teflon liquid dope applied to male threads only.

3.4 INSTALLATION, PIPE WRAP

- A. Install in accordance with AWWA C209 and C214.
- B. Apply in accordance with the manufacturer's instructions.
- C. Apply wrapping to fittings in field after installation.

3.5 ADJUSTING AND CLEANING

A. General:

1. Clean interior of all piping before installation.
2. Flush sediment out of all piping systems with a minimum velocity of 5 to 6 FPS.
3. Prepare system for adjusting and balancing. If any system components, including control valves, balancing valves, automatic flow control valves, strainers, or other valves and specialties have sediment present, remove, clean and replace damaged or worn components.

END OF SECTION 232000

SECTION 233113 - LOW PRESSURE DUCTWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes low pressure structural ductwork, single wall housing plenums, flexible ducts, exposed ductwork for typical building HVAC applications, and grease hood exhaust ductwork for commercial kitchen Type 1 hoods.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230500, Common Work Results for HVAC
- B. Section 230529, Hangers and Supports for HVAC Piping and Equipment
- C. Section 230545, Seismic Restraints for HVAC Piping and Equipment
- D. Section 230548, Vibration and Seismic Controls for HVAC Piping and Equipment
- E. Section 230593, Testing, Adjusting, and Balancing
- F. Section 230719, HVAC Insulation
- G. Section 233300, Air Duct Accessories
- H. Section 233600, Air Terminal Units
- I. Section 233700, Air Outlets and Inlets

1.3 REFERENCES

- A. NFPA: National Fire Protection Association
 - 1. NFPA 13: Standard for the Installation of Sprinkler Systems
 - 2. NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems
- B. OMSC: Oregon Mechanical Specialty Code
- C. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association
 - 1. SMACNA HVAC Duct Construction Standards - Metal and Flexible

1.4 SUBMITTALS

- A. For systems, equipment, and components specified below, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.
 - 1. Sheet Metal Ductwork: Schedule of duct construction standards.
 - 2. Single Wall Housing Plenums: Shop drawings showing materials and construction details.
 - 3. Grease Hood Exhaust Ducts: Detailed shop drawings stamped by a registered professional mechanical engineer licensed in the state of Oregon.
- B. For systems, equipment, and components specified herein, submit commissioning plans and schedules; checkout, startup, operational, functional and final acceptance test plans, procedures, checklists, and reports; systems manuals; and operation and maintenance training plans.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Work performed by qualified, experienced mechanics, in accordance with the SMACNA HVAC Duct Construction Standards and these specifications.
- B. Regulatory Requirements:
 - 1. Sheet Metal Ductwork, Single Wall Housing Plenums, Flexible Ducts, and Exposed Ductwork:
 - a. Entire ductwork system, including materials and installation, shall be installed in accordance with NFPA 90A.
 - b. Ductwork and components shall be listed as UL 181, Class I air duct; flame rating shall not exceed 25 and smoke rating shall not exceed 50.
 - 2. Grease Hood Exhaust Ductwork: Design, construction, and installation shall be in accordance with Chapter 5 of OMSC.

PART 2 - PRODUCTS

2.1 HANGERS, SUPPORTS, ANCHORAGE, SEISMIC RESTRAINTS, AND SEISMIC CONTROL

- A. Provide hangers, supports, anchorage, seismic restraints, and seismic control for products specified herein in accordance with the requirements of the contract documents and SMACNA "HVAC Duct Construction Standards."

2.2 SHEET METAL DUCTWORK

- A. Fabricate from galvanized steel, unless noted otherwise on the drawings.
- B. Minimum gauge, duct construction, joint reinforcing, and fittings shall be in accordance with SMACNA "HVAC Duct Construction Standards - Metal and Flexible."

- C. Duct Classification: Ducts shall be considered low pressure when design velocities are 2000 fpm or less and maximum static pressure is 2-inch W.G., positive or negative.
1. Construct the following ductwork in accordance with minimum reinforcement requirements for static pressure class of 1/2-inch W.G., positive or negative.
 - a. Supply ductwork downstream from terminal units.
 - b. Supply, return, or exhaust ductwork serving fans scheduled to operate at less than 1/2-inch W.G.
 - c. Supply, return, or exhaust branch ductwork which serves one or two inlets/outlets.
 2. Construct the following ductwork in accordance with minimum reinforcement requirements for static pressure class of 1-inch W.G. positive or negative.
 - a. Supply, return, or exhaust ductwork serving fans scheduled to operate at less than 1-inch W.G. On supply fans, pressure drops for louvers, coils, clean filters, and sound traps may be deleted from scheduled fan static.
 - b. Supply, return, or exhaust ductwork serving multiple duct branches where the Contractor can demonstrate that pressures will not exceed 1-inch W.G., positive or negative.
 3. Construct the following ductwork in accordance with minimum reinforcement requirements for static pressure class of 2-inch W.G., positive or negative.
 - a. Supply, return, or exhaust ductwork serving fans scheduled to operate at pressures greater than 1-inch W.G., positive or negative.
- D. Longitudinal seams on rectangular duct shall be Pittsburgh or Button punch snap lock, or equal. Snap lock seams for round duct may be used only on ducts classified for 1/2-inch W.G. Longitudinal seams for round ducts using lap and rivet, spot weld, or fillet weld may be used only on ducts classified for statics 1-inch W.G. or less.
- E. Joining and reinforcing systems manufactured by Ductmate, Roloc, TDC, or equal, are acceptable. Ductmate 35 is equivalent to SMACNA "J," and Ductmate 25 is equivalent to SMACNA "F."
- F. Do not use adjustable round elbows.

2.3 EXPOSED DUCTWORK IN FINISHED SPACES

- A. Round:
1. Acceptable Manufacturers: United Sheet Metal, Semco, Metco, Dee's, Rolok, Streimers, Temp Control, Arrow, or equal.
 2. Material: Round or flat oval, machine formed, spiral lock-seam galvanized sheet metal ductwork of thicknesses as listed for sheet metal duct. Paintable surface.
 3. Fittings: Machine formed, shop fabricated, with welded seams, designed for easiest air flow, similar to United Sheet Metal numbers listed, or equal.
 - a. Mitered Elbow with Turning Vanes: Type EV-90-2.
 - b. Radius Elbows: Type E090-5. Similar for less than 90-degree elbows.
 - c. Tees: Type Con-T-1.
 - d. Reducing Fittings: May be used unless noted otherwise.
- B. Rectangular: Same as for sheet metal ductwork but paintable surface. All reinforcing shall be inside. Use special care to prevent imperfections in the metal surface.

PART 3 - EXECUTION

3.1 APPLIED LOCATIONS

- A. HVAC Supply Ductwork on Downstream Side of Terminal Box: Lined sheet metal ductwork for the first 5 feet. At the Contractor's option, lined sheet metal may be used throughout.
- B. HVAC Supply Ductwork from Spin-In Fittings to Supply Outlet Collar Connection: Flexible duct, maximum 6'-0" length.
- C. HVAC Return Air Trunk Ductwork from End Run to Unit Connection: Galvanized sheet metal, lined throughout.
- D. HVAC Ductwork Between Transfer Grilles: Sheet metal.
- E. Exposed HVAC Ductwork in Finished Spaces: Sheet metal.

3.2 INSTALLATION

- A. Sheet Metal Ductwork:
 - 1. Seal traverse joints with an approved mastic during joining procedure or tape after joining to provide airtight duct system.
 - 2. Hang, support, restrain, and control movement and vibration of low pressure ductwork systems, equipment, and components in accordance with the requirements of the contract documents and SMACNA "HVAC Duct Construction Standards - Metal and Flexible." Do not use wire supports.
 - 3. Provide supplementary steel for support of ductwork in shafts and between building structural members.
 - 4. Fabricate changes in direction to permit easy air flow, using full 1.5D radius bends or fixed turning vanes in square elbows. Radius elbows less than 1.5D radius shall have splitter vanes.
 - 5. Change in duct size or shape necessitated by interference shall be made using rectangular equivalents of equal velocity.
 - 6. Where pipe, structural member, or other obstruction passes through a duct, provide streamlined sheet metal collar around member and increase duct size to maintain net free area. Fit collar and caulk to make airtight.
- B. Sound Attenuation (Internal Insulation):
 - 1. Provide sound attenuation duct in accordance with Section 230719, HVAC Insulation.
 - 2. Duct dimensions shown are net inside attenuating material.
- C. Dampers: Install where shown and where required. Install regulators as specified. Leave all dampers locked wide open.
- D. Extractors: Install behind supply grilles and registers.
- E. Flexible Connectors: Make connections to fans and other rotating equipment with flexible connectors with 2-inch minimum clearance between casing and ductwork. Not required on internally isolated spring units.

- F. Spin-In Fittings:
1. Install at branch take-offs to outlets using round or flex duct.
 2. Connect to flexible duct with draw band strap and minimum of two wraps of duct tape.
 3. Leave all dampers locked wide open.
- G. Flexible Ducts:
1. Make connections at ends using draw band strap and a minimum of two wraps of duct tape.
 2. Suspend center spans from structure above using galvanized steel straps or fire-resistant fabric straps as required by code. Use 1-inch wide (minimum) galvanized steel straps (or fire-resistant fabric straps) with single loop at top and smooth edges.
 3. Do not lay flexible duct on the ceiling.
 4. Avoid crimping flex duct. Make all changes in direction using 2D radius. Duct connections to grilles, registers and diffusers using less than 2D radius bends are not acceptable. Where space is constricted, use sheet metal elbows.
 5. Maximum flexible duct length shall be 6 feet.
- H. Ductwork, Exposed in Finished Areas:
1. Use extreme care in handling and installing.
 2. Replace all dented or damaged sections.
 3. Install ductwork straight and true, parallel to building lines.
 4. Make all connections with pop rivets using couplings where applicable. Grind all raw edges smooth and apply paintable sealant to cover imperfections.
 5. Remove all excess sealant to provide a finished joint.
 6. Provide floor, wall, and ceiling plates.
 7. Finish, clean and prime all ductwork and hangers for painting.
- I. Single Wall Housing Plenums:
1. Install housing plenums in accordance with SMACNA "HVAC Duct Construction Standards - Metal and Flexible."
 2. Seal joints and seams with high pressure duct sealer or gaskets and fasten with bolts, screws, or pop rivets.
 3. Seal pipe, duct, conduit, and control penetrations to prevent air leakage using close off sheets and strips.
 4. Securely anchor housing panels to floor or roof curbs.
 5. Block outside air or return air dampers open to prevent damage during construction until automatic control system is operational and adjusted.
 6. Standing seams shall face into plenum where possible.
 7. Provide access doors where required for cleaning and maintenance. Install access doors to open against air pressure.

END OF SECTION 233113

SECTION 233114 - MEDIUM PRESSURE DUCTWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes medium pressure ductwork and fittings, including round and oval, single and double wall, and rectangular steel.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230500, Common Work Results for HVAC
- B. Section 230529, Hangers and Supports for HVAC Piping and Equipment
- C. Section 230545, Seismic Restraints for HVAC Piping and Equipment
- D. Section 230548, Vibration and Seismic Controls for HVAC Piping and Equipment
- E. Section 230590, Pressure Testing of HVAC Systems
- F. Section 230593, Testing, Adjusting, and Balancing
- G. Section 230719, HVAC Insulation
- H. Section 233300, Air Duct Accessories
- I. Section 233600, Air Terminal Units

1.3 REFERENCES

- A. NFPA: National Fire Protection Association
 - 1. NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems
- B. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association
 - 1. SMACNA HVAC Duct Construction Standards - Metal and Flexible

1.4 SUBMITTALS

- A. For systems, equipment, and components specified herein, submit product/material data; shop drawings; as-constructed data; installation, startup, and testing manuals; and as-constructed drawings.
 - 1. Rectangular Steel Ductwork: Include schedule of rectangular duct construction standards.

- B. Commissioning Plans and Related Documentation: For systems, equipment, and components specified herein, submit commissioning plans and schedules; and checkout, startup, operational, functional and final acceptance test plans, procedures, checklists, and reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Work shall be performed by qualified, experienced mechanics, in accordance with SMACNA and these specifications.
- B. Regulatory Requirements:
 - 1. Entire ductwork system, including materials and installation, shall be installed in accordance with NFPA 90A.
 - 2. Ductwork and components shall be listed as UL 181, Class I air duct; flame rating shall not exceed 25 and smoke rating shall not exceed 50.

PART 2 - PRODUCTS

2.1 HANGERS, SUPPORTS, ANCHORAGE, AND SEISMIC RESTRAINTS

- A. Provide hangers, supports, anchorage, seismic restraints, and seismic control for products specified herein in accordance with the requirements of the contract documents and SMACNA "HVAC Duct Construction Standards - Metal and Flexible."

2.2 GENERAL

- A. Fabricate from galvanized steel, unless otherwise shown on the drawings.
- B. Minimum gauge, duct construction, joint reinforcing, fittings, hangers, and supports in accordance with SMACNA "HVAC Duct Construction Standards - Metal and Flexible."
- C. Duct Classification: Ducts shall be considered medium pressure when design velocities exceed 2000 fpm and static pressure is 2-inch W.G. or greater positive. Construct ducts in accordance with minimum reinforcement requirements for static pressure class of 4 inches positive.

2.3 SINGLE WALL ROUND DUCT AND FITTINGS

- A. Acceptable Manufacturers: United Sheet Metal; Semco; Streimers; Dee's; Metco; Temp Control; Arrow; or equal.
- B. Materials:
 - 1. Medium pressure round ductwork up to 36-inch diameter spiral lock seam. Round ducts over 36 inches in diameter shall be either spiral lock seam or shop fabricated with longitudinal seams.
 - 2. Takeoffs: Main and branch takeoffs similar to United Spiral Uniform Duct fittings type SRSTC, SRSTL, SRSPTC, or SRSPTL, typically. All fittings shall be continuously welded.

3. Transitions, Elbows:
 - a. Transitions of concentric type or eccentric type to maintain elevations detailed, with not more than 15-degree angle variation on sloped portion.
 - b. 90-degree elbows of five-piece design with centerline radius equal to 1 1/2 times duct diameter minimum, continuously welded. Mitered elbows will not be allowed.
 - c. 60-degree and 45-degree elbows of three-piece design with long radius.
 - d. Y-branch fittings similar to United Uniseal SRHY or SRHYR. Bull head tees will not be allowed.

2.4 SINGLE WALL OVAL DUCT AND FITTINGS

- A. Acceptable Manufacturers: United Sheet Metal; Semco; Metco; Dees; or equal.
- B. Materials:
 1. Medium pressure oval ductwork through 24 inches minor axis (duct height) fabricated from spiral lock seam. Ducts with minor axis above 24 inches shall be fabricated from longitudinal seam ducts.
 2. Takeoffs: Main and branch takeoffs shall be similar to United Uniseal fittings type SOSTC, SOSTL, SOSPTC, or SOSPTL, typically. Provide standing seam joints sealed with high pressure duct sealer, or provide welded joints, or provide spot welded joints sealed with high pressure duct sealer.
 3. Transitions and Elbows:
 - a. Transitions of concentric type or eccentric type to maintain elevations detailed, with not more than 15-degree angle variation on sloped portion.
 - b. 90-degree elbows of pie stamped or five-piece design with centerline radius equal to 1 1/2 times duct diameter minimum. Mitered elbows will not be allowed.
 - c. 60-degree and 45-degree elbows of three-piece design with long radius.
 - d. Y-branch fittings similar to United Uniseal SOSYH or SOSYE. Bull head tees are not allowed.

2.5 DOUBLE WALL ROUND AND FLAT OVAL DUCTWORK

- A. Acceptable Manufacturers: United Sheet Metal; Semco; Metco; Dees; or equal.
- B. Materials:
 1. Medium pressure double wall round and oval ductwork shall have outer pressure sheet from spiral lock seam up to 36-inch diameter round and 22-inch minor axis oval. Round ducts over 36-inch diameter and oval ducts over 22-inch minor axis shall have either spiral lock seam or longitudinal welded seams. Provide 1-inch-thick layer of fiberglass insulation having a k-factor of not less than 0.27 BTU/HR/SF/0 F at 75 degrees F ambient. Inner liner shall be perforated with not less than 23 percent free area.
 2. Double wall fittings shall be similar to single wall fittings except they shall conform to double wall construction as specified above.

PART 3 - EXECUTION

3.1 MEDIUM PRESSURE ROUND AND OVAL DUCTWORK INSTALLATION

- A. Install in accordance with the manufacturer's instructions and with SMACNA "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal all traverse and longitudinal joints with high pressure duct sealer and wrap with duct sealer tape or hard cast with minimum 2-inch overlap.
- C. Use slip-on connections for round ducts 36 inches in diameter and less, and for oval ducts with a 42-inch major axis and less not requiring additional reinforcement. Other ducts shall use flanged joint connections, fabricated and sealed in accordance with the manufacturer's instructions.
- D. Reinforce oval duct in accordance with SMACNA standards.
- E. At connections to terminal units a maximum 5 feet of flexible duct may be substituted for straight duct only.

3.2 MEDIUM PRESSURE ROUND AND OVAL DOUBLE WALL DUCT INSTALLATION

- A. Install in accordance with the manufacturer's instructions.
- B. Seal all traverse and longitudinal joints with high pressure duct sealer and wrap with duct sealer tape or hardcast with minimum 2-inch overlap. Treat all welded seams with protective paint inside and outside.
- C. Use slip-on connections for double wall round duct 34 inches in diameter and below, or 40-inch major axis on oval duct and below. Use flange connections on all other sizes.

3.3 TESTING

- A. Check out, start up, and test systems, equipment, and components specified herein.
- B. Field Tests: Perform leakage tests in accordance with Section 230590.

END OF SECTION 233114

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes medium and low pressure HVAC duct accessories, sealants and tapes, flexible connectors, combination fire/smoke dampers, access doors, spin-in fittings, extractors, drain pans, back draft dampers, and airflow measuring stations.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230719, HVAC Insulation
- B. Section 230900, Instrumentation and Controls of HVAC Systems
- C. Section 233113, Low Pressure Ductwork
- D. Section 233114, Medium Pressure Ductwork

1.3 REFERENCES

- A. NFPA: National Fire Protection Association
 - 1. NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems
- B. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association, Inc.
 - 1. SMACNA HVAC Duct Construction Standards - Metal and Flexible

1.4 SUBMITTALS

- A. For systems, equipment, and components specified herein, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.
 - 1. Include the manufacturer's installation instructions.
- B. For systems, equipment, and components specified herein, submit commissioning plans and schedules; checkout, startup, operational, functional and final acceptance test plans, procedures, checklists, and reports; systems manuals; and operation and maintenance training plans.

1.5 QUALITY ASSURANCE

- A. Work shall be performed by qualified, experienced mechanics in accordance with SMACNA and these specifications.

- B. Install entire ductwork system, including materials and installation, in accordance with NFPA 90A.
- C. Flexible connectors, flexible equipment connections, tapes and sealants shall be listed as UL 181, Class I air duct; flame spread rating shall not exceed 25 and smoke developed rating shall not exceed 50.

PART 2 - PRODUCTS

2.1 MEDIUM PRESSURE HVAC DUCT ACCESSORIES

- A. Acceptable Manufacturers: As indicated, or equal.
- B. Duct Sealer: Duro Dyne, EC900, S-2; 3M, United, or equal.
- C. Duct Tape: Duro Dyne, FT-2, Hardcast, Nashua, United; or equal.
- D. Tape and Adhesive/Activator System for Sheet Metal: Hardcast, or equal.
- E. Flexible Connector:
 - 1. Acceptable Manufacturers: Duro Dyne Durodon, or equal.
 - 2. Description: Flexible duct connector, 26 oz. Hypalon-coated woven glass fabric.
- F. Access Doors:
 - 1. Acceptable Manufacturers: United Sheet Metal APR or ASR; Metco; Semco; Cesco; Ruskin; Nailor-Hart, or equal.
 - 2. Description: Round, oval or rectangular to match duct, single wall to open against positive duct pressure, fastened with spring clips, pressure seal gasket, fastened with chain. Double wall access doors similar except provide insulated frame and insulated door.
- G. Bell Mouth Fittings: Round or flat oval, radius of 0.20 D minimum.

2.2 LOW PRESSURE HVAC DUCT ACCESSORIES

- A. Acceptable Manufacturers: As indicated, or equal.
- B. Damper Regulators:
 - 1. Ventlok model numbers used; similar products by Elgen, Young, or Durodyne are acceptable.
 - 2. Dial Regulator: Concealed or exposed duct in unfinished spaces, blade lengths 18-inch and less, 3/8-inch, Ventlok 635 or 638 for insulated duct. For blade lengths 19 inches and more, similar except 1/2-inch shafts.
 - 3. Dial Regulator: Exposed duct finished space, 3/8-inch, Ventlok 640.
 - 4. Dial Regulator: Concealed, not accessible, blade lengths 18-inch and less, 3/8-inch Ventlok 666 regulator with 680 mitered gear assembly where right angle turn is necessary. Blade lengths 19 inches and more, similar except 1/2-inch shafts.

5. End Bearings: For ducts rated to 1-inch W.G., open end, Ventlock 607. For ducts rated above 1-inch W.G., closed end, Ventlock 609. Exposed ductwork, finished spaces, Ventlock 609. Spring end bearings will not be allowed.
- C. Volume Damper Fabrication:
1. Single blade dampers shall be reinforced or crimped for rigidity, with pivot rod extending through duct. Dampers over 12 inches high shall use multiple opposed blade damper. Single blade damper shall be no larger than 12 inches by 48 inches. Multiple blade damper factory fabricated, Ruskin MD-35 or equal.
 2. Construct minimum gauge and duct in accordance with SMACNA "HVAC Duct Construction Standards - Metal and Flexible."
 3. Splitter and butterfly dampers shall be fabricated of 18-gauge galvanized steel.
 4. Dampers shall be of length suitable to close branch ducts without damper flutter.
 5. Damper blade shall be aligned with handle and index pointer.
- D. Flexible Equipment Connections:
1. Acceptable Manufacturers: Duro Dyne Durolon, or equal.
 2. Description: Flexible duct connector, 26 oz. Hypalon-coated woven glass fabric.
- E. Extractors (EX): Gang operated blades, steel construction, blades at 1-inch centers, slide operator set 15 degrees into main trunk duct. Titus AG-45 with No. 1 operator; Carnes; Anemostat; Barber-Coleman; Nailor-Hart.
- F. Spin-In Fittings:
1. Sheet Metal Duct: Straight pattern sheet metal spin-in fitting designed for connection to sheet metal ductwork, volume damper, and locking quadrant. Construct with spot welds or rivets. Button-punch fabrication prohibited.
 2. Fiberglass Duct: Straight pattern sheet metal spin-in fitting designed for connection to fiberglass ductwork volume damper, and locking quadrant. Construct with spot welds or rivets. Button-punch fabrication prohibited.
- G. Duct Sealer: United; Duro Dyne, S-2; 3M, EC900; Atlas, Multi-Purpose.
- H. Duct Tape for Sheet Metal: ARNO, C520; United; Duro Dyne; Nashua.
- I. Tape and Adhesive/Activator System for Sheet Metal: Hardcast.
- J. Turning Vane Assemblies:
1. Sheet Metal Vanes: Multiple radius hollow vane air foil type 2-inch (small vane) or 4 1/2-inch (large vane) inside radius, galvanized steel construction.
 2. Runners: Push-on type.
 3. Acoustical Vanes: Multiple radius air foil type, perforated steel construction with fiberglass fill. AirSan Acoustiturn.
- K. Access Doors:
1. Acceptable Manufacturers: Air Balance; Ruskin; Metco; Durodyne; Cesco; Nailor-Hart.
 2. Doors shall be complete with steel frame, steel door with backing plate, cam latches (two on units 14-inch by 14-inch and larger), hinge and gasketing. Doors on insulated or lined ducts shall be insulated.

3. Size:

<u>Duct Width or Duct Diameter</u>	<u>Net Access Door Opening</u>
Up to 8"	6" x 6"
9" to 12"	8" x 8"
13" to 20"	12" x 12"
21" to 30"	16" x 14"
31" to 42"	18" x 14"
Over 42"	Two 16" x 14"

L. Backdraft Dampers:

1. Acceptable Manufacturers: Air Balance; Ruskin; Cesco; Advanced Air; Nailor-Hart.
2. Description: Gravity operated, vinyl edged, metal bladed backdraft dampers.

M. Drip Pans: Provide Type 304 stainless steel drip pans for cooling coils.

N. Louver Blank-Off Panels: At air intake or exhaust louvers which are only partially active area, blank off inactive area with sheet metal closure panels caulked airtight, secured to louver frame and insulated with 2-inch rigid fiberglass insulation in accordance with Section 230719, HVAC Insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all devices in accordance with the manufacturer's recommendations.
- B. Install medium pressure duct accessories in accordance with Section 233114, Medium Pressure Ductwork.
- C. Install low pressure duct accessories in accordance with Section 233113, Low Pressure Ductwork.
- D. Access Doors: Install where indicated and at all automatic control dampers, fire dampers, and air flow stations to provide access for cleaning and maintenance.
- E. Back Draft Dampers: Install where indicated and at the discharge (or inlet) of exhaust fans where automatic dampers are not indicated.
- F. Automatic Dampers: Install in accordance with Section 230900, Instrumentation and Controls of HVAC Systems. Coordinate damper operators with Section 230900.
- G. Louver Blank-Off Panels: Install blank-off panels on unused portions of louvers.
- H. Airflow Station (Fan Inlet): Install in fan inlet bell in accordance with the manufacturer's instructions.

3.2 COMMISSIONING

- A. Commission systems, equipment, and components specified herein.

3.3 TESTING

- A. Check out, start up, and test systems, equipment, and components specified herein.

END OF SECTION 233300

SECTION 233600 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes air terminal units.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 230500, Common Work Results for HVAC
- B. Section 230529, Hangers and Supports for HVAC Piping and Equipment
- C. Section 230545, Seismic Restraints for HVAC Piping and Equipment
- D. Section 230553, Identification for HVAC Piping and Equipment
- E. Section 230593, Testing, Adjusting, and Balancing
- F. Section 230719, HVAC Insulation
- G. Section 230900, Instrumentation and Controls for HVAC Systems
- H. Section 232000, HVAC Piping
- I. Section 233113, Low Pressure Ductwork
- J. Section 233114, Medium Pressure Ductwork

1.3 REFERENCES

- A. ADC: Air Diffusion Council
- B. ARI: Air-Conditioning and Refrigeration Institute
 - 1. ARI 880: Performance Rating of Air Terminals
- C. ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers
 - 1. ASHRAE 130: Methods of Testing Air Terminal Units
- D. NFPA: National Fire Protection Association
 - 1. NFPA 90A: Standard for the Installation of Air-Conditioning and Ventilating Systems
- E. UL: Underwriters Laboratories
 - 1. UL 181: Standard for Factory-Made Air Ducts and Air Connectors

1.4 SUBMITTALS

- A. For equipment and components specified herein, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.
 - 1. Product Data:
 - a. Include construction details and performance characteristics for each type and size of terminal unit.
 - b. Include data showing compliance with discharge and radiated sound power level specified.
 - c. Include computer calculations for heating coils supplied with unit.
- B. For equipment and components specified below, submit commissioning plans and schedules; checkout, startup, operational, functional and final acceptance test plans, procedures, checklists, and reports; systems manuals; and operation and maintenance training plans.

1.5 QUALITY ASSURANCE

- A. Select units for sound levels, maximum pressure drops, and maximum inlet velocity as specified.

PART 2 - PRODUCTS

2.1 VARIABLE VOLUME TERMINAL UNITS

- A. Acceptable Manufacturers: Titus, Environmental Technologies, Trane, Krueger, or pre-bid approved equal.
- B. Description: Single duct, medium velocity, pressure independent, variable volume.
- C. Construct of minimum 22-gauge galvanized steel. Construction shall be leakproof with all joints sealed and all access doors gasketed. Leakage rate shall be less than 15 cfm at 3.0-inch differential S.P. Provide access door for cleaning of coil as an integral part of the unit. Interior lined with coated dual density or matt faced insulation meeting NFPA 90A requirements with lining in accordance with UL 181.
- D. Volume Regulator Assembly:
 - 1. Controller and actuator shall be in accordance with Section 230900, Instrumentation and Controls for HVAC Systems, and factory mounted in NEMA panel.
 - 2. Provide averaging type velocity sensor utilizing multiple sensing points.
 - 3. Factory set but field adjustable with CFM scale external to unit.
 - 4. Air valves shall be all metal construction, non-corrosive, with self-lubricating bearings and moving parts that are replaceable in the field.
- E. Air static pressure drop across terminal unit shall not exceed 0.35-inch W.G. without coil and 0.55-inch W.G. with water coil. Maximum inlet duct velocities shall not exceed 2200 fpm.

- F. Sound ratings shall be tested as power level 10-12 watts in accordance with ARI 880 standard and ASHRAE 130 at 1.5-inch W.G. inlet static pressure. Unit discharge airborne and casing radiated sound shall not exceed following rated sound power levels:

MAXIMUM AIRBORNE SOUND POWER (db)

	Octave Band & Center Frequency (Hz)						
	1	2	3	4	5	6	7
CFM	63	125	250	500	1K	2K	4K
0 – 300	--	63	64	60	60	60	52
301 - 400	68	65	65	63	60	60	52
401 - 800	71	68	67	67	60	60	52
801 - 1200	73	72	68	67	60	60	52
1201 - 2000	73	75	69	67	60	60	54
2001 and above*	--	80	78	76	67	67	60

* Units shall have 5'-0" of 2-inch-thick lined duct or 3'-0" IAC MS sound trap provided with unit at units' discharge to meet acoustic design goals.

- G. Provide normally open-air valves as specified.
- H. Provide water heating coils as specified.

PART 3 - EXECUTION

3.1 INSTALLATION, TERMINAL UNITS

- A. Support terminal units from structure using threaded rod and brackets provided. Make medium velocity duct connection to the inlet with minimum length of straight duct upstream of unit as recommended by the manufacturer or as specified, whichever is greater.
- B. Install minimum 5 feet of lined sheet metal ductwork on outlet of terminal units, or as specified on drawings, whichever is greater. Install terminal unit to allow complete access to controls.
- C. Provide a minimum of 5 feet of ductwork prior to first spin-in fitting or outlet branch duct takeoff.
- D. Where units have loaded vinyl wrap over insulation, install wrap to allow access into control panel.

3.2 TESTING

- A. Check out, start up, and test the equipment and components specified herein.

END OF SECTION 233600

SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes ceiling diffusers and sidewall grilles.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 233113, Low Pressure Ductwork
- B. Section 230593, Testing, Adjusting, and Balancing

1.3 SUBMITTALS

- A. For equipment and components specified herein, submit product/material data; shop drawings; operation and maintenance data; as-constructed data; installation, startup, and testing manuals; operation and maintenance manuals; and as-constructed drawings.
 - 1. Shop Drawings: Include dimensions and details of construction.
 - 2. Product Data: Show performance data including installed location by room number, air volumes, outlet velocity, pressure drop, throw at applicable pattern deflection, and noise level.
- B. For equipment and components specified herein, submit commissioning plans and schedules; checkout, startup, operational, functional and final acceptance test plans, procedures, checklists, and reports; and operation and maintenance training plans.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Where only Titus figure numbers are listed, provide products by Barber Colman, Carnes, Krueger, Metal-aire, or equal.
- B. All such products shall be of one manufacturer.

2.2 PERFORMANCE

- A. Unit sizing shall be based on air being introduced at 20 degrees F temperature differential and being diffused at the 5-foot level to a velocity not greater than 50 FPM and a temperature differential not greater than 1.5 degrees F. Select units so as not to exceed the NC-30 curve.

2.3 DIFFUSERS AND GRILLES

- A. Ceiling Supply Diffuser (C-1): Provide perforated face modular diffuser with adjustable modular core, steel panel, nominal 24 by 24 face, square or rectangular neck size as indicated, discharge pattern as indicated, lay-in tee bar ceiling, with white baked enamel finish. Titus PMC, Border Type 3.
- B. Ceiling Return/Exhaust Grille (C-2): Provide perforated face modular ceiling grille, steel panel, nominal 24 by 24 face, with duct adapters for round or rectangular as indicated, lay-in tee bar ceiling, with white baked enamel finish. Titus PAR, Border Type 3.
- C. Slot Supply Diffuser (S-1) Slot diffuser with one 3-inch slot, high throw pattern controller, continuous plenum lined with 1/2-inch insulation, baked enamel finish, and color to match ceiling grid. Length shown. Border type 11. Titus FL-30.
- D. Slot Return/Exhaust Diffuser (S-2): Slot diffuser with one 3-inch slot, continuous lined plenum with 1/2-inch insulation, baked enamel finish, and color to match ceiling grid. Side wall or ceiling application as shown. Length as shown. Border type 11. Titus FL-30.
- E. Wall Return/Exhaust Grille (H-1): Steel, 45-degree fixed single deflection, horizontal blades, 3/4-inch spacing 1-1/4-inch border, gasketed around face flange, with white baked enamel finish. Titus model 23RL.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install diffusers tight to their respective mounting surfaces.
- B. Install plumb and true with room dimensions and accurately centered on projections.
- C. Install extractors behind duct-mounted sidewall supply grilles. Turning vanes will be allowed if condition is the last outlet on a branch.
- D. Set pattern control for directions of throw prior to air balancer arriving on project.
- E. Paint ductwork behind outlets flat black.

3.2 TESTING

- A. Check out, start up, and test the equipment and components specified herein.

END OF SECTION 233700

SECTION 260500 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This division includes the electrical requirements of the work including, but not restricted to, the following key elements:
 - 1. Low voltage distribution system.
 - 2. Emergency power system.
 - 3. Lighting systems.
 - 4. Lighting control system.
- B. This section includes general electrical requirements which apply to the entire electrical division including, but not necessarily restricted to, the following:
 - 1. Procedural requirements.
 - 2. Port standards.
 - 3. Specifications for general items not specifically covered in other technical sections.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 024119, Selective Interior Demolition
- B. Section 083100, Access Doors and Panels
- C. Section 260533, Raceway and Boxes for Electrical Systems
- D. Section 271000, Structured Cabling

1.3 REFERENCES

- A. All equipment and materials shall be in accordance with the applicable standards of the following organizations:
 - 1. ANSI: American National Standards Institute
 - 2. FAA: Federal Aviation Administration
 - 3. IBC: International Building Code
 - 4. ICEA: Insulated Cable Engineers Association
 - 5. IEEE: Institute of Electrical and Electronic Engineers
 - 6. NEC: National Electrical Code
 - 7. NEMA: National Electrical Manufacturers Association
 - 8. NFPA: National Fire Protection Association
 - 9. OAR: Oregon Administrative Rules
 - 10. OR-OSHA: Oregon Occupational Safety and Health Administration
 - 11. UL: Underwriters Laboratories

1.4 CODES, PERMITS, AND CERTIFICATES

- A. See Division 1 for specific requirements relating to codes enforced, permits, and inspections.
- B. Provide notification 48 hours prior to covering concealed electrical work to allow for inspection.
- C. Notify the electrical inspector of jurisdiction having authority sufficiently in advance to completely inspect the work in the various stages necessary. Uncover concealed work and provide qualified staff to assist inspectors.
- D. In preparation for final inspection, all electrical equipment shall have wires installed and under terminal posts, and circuit schedule and labeling complete.
- E. Deliver certificates from inspection authorities, certifying work is complete and satisfactory, before acceptance of the work.

1.5 ELECTRICAL SAFETY PROGRAM

- A. Contractors doing work on Port property are required to have an electrical safety program that meets or exceeds all OR-OSHA requirements.
- B. Prior to commencement of electrical work, the Contractor shall meet with Port facility safety personnel and inform each other of existing known hazards, personal protective equipment requirements, safe work practice procedures, and emergency/evacuation procedures applicable to the work to be performed. This coordination shall include a meeting and documentation.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle materials to protect against corrosion or mechanical damage. Remove damaged materials from site immediately after detection.
- B. Deliver materials in manufacturer's packaging. Deliver conductors and cables in complete coils.

1.7 ELECTRICAL DRAWINGS

- A. The drawings are diagrammatic and do not show every detail of installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Supply all materials to complete and provide the operating system specified, unless it is specifically indicated that materials are being furnished by others, or that existing equipment shall or may be reused.

- B. All materials shall be new and meet the requirements of these specifications. Materials shall be subject to Port approval via the submittal process.
- C. All components and equipment provided and normally tested and labeled by Underwriters Laboratories (UL), or similar recognized third party approval authority, shall be so labeled.

2.2 GENERAL SUPPORT AND ANCHORING HARDWARE

- A. All anchors, nuts, washers, and bolts shall be rust resistant, plated type, unless specified otherwise. Anchors, nuts, washers, and bolts for exterior use shall be stainless steel.
- B. Brackets and miscellaneous hardware shall be rust resistant, plated type, unless specified otherwise.
- C. Bolts associated with lighting fixture installation shall be applied with anti-seize lubricant such as Never-Seez, or equal, prior to installation.
- D. Exterior channel-type support or where noted on drawings shall be hot-dipped galvanized. Interior channel-type support shall be hot-dipped galvanized or electro-galvanized plus zinc chromate finish. Kindorf, Superstrut, Unistrut, or equal.
- E. Clamps, brackets, and similar hardware utilized with the channel support system shall be of the same manufacturer and be similarly galvanized.

PART 3 - EXECUTION

3.1 LAYOUT AND COORDINATION

- A. Layout of the various equipment is very specific with the dimensioning, relative location and/or dimensions shown on the drawings. Call attention to any error, conflict, or discrepancy in the drawings or specifications. Do not proceed with any questionable items of work until clarification has been received.
- B. Work under this division shall be conducted in a cooperative manner with work of other divisions employed on the project, for proper installation of all items of equipment.
- C. Verify the physical dimensions of each item of electrical equipment to fit the available space and provide prompt notification prior to roughing-in if conflicts appear. Coordinate equipment to fit into the available spaces and coordinate access routes through the construction site.

3.2 PROTECTION

- A. Electrical work, wire and cable, materials, and other equipment specified in this division shall be protected against damage by other construction activities, weather conditions, or any other causes as a part of this work. Equipment found damaged or in other than new condition shall be rejected as defective.

- B. Keep light fixtures and electrical equipment covered or closed to exclude moisture, dust, dirt, cement, or paint and shall be free of all contamination before acceptance. Enclosures and trims shall be in new condition, free of rust, scratches or other finish defects. Properly refinish to new condition if damaged.
- C. Keep conduit and raceways closed during construction to prevent entrance of dirt, moisture, concrete or foreign objects. Raceways shall be clean and dry before installation of wire and shall be so at the time of final acceptance.
- D. Comply with the requirements of Section 017000, Execution Requirements, for investigation prior to penetration of floor slabs.

3.3 GENERAL INSTALLATION METHODS

- A. Install all material and equipment in accordance with the manufacturer's recommendations, instructions, and/or installation drawings, and in accordance with NEC and specifications.
- B. Unless otherwise noted on the drawings, conceal all wiring in finished spaces. Exposed conduit is acceptable only when and where prior specific authorization is obtained from Port. If exposed conduit is installed, it shall be parallel to structural lines.
- C. Unless otherwise noted on the drawings, all wiring devices, recessed light fixtures, etc., in finished spaces shall be flush-mounted.
- D. Provide necessary rigid conduit sleeves, openings, and chases where conduits or cables are required to pass through floors, ceilings, or walls. Seal all openings around conduits against leaks and in a manner to maintain the fire rating of the structure penetrated. Prevent unnecessary cutting in connection with the finished work. Make all repairs and seals in a manner acceptable to the Port.
- E. Cutting or notching shall be kept to a minimum and shall only be done in a Port-approved method. Structural members shall not be disturbed or cut in any way without specific written approval from the Port on a case-by-case basis. Patch and correct finished surfaces damaged by electrical work.
- F. The extent of the branch circuiting and control wirings shown shall not be changed.
- G. Provide all backing and mounting hardware required to complete the electrical systems in a safe, working condition as part of the contract work.
- H. Comply with code requirements and methods.
- I. In general, mounting heights shall be as noted on the drawings. Where no heights are indicated, request clarification. All device dimensions are to the center above finish floor unless specified otherwise. Lighting dimensions are to the bottom of suspended fixtures.

3.4 EXISTING ELECTRICAL SYSTEMS

- A. Existing electrical services shall be maintained operational at all times unless specified, scheduled, and/or approved otherwise.
- B. All switching of the existing electrical distribution systems, when required and scheduled as specified, will be performed by Port maintenance staff unless specifically approved otherwise.
- C. Notify Port inspectors prior to de-energizing or energizing any circuit.
 - 1. Work requiring de-energizing 600V or less feeder circuits to transformers, panelboards, bus ducts, and motor control centers, and critical equipment (HVAC equipment, baggage conveyor systems, passenger loading bridges, etc.) shall require a minimum of 72 hours' advance notification.
 - 2. Work requiring de-energizing 5kV and 15kV feeders shall require a minimum of 7 days' advance notification.
 - 3. Work requiring de-energizing select branch circuits shall require 24 hours' advance notification to Port inspectors. Prior to de-energizing any branch circuit, notify the Port inspectors and PDX maintenance trouble line (503-460-4683), identifying panel, circuit location, and estimated duration.
- D. The Contractor shall be responsible for ensuring the safety of Contractor's personnel when working on Port electrical systems. Those responsibilities include:
 - 1. Compliance with Oregon Administrative Rules, Chapter 437, when working on or near exposed de-energized or energized parts.
 - 2. Confirming that the equipment has, in fact, been de-energized by testing and installing grounds to the system being worked on.
 - 3. Providing the spider and locking device necessary to lock out the disconnect switch.
 - 4. Providing a circuit breaker locking device or disconnecting the branch circuit conductor from the circuit breaker and tagging the conductor.
 - 5. Providing the personnel responsible for attaching tags and locks with a mobile telephone.
- E. An example of an approved lockout tag will be provided to be used by the electrician responsible for the work being performed and for installing and removing the lock and tag. The electrician shall attach the tag to the lockout device using a tie string or wire indicating the following: The electrician's name, company, time of lockout, mobile telephone number, estimated time the circuit can be energized, and who authorized the outage.
- F. The individual responsible for signing the tag shall be required to remove the lock and, unless the circuit has been approved for an extended outage, that person shall remain on site until all related work is completed and the tags and locks are removed. No one else shall be allowed to remove them even if told to do so. Where shift work is in progress, he can remove his tag and the responsible individual on the next shift shall immediately install his tag.
- G. Circuits shall not be tested by requesting the control tower to turn on airfield circuits. Test airfield lighting circuit(s) by activating the regulator's local control switch at the regulator vault.

3.5 EXISTING SIGNAL AND COMMUNICATION SYSTEMS

- A. Signal and communication systems and equipment shall be kept in operation wherever these serve occupied or functional portions of the building. Outages of these facilities shall be kept to a minimum and be prearranged with the Port. The Contractor shall be liable for any damages resulting from unscheduled outages or for outages not confined to the prearranged times.
- B. Telephone services where required during the construction work shall be maintained operational by the Contractor. Coordinate this work with Port IT Communications personnel in such a manner that service, as required by the building occupants, can be readily installed and maintained.
- C. The Port will perform cross-connections at termination blocks and/or patch panels within the Port's IT network and communication rooms. Provide materials and installation in accordance with Section 271000. Notify the Port one week in advance for associated cross-connection work.

3.6 DEMOLITION

- A. Remove or relocate electrical wiring, equipment, luminaires, etc., as encountered in existing area affected by this work. Wiring which serves usable existing outlets shall be restored and routed clear of the construction or demolition. Cable and conduit to be demolished shall be removed back to the source.
- B. Protect equipment identified to be salvaged. Remove salvaged equipment prior to demolition of adjacent services. Arrange with the Port for storage and return of salvaged equipment.
- C. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations. Prior to demolition, verify that demolished services will not affect the operation of existing systems that are to remain and notify the Port.
- D. Demolition Service/System Requirements:
 - 1. Locate, identify, disconnect, and seal or cap off indicated utility services and electrical systems serving areas to be selectively demolished.
 - 2. Demolish all service back to nearest active main or point of future connection as indicated. Verify with Port extent of demolition prior to proceeding if extent is not clear.
 - 3. The Port will arrange to shut off indicated services/systems when requested by the Contractor.
 - 4. If services/systems are required to be removed, relocated, or abandoned: Before proceeding with selective demolition, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 5. Remove all accessories associated with removed utilities including supports, hangers, braces, clips, etc., in their entirety.
 - 6. Patch penetrations of walls and floors related to demolished services restoring existing fire separations, assembly ratings, and waterproofing membranes.

3.7 CUTTING AND PATCHING

- A. Include cutting, patching, and restoration of finishes necessary for the work. Surfaces damaged by the work and spaces around conduits passing through floors and walls shall be neatly patched and finished to match the adjacent construction, including painting or other finishes. Patch, clean, and remove all dirt and debris.
- B. Where equipment installations or connections require the installation of an access panel, coordinate and provide a properly sized and installed access panel, as approved by the Port. See Section 083100 for additional requirements.

3.8 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 7.

3.9 EQUIPMENT CONNECTIONS

- A. For each electrical equipment connection indicated, provide incidental wiring, devices, labor, and all materials and accessories as needed to complete splices and terminations of the equipment.
- B. Verify the location and method for connecting to each item of equipment prior to roughing-in. Check the voltage and phase of each item of equipment before connecting. Motor connections shall be made for the proper direction of rotation. Pump motors shall not be test run until liquid is in the system and proper lubrication to all bearings in the unit is checked.
- C. Conduit, wire, and circuit breaker sizes for equipment furnished under other divisions are based on the equipment ratings of one manufacturer. The electrical characteristics of the equipment furnished may differ from the ratings of the specified equipment. Coordinate the electrical requirements of the equipment to be furnished with the equipment supplier prior to purchase or installation of conduit, wire, starts, and circuit protection required for equipment connection.

3.10 NOISE CONTROL

- A. Outlet boxes at opposite sides of partitions shall not be placed back to back, nor shall straight-through boxes be employed, except where specifically permitted on the drawings by note, to minimize transmission of noise between occupied spaces.
- B. Route conduit along corridors or other “noncritical” space to minimize penetrations through sound-rated walls. All penetrations through sound-rated partitions shall be grouted solid and airtight. Conduit and its associated attachment shall not rigidly connect (i.e., bridge) independent wall structures. Flexible connections or attachments are required.
- C. Contactors, transformers, starters, and similar noise-producing devices shall not be placed on walls which are common to occupied spaces unless specifically called for on the drawings. Where such devices must be mounted on walls common to occupied spaces, they shall be shock-mounted or isolated in a manner that effectively prevents the transmission of noise to the occupied space.

- D. Ballasts, contactors, starters, transformers and like equipment which are noticeably noisier than other similar equipment used for the work will be deemed defective and shall be replaced at no additional cost to the Port.

3.11 GENERAL EQUIPMENT SUPPORT

- A. Each fastening device and support for electrical equipment, luminaires, panels, outlets, and cabinets shall be capable of supporting no less than four times the ultimate weight of the object or objects fastened to or suspended from the building structure and shall be installed to resist seismic forces as specified in the IBC for the ground motion accelerations corresponding to the work location.
- B. Properly and independently support luminaires installed under this work from the building structure. Supports shall provide proper alignment and leveling of luminaires. Where permitted, flexible connections to exposed luminaires shall be neat and straight, without excess slack, attached to the support device.
- C. Support all junction boxes, pull boxes, or other conduit terminating housings located above the suspended ceiling from the floor above or roof structure to prevent sagging or swaying.
- D. Conduits:
 - 1. Support suspended conduits from the overhead structural system with metal ring or trapeze hangers and threaded steel rod having a safety factor of 4.
 - 2. Anchor conduit installed in poured concrete to the steel reinforcing with No. 14 black iron wire.
- E. Power-actuated fasteners are not allowed except for slack wires where there is no continuous loading in tension for items such as light fixtures.

3.12 INSTALLATION ABOVE BAGGAGE CONVEYOR

- A. Where possible, do not install conduit, equipment, or other electrical items above conveyors or catwalks. If in the opinion of the Contractor a pipe or conduit must be located above a conveyor or catwalk, request permission from the Port and do not proceed unless and until permission is granted. Where such permission is granted, install the item as high as possible above the conveyor or catwalk. Prior to installing items above or within 4 feet of any conveyor or catwalk component, coordinate the location in the field with the Port's baggage handling system manager. When crossing above a conveyor or catwalk, install pressurized piping tight to the structure and ceiling deck even if the installation creates vertical bends in the piping. If installing above the conveyor, the bottom of any item shall never be less than 34 inches above the conveyor bed. See Section 260533, for installing conduit above conveyors or catwalk requirements.

3.13 TESTING

- A. Upon completion, test systems to show the equipment installed operates as designed and specified, free of faults and unintentional grounds. Submit testing plans per Section 013300, Submittal Procedures, for review prior to testing. The system tests shall be set up for as many at one time as possible to work into construction phasing. Tests shall be done in the presence of the Port, and shall be scheduled 48 hours in advance.
- B. A journeyman electrician with required tools shall be available to conduct all tests, with or without the equipment factory representative present.
- C. Systems to be tested shall include, but not be limited to the following:
 - 1. Low voltage distribution system.
 - 2. Emergency power system.
 - 3. Lighting systems.
 - 4. Lighting control system.
- D. A written record of performance tests shall be compiled, dated, witnessed, and submitted along with operating and maintenance data, to the Port prior to substantial completion.
- E. See other sections for possible testing requirements as they apply to those sections. Notify the Port prior to testing.

3.14 COMMISSIONING

- A. Complete all phases of work so the system, equipment, and components can be checked out, started, calibrated, operationally tested, adjusted, balanced, functionally tested, and otherwise commissioned. Complete systems, including all subsystems, so they are fully functional.
- B. Perform commissioning as specified in the technical sections, and this section. Unless specified otherwise in the technical sections, provide factory startup services for the following items of equipment:
 - 1. Electrical distribution systems.
 - 2. Lighting control systems.
- C. Participation in Commissioning:
 - 1. Provide skilled technicians to checkout, startup, calibrate, and test systems, equipment, and components.
 - 2. The Port reserves the right to judge the appropriateness and qualifications of the technicians relative to each item of equipment or system.
- D. Resolution of Deficiencies:
 - 1. Corrective work shall be completed in a timely fashion to permit timely completion of the commissioning process. Experimentation to correct system performance will be permitted.
- E. Verification and Documentation:
 - 1. Submit site observation reports for deficiencies in the system.
 - 2. Record the result of individual checks or tests on the pre-approved checklist, test, and submit results for Port review.

END OF SECTION 260500

SECTION 260505 – SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes electrical demolition.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as indicated.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents.
- D. Report discrepancies to the Port before disturbing existing installation.
- E. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate feeder and service outages with Port.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Protect equipment identified to be salvaged. Remove salvaged equipment prior to demolition of adjacent services. Arrange with the Port for storage and return of salvaged equipment.
 - 1. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations. Prior to demolition, verify that demolished services will not affect the operation of existing systems that are to remain and notify the Port.

- E. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Obtain permission from the Port at least 24 hours before partially or completely disabling system.
 - 2. Make temporary connections to maintain service in areas adjacent to work area.
- F. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Notify the Port before partially or completely disabling system.
 - 2. Notify monitoring facility of prior to any system/wiring/device changes.
 - 3. Make notifications at least 24 hours in advance.
 - 4. Make temporary connections to maintain service in areas adjacent to work area.
- G. Existing Telephone System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Notify Port at least 24 hours before partially or completely disabling system.
 - 2. Notify telephone service provider at least 24 hours before partially or completely disabling system.
 - 3. Make temporary connections to maintain service in areas adjacent to work area.
- H. Existing Paging System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Notify Port at least 24 hours before partially or completely disabling system.
 - 2. Notify telephone service provider at least 24 hours before partially or completely disabling system.
 - 3. Make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
 - 1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
 - 2. PCB- and DEHP-containing lighting ballasts.
 - 3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

- E. Locate, identify, disconnect, and seal or cap off indicated utility services and electrical systems serving areas to be selectively demolished.
- F. Demolish all service back to nearest active main or point of future connection as indicated. Verify with the Port extent of demolition prior to proceeding if extent is not clear.
- G. The Port will arrange to shut off indicated services/systems when requested by the Contractor.
- H. If services/systems are required to be removed, relocated, or abandoned: Before proceeding with selective demolition, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
- I. Remove all accessories associated with removed utilities including supports, hangers, braces, clips, etc., in their entirety.
- J. Patch penetrations of walls and floors related to demolished services restoring existing fire separations, assembly ratings, and waterproofing membranes.
- K. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- L. Disconnect and remove abandoned panelboards and distribution equipment.
- M. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- N. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- O. Repair adjacent construction and finishes damaged during demolition and extension work.
- P. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- Q. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that remain or that are to be reused.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts/drivers and broken electrical parts.

3.5 SALVAGED EQUIPMENT AND COMPONENTS

- A. For the following temporary spaces that are to be demolished, the following equipment and system components are to be salvaged:
 - 1. Restrooms
 - a. Fire alarm devices that meet the current specified standards.

END OF SECTION 260505

SECTION 260519 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes wires, cables, and connectors.

1.2 REFERENCES

- A. ASTM: American Society For Testing And Materials:
 - 1. ASTM B8: Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
 - 2. ASTM B33: Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes
 - 3. ASTM B172: Standard Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members, for Electrical Conductors
 - 4. ASTM B189: Standard Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes
- B. ICEA: Insulated Cable Engineers Association
 - 1. ICEA 566-524: Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable for Transmission and Distribution of Electrical Energy
 - 2. ICEA S-95-658: Non-shielded 0-2 kV Cable
 - 3. ICEA S-75-381: Portable and Power Feeder Cables for Use in Mines and Similar Applications
- C. NEC: National Electric Code
 - 1. NEC Article 336: Power and Control Tray Cable, Type TC
- D. NEMA: National Electrical Manufacturers Association
 - 1. NEMA WC 58: Portable and Power Feeder Cables for Use in Mines and Similar Applications
 - 2. NEMA WC 70: Power Cables Rated 2000 V or Less for the Distribution of Electrical Energy
- E. UL: Underwriters Laboratories:
 - 1. UL 44: Thermoset-Insulated Wires and Cable
 - 2. UL 83: Thermoplastic-Insulated Wires and Cables
 - 3. UL 1277: Standard for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members
 - 4. UL 1581: Reference Standard for Electrical Wires, Cables, and Flexible Cords

1.3 SUBMITTALS

- A. Submit the following materials:
 - 1. Lighting and receptacle circuit conductors.
 - 2. Single conductor 600-volt power and control conductors.
- B. Submittals of the following materials shall consist only of a listing of the manufacturer's name and the applicable catalog numbers of the items to be utilized. Upon review of the list, further information may be requested.
 - 1. Connectors.
 - 2. Branch circuit conductor splices.
 - 3. Splices with compression fitting and heat-shrinkable insulator.
- C. Submit cable test data per testing requirements of Part 3.

PART 2 - PRODUCTS

2.1 GENERAL

- A. With the exception of lighting and receptacle circuits, the type, size, and number of conductors shall be as specified on the drawings or schedules. Lighting and receptacle circuit conductors are unscheduled and shall be sized in accordance with the NEC to limit voltage drop to 3 percent.

2.2 COLOR CODING

- A. Power Conductors: Single-conductor power conductors shall have the following color codes for the indicated voltage:

	<u>480/277V</u>	<u>208/120V</u>	<u>240/120V</u>
Phase A	Brown	Black	Black
Phase B	Orange	Red	Red
Phase C	Yellow	Blue	--
Ground	Green	Green	Green
Neutral	Gray	White	White or Gray*
* If installed with 480/277V or 208/120V in the same raceway, box, gutter, or other enclosure, 240/120V neutral conductor color shall differ from the other system neutral conductor per NEC 200.6(D).			

- B. Multi-conductor power cable color coding shall be the manufacturer's standard.
- C. Cables sized No. 4 AWG and larger may be black with 3/4 inch vinyl colored plastic tape applied in 3 inch lengths around the cable at each end. The cables shall be colored at terminations and in pull boxes, handholes, and manholes.

2.3 LIGHTING AND RECEPTACLE CIRCUIT CONDUCTORS

- A. Lighting and receptacle circuit conductors shall be stranded except for No. 12 AWG which may be solid. Minimum conductor size shall be No. 12 AWG.
- B. Conductors shall have the following characteristics:
1. Voltage: 600 volts.
 2. Conductor: Bare annealed copper, stranded in accordance with ASTM B8.
 3. Insulation:
 4. Dry Areas and Above Grade: THWN/THHN, 90°C dry, 75°C wet, polyvinylchloride (PVC) in accordance with UL 83.
 5. Dry or Wet Areas and Below Grade: XHHW, 90°C dry, 75°C wet, cross linked polyethylene in accordance with UL 44.
 6. Jacket: Nylon. Not applicable.
 7. Flame resistance: UL 83. UL 44.
 8. Manufacturer: Cablec, Essex, Okonite, Southwire, or equal.

2.4 POWER CONDUCTORS AND CABLE, 600 VOLT

- A. Single Conductor:
1. Single conductor cable shall be stranded and used in conduits for power and control circuits. Unless otherwise specified, minimum size for power applications shall be No. 12 AWG and minimum size for control applications shall be No. 14 AWG.
 2. Conductors installed in cable tray shall be UL labeled, Type TC, designated for cable tray, installation in accordance with NEC Article 336.
 3. Conductors shall have the following characteristics:
 - a. Voltage: 600 volts.
 - b. Conductor: Coated, Class B, stranded annealed copper in accordance with ASTM B8.
 - c. Insulation:
 - d. Dry Areas and Above Grade: THWN/THHN, 90°C dry, 75°C wet, polyvinylchloride (PVC) in accordance with UL 83.
 - e. Dry/Wet Areas and Below Grade: XHHW, 90°C dry, 75°C wet, cross linked polyethylene in accordance with UL 44.
 - f. Flame resistance: IEEE 383 flame test. UL 44, UL 83.
 - g. Manufacturer: Anixter, Cablec, Essex, Okonite, Southwire, or equal.

2.5 SPLICING AND TERMINATING MATERIALS

A. 600-Volt Conductor and Cable Connectors:

1. Connectors shall be one-piece tool applied compression type of correct size and UL listed for the specific application. Connectors for wires No. 10 AWG and smaller shall be self-insulating ring tongue or locking spade terminals. Connectors for No. 8 AWG and larger shall be one-hole lugs up to size No. 3/0 AWG and two-hole or four-hole lugs for size No. 4/0 and larger. Mechanical clamp or screw type connectors are not acceptable.
2. 120-Volt Branch Circuit Conductor Splices: Live spring type, Scotch-Lok, Ideal Wing Nut; self-stripping type, 3M Series 560; or equal.
3. 600-Volt Branch Circuit Conductor Splices: #10 and #12 conductors may be live spring type, Scotch-Lok, Ideal Wing Nut; self stripping type, 3M series 560; or equal.
4. Only use in-line splices and taps where specifically called for on the drawings or by written consent of the Port. Splices shall be compression type, made with a compression tool die approved for the purpose, as made by Thomas and Betts Corp., or equal. Splice shall be covered with a heat-shrinkable sleeve or boot.

PART 3 - EXECUTION

3.1 GENERAL

- A. Wire shall be continuous between each end of a conduit. Splices and terminals are not permitted within a conduit run.
- B. Each main and branch circuit shall have its own dedicated neutral conductor. Do not install shared or common neutrals.
- C. Pull wire and cable into conduit or trays without damaging or putting undue stress on the cable insulation. UL listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable. Raceway construction shall be complete, cleaned, and protected from the weather before cable is placed.
- D. Provide a cable support whenever a cable leaves a raceway.
- E. When flat bus bar connections are made with unplated bar, scratch-brush the contact areas. Torque bolts to the bus manufacturer's recommendations.

3.2 600-VOLT CONDUCTORS AND CABLE

- A. Incoming wire in panels, No. 6 AWG and smaller, shall be bundled and laced at intervals not greater than 6 inches, and neatly spread into trees and connected to their respective terminals. Allow sufficient slack in cables for alterations in terminal connections. Lace with plastic cable ties or linen lacing twine.
- B. Where plastic panel wiring duct is provided for wire runs, lacing is not necessary when the wire is properly installed in the ducts. Provide slack in junction and pull boxes and in handholes and manholes. Amount of slack shall be equal to the largest perimeter dimension of the box.

- C. Wire crossing hinges shall be stranded and made up into groups not exceeding 12 and shall be arranged so that they will be protected from chafing when the hinged member is moved.
- D. Terminate stranded wire as described in Part 2 except where terminals will not specifically accept such terminations. In these cases, terminate the wires directly on the terminal block. Install compression lugs and connectors using manufacturer's recommended tools.
- E. Solid wire shall not be lugged. Do not use electrical spring connectors, set screws, wire nuts, and wing nut connectors on anything other than solid wires in lighting and receptacle circuits. Install lugs and connectors with a compression tool.
- F. All splices and terminations are subject to inspection prior to and after insulating. Terminations at 460-volt motors shall be made by bolt-connecting the lugged connectors. Insulate and seal connections with factory-engineered kits. Motor connection kits shall consist of heat shrinkable, polymeric insulating material over the connection area and a high dielectric-strength mastic to seal the ends against moisture and contamination. Keep bolt connection area free of mastic and fillers to facilitate rapid stripping and re-entry. Motor connection kits shall accommodate a range of cable sizes for both in-line and stub-type configurations. Connection kits shall be independent of cable manufacturer's tolerances.
- G. In-line splices and tees (where approved) shall be made with tubular compression connectors and insulated with factory-engineered kits. Kits shall consist of heat shrinkable, polymeric insulating material over the connection area and a high dielectric strength mastic to seal the ends against moisture and contamination. Keep connection area free of mastic and fillers to facilitate rapid stripping and re-entry. Wires No. 10 AWG and smaller may be spliced using self-insulating connectors as specified in Part 2.
- H. In-line splices and tees (where approved) shall be made with tubular compression connectors and insulated as specified above for motor terminations, except that wires No. 10 AWG and smaller may be spliced using self-insulating connectors as specified in Part 2.
- I. Insulate splices and tees in underground handholes or pull boxes using Scotch-cast epoxy resin splicing kits. Provide conductor and cable markers at splice and termination points and use self-insulating tubular compression connectors.
- J. Make terminations at solenoid valves, 120 volt, and other devices furnished with pigtail leads using self-insulating tubular compression connectors.

3.3 FIELD TESTING

- A. 600-volt rated conductors greater than or equal to 500 kcmil, or in parallel runs, shall be tested by the Contractor for continuity and shall be meggered after installation and prior to termination. Provide the megger, rated 1,000 volts d.c., and record and maintain the results, in tabular form, clearly identifying each conductor being tested; submit copies. Repeat testing after any cables are replaced.
 - 1. Replace cables when test value is less than 15 megohms.
 - 2. Cable test submittal shall include results, equipment used, date, and the Port inspector's signature.

3.4 EXISTING CIRCUITS

- A. Confirm the destination and purpose of each existing circuit before connecting to new equipment and new wiring. Connections shown on the one-line diagram drawing are the preferred connections.
- B. Remove existing terminations leaving as much existing cable as possible. Conserve existing cable when making splices to new cables. Existing cable length may require different routings within manhole vaults than are shown on the drawings. Do not unnecessarily cut off any existing cable length.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes a grounding system including a conduit system, equipment grounding conductor, transformer housings, a switchboard frame and neutral bus, motors, and miscellaneous grounds. Work also includes a 600V insulated main bonding jumper for service connection between the ground bus in the switchgear lineup and a ground termination point or service ground in the transformer.

1.2 REFERENCES

- A. NEC: National Electrical Code.
 - 1. NEC Article 250: Grounding and Bonding.

PART 2 - PRODUCTS

2.1 GROUND CONDUCTORS

- A. Bare or green insulated copper for interior systems.

2.2 CONNECTORS

- A. Cast, set screw, or bolted allowed in dry locations only.
- B. Compression-tool applied. Burndy "Hyground Compression System," or equal.
- C. Grounding lugs where furnished as standard manufacturer's items on equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Size grounding conductors in accordance with National Electrical Code (NEC) Article 250, Tables 250-66 and 250-122.
- B. Grounding conductor connectors shall be made up tight and located for future servicing and to ensure low impedance.

- C. Ground the electrical system, the cold-water service, structural steel, and transformers to the building ground grid.
- D. All plug-in receptacles shall be bonded to the boxes, raceways and grounding conductor.
- E. Provide equipment grounding conductor in all conduit runs.
- F. Provide ground bond for all conduits terminated at or near cable trays, including communication and data conduits provided for cabling to the cable tray.

3.2 EQUIPMENT

- A. Provide separate green insulated equipment ground conductor for all circuits. Effectively ground all fixtures, panels, controls, motors, disconnect switches, exterior lighting standards, and non-current-carrying metallic enclosures. Use bonding jumpers, grounding bushings, lugs, buses, etc., for this purpose.
- B. Provide grounding bushings on all feeder conduit entrances to panels and equipment enclosures and bond bushings to enclosures with minimum No. 10 AWG conductor. Connect the equipment ground to the building system ground. Use the same size equipment ground conductors as phase conductors, up through No. 10 AWG.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes supporting devices for electrical equipment, associated conduit, and cable.

1.2 REFERENCES

- A. IBC: International Building Code
 - 1. IBC Chapter 16: Structural Design
- B. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association
 - 1. SMACNA Seismic Restraint Manual - Guidelines for Mechanical Systems, for Seismic Hazard Level (SHL)

1.3 SUBMITTALS

- A. Submit shop drawings and calculations for seismic anchorage and bracing for the vertical and lateral restraint of conduit, cable trays, bus ducts, and electrical equipment as required by IBC Chapter 16 and the SMACNA Seismic Restraint Manual – Guidelines for Mechanical Systems, for Seismic Hazard Level (SHL) A. Shop drawings and calculations shall bear the seal of a professional engineer registered in the state of Oregon.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Hangers: Kindorf B-905-2A channel, H-119-D washer, C105 strap, minimum 1/2-inch rod with ceiling flange, or equal.
- B. Pipe Straps: Two-hole galvanized or malleable iron.
- C. Support of Open Cabling: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide all electrical equipment supports.
- B. Install vertical support members for equipment, straight and parallel to building walls.
- C. Provide independent supports to structural member for electrical fixtures, materials, or equipment installed in or on ceiling, walls, or in void spaces and/or over furred or suspended ceilings.
- D. Do not use other trades' fastening devices to support electrical equipment materials or fixtures.
- E. Do not use supports and/or fastening devices to support other than one particular item.
- F. Support conduits within 18 inches of outlets, boxes, panels, cabinets, and deflections.
- G. Provide complete seismic anchorage and bracing for the vertical and lateral restraint of conduit, cable trays, bus ducts, and electrical equipment as required by IBC Chapter 16 and the SMACNA Seismic Restraint Manual - Guidelines for Mechanical Systems, for SHL A.
- H. Building Attachments:
 - 1. Where possible, support all conduit, cable tray, and equipment from structural members, beams, and joists.
 - 2. Provide structural steel angles, channels, or other members to support conduit, cable tray, and equipment where structural members do not occur as required for proper support.
 - 3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at joist panel points or provide web reinforcing as required.
 - 4. Do not fasten or attach to unfilled steel roof deck structure.
 - 5. Attach to concrete-filled steel floor deck structure for loads up to 400 pounds. Loads larger than 400 pounds shall be designed per code. Submit structural calculations stamped and signed by a structural engineer licensed in the State of Oregon showing that the concrete-filled floor deck has sufficient capacity to support the load at the points of anchorage.

3.2 LUMINAIRES

- A. Light-Duty Ceiling Systems:
 - 1. Attach No. 12 hanger wire from each corner of the luminaire to the structure above.
 - 2. Positively and securely attach luminaire within 6 inches of each corner to the suspended ceiling framing member by mechanical means.
- B. Intermediate-Duty Ceiling Systems:
 - 1. Positively and securely attach luminaire within 6 inches of each corner to the suspended ceiling framing member by mechanical means.
 - 2. Attach No. 12 hanger wire within 3 inches of each corner of each luminaire.
 - 3. Connect two 12-gauge slack wires from the luminaire housing to the structure above for luminaires weighing less than 56 pounds.
 - 4. Support luminaires weighing 56 pounds or more directly from the structure above with approved hangers attached to each corner of the luminaire.

C. Heavy-Duty Ceiling Systems:

1. Positively and securely attach luminaire within 6 inches of each corner to the suspended ceiling framing member by mechanical means.
2. Connect two 12-gauge slack wires from the luminaire housing to the structure above for luminaires weighing less than 56 pounds.
3. Support luminaires weighing 56 pounds or more directly from the structure above with approved hangers attached to each corner of the luminaire.

3.3 PULL AND JUNCTION BOXES

A. Pull and junction boxes installed within the cavity of a suspended ceiling that is not a fire rated assembly may be attached to the suspended ceiling framing members, provided the following criteria are met:

1. Installation complies with the ceiling system manufacturer's instructions.
2. Pull or junction box is not larger than 100 cubic inches.
3. The pull or junction box is supported to the main runner with two fastening devices that are designed for framing member application and positively attach or lock to the member.
4. The pull or junction box serves branch circuits and associated equipment in the area.
5. The pull or junction box is within 6 feet of the luminaires supplied.
6. The framing members are not rotated more than 2 degrees after installation.

B. Pull and junction boxes installed within the cavity of a suspended ceiling may be attached to independent support wires, provided the following criteria are met:

1. Independent support wires are taut and connected at both ends, one end to the ceiling framing member and the other to the structure above.
2. Pull or junction box is not larger than 100 cubic inches.
3. The pull or junction box is secured to the independent support wires by two fastening devices that are designed for the application.
4. Independent support wires in a fire-rated ceiling are distinguishable by color, tagging or other effective means.

3.4 CABLES AND RACEWAY

A. Cables and raceway installed within the cavity of a suspended ceiling may be attached to independent support wires provided the following criteria are met:

1. Independent support wires are taut and connected at both ends, one end to the ceiling framing member and the other to the structure above.
2. Raceways are not larger than one-inch trade size and cables and bundled cables are not larger than one-inch diameter including insulation.
3. Not more than three raceways or cables are supported by any independent support wire and are supported within the top or bottom 12 inches.
4. Cables for telecommunications, data processing, Class 2 power-limited signaling systems, fiber optics, and other power limited systems are securely fastened within 2 feet of each termination and at intervals not to exceed 5 feet or per the manufacturer's installation instructions.
5. Raceways are secured at intervals required for the type of raceway installed.
6. Cables and raceway are secured to independent support wires by fastening devices and clips designed for the purpose.

7. Independent support wires are distinguishable by color, tagging, or other effective means.
- B. Cables and raceway installed within the cavity of a suspended ceiling may be supported with trapezes constructed of steel rods and channels provided the following criteria are met:
1. The size of the rods, channel, and fastening devices are suitable for the anticipated weight.
 2. The spacing of the trapezes meets that required for the type of raceway installed.
 3. Cables and raceway are secured to a trapeze by straps designed for the purpose.
 4. Cables and raceway do not support other raceway or cables.
 5. An appropriately sized seismic bracing system is installed.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes raceways, conduits, and boxes for electrical systems wiring, including all fittings, hangers, and appurtenances.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 260526, Grounding and Bonding for Electrical Systems
- B. Section 260553, Identification for Electrical Systems
- C. Section 262726, Wiring Devices

1.3 REFERENCES

- A. ANSI: American National Standards Institute:
 - 1. ANSI C80.1: Electrical Rigid Steel Conduit
 - 2. ANSI C80.3: Steel Electrical Metallic Tubing
 - 3. ANSI C80.4: Fittings for Rigid Metal Conduit and Electrical Meta
- B. ASTM: American Society for Testing Materials:
 - 1. ASTM A193: Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
 - 2. ASTM E814: Standard Test Method for Fire Tests of Penetration Firestop Systems
- C. JIC: Joint Industrial Council
 - 1. JIC EMP-1: Electrical
- D. NEC: National Electrical Code:
- E. NEMA: National Electrical Manufacturers Association.
 - 1. NEMA RN 1: Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
 - 2. NEMA TC2: Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
 - 3. NEMA Product and Installation Standards.
- F. NFPA: National Fire Protection Association:
 - 1. NFPA 70: National Electrical Code
- G. TIA: Telecommunications Industry Association/Electronic Industries Association
 - 1. TIA 569-A: Commercial Building Standard for Telecommunications Pathways and Spaces

- H. UL: Underwriters Laboratories:
 - 1. UL 360: Standard for Liquid-Tight Flexible Metal Conduit
 - 2. UL 651: Rigid Nonmetallic Electrical Conduit
 - 3. UL 651A: High-Density Polyethylene Conduit
 - 4. UL 1479: Intermediate Metal Conduit.

1.4 DEFINITIONS

- A. “Where subject to physical damage,” is defined as a surface installation within an 8-foot zone above a finished floor, in areas subject to vehicular traffic, including manually operated fork lifts.

1.5 SUBMITTALS

- A. Submittals for the following materials shall consist only of a listing of the manufacturer’s name and the applicable catalog numbers of the items to be utilized. Upon review of this list, further information may be requested.
 - 1. Conduit.
 - 2. Conduit fittings.
 - 3. Supports.
- B. Submittals for the following materials shall be complete with detailed information and cut sheets.
 - 1. Wireway and wire gutters.
- C. Provide as-constructed drawing information identifying final conduit routing and box locations upon completion of the work.

1.6 QUALITY ASSURANCE

- A. Products shall be new and certified by an approved testing laboratory.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials shall be of current standard design and shall conform to the established standards of an approved testing laboratory. Like items shall be of the same manufacturer and type.

2.2 METALLIC CONDUITS

- A. Galvanized Rigid Steel Conduit (GRSC):
 - 1. Heavy wall construction, manufactured in conformance with ANSI C80.1 and listed as UL 6 approved.

- B. Electrical Metallic Tubing (EMT):
 - 1. Thin wall electrogalvanized steel, manufactured in conformance with ANSI C80.3 and listed as UL 797 approved.
- C. Flexible Metal Conduit:
 - 1. Manufactured from hot dipped galvanized steel manufactured in conformance with UL standards. Flexible metal conduit shall be a minimum of 1/2-inch standard trade size.
- D. Liquid-Tight, Flexible Metal Conduit:
 - 1. Conduit shall have a ground wire.
 - 2. Aluminum or galvanized flexible metal conduit shall have a polyvinylchloride chemical resistant jacket in conformance with the requirements of UL 360. Acceptable manufacturers are Sealtight, or equal.

2.3 METALLIC BOXES

- A. Flush and Concealed Outlet Boxes:
 - 1. Galvanized stamped steel with screw ears for device ring mounting, knock-out plugs, mounting holes, and fixture studs if required. Acceptable manufacturers are RACO, or equal.
- B. Surface Outlet Boxes (Interior Locations):
 - 1. Boxes for use on ceilings shall be galvanized stamped steel with screw ears for device ring mounting, knock-out plugs, mounting holes, and fixture studs if required. Acceptable manufacturers are RACO, or equal.
 - 2. Boxes for use on walls below 8 feet or where noted on drawings shall be cast steel or aluminum with threaded hubs.
- C. Large Boxes:
 - 1. When required, boxes exceeding 4 11/16 inches square shall be welded steel construction with screw cover and painted, steel gauge matching physical size. Acceptable manufacturers are Hoffman, Circle AW, or equal.

2.4 BOXES AND FITTINGS

- A. Sheet Metal Boxes and Fittings:
 - 1. Boxes and fittings installed in areas where electrical metallic tubing is specified shall be standard UL-approved sheet steel type.
- B. Hubs:
 - 1. Hubs for connection of conduit to junction, device, or terminal boxes shall be made of cast ferrous alloy, electroplated with zinc and shall have insulating bushings.
 - 2. Hubs shall contain a neoprene O-ring and shall provide a watertight connection.

2.5 CONDUIT FITTINGS

- A. GRSC:
 - 1. Fittings, including couplings, shall be threaded unless otherwise approved by the Port.

2. Threadless Couplings and Connectors:
 - a. GRSC couplings and box connectors may be steel threadless, compression ring, or set screw type for use with conduits 1 inch and smaller installed in poured concrete locations where limited working space makes threaded fittings impractical.
 - b. Threadless fittings are not acceptable for use with GRSC conduits except as allowed above. They may, however, be used with EMT type conduits.
3. Myers hubs or equal shall be used with NEMA 2, 3, 3R, 4 and 12 enclosures.
4. Threaded Locknuts:
 - a. Sealing type may be used with NEMA 2, 3, 3R, 4 and 12 enclosures at bottom penetrations.
 - b. Extra-heavy electrogalvanized steel for sizes up to 2 inches. Locknuts larger than 2 inches shall be electrogalvanized malleable iron.
5. Threaded Bushings:
 - a. 1 1/4 inch and larger, insulated, grounding type as required in Section 260526.
 - b. Electrogalvanized malleable iron with insulating collar.
 - c. Locking type and provided with a feed-through compression lug for securing the ground cables.
6. Unions shall be electrogalvanized ferrous alloy type. Acceptable manufacturers are Appleton, UNF or UNY; Crouse-Hinds, UNF or UNY; or equal.
7. Conduit bodies shall be ferrous alloy type (malleable iron), with clamp type fastening covers.
8. Gaskets shall be neoprene.

B. EMT:

1. EMT couplings and connectors shall be watertight compression type or set screw type with steel bodies, zinc or cadmium coated. Die cast fittings will not be permitted.
2. Connectors shall be steel compression ring or set screw type for conduit termination, with insulated throat, suitable for the application.
3. Couplings shall be steel compression ring or set screw type.

C. Flexible Metal Conduit:

1. Fittings shall be 2-screw steel body type, zinc, or cadmium coated. Die cast fittings will not be permitted.

D. Liquid-Tight, Flexible Metal Conduit:

1. Fittings for liquid-tight conduit shall have a cadmium-plated malleable iron body and gland nut with cast-in lug, brass grounding ferrule, threaded to engage conduit spiral and o-ring seals around the conduit and box connection and insulated throat. Use 45-degree and 90-degree fittings where necessary.
2. Fittings shall be threaded and compression type for polyvinyl jacketed flex.

E. Weatherproof Connectors:

1. Provide threaded connectors.

2.6 RACEWAY SUPPORTS

A. Conduit Supports:

1. Hot-dipped galvanized (exterior) or electrogalvanized (interior) steel framing channel to support groups of conduit.

2. Use one-hole galvanized malleable iron pipe straps with galvanized clamp backs and nesting backs where required.
 3. Use one-hole galvanized steel pipe straps on studs for interior applications.
 4. Supports for PVC coated rigid steel shall be PVC coated straps, struts, or hangers.
- B. Ceiling Hangers:
1. Adjustable galvanized carbon steel rod hangers in conformance with ASTM A193. Rods shall be minimum 1/2 inch in diameter, threaded continuously.
 2. Use stainless steel hanger rods where rods will be located in corrosive areas and exposed to the effects of weather or moisture.
- C. Structural Attachments (Racks):
1. Hot-dipped galvanized steel framing channel.
 2. Treat field cuts with zinc-enriched paint.

2.7 WIREWAYS

- A. Wireway and auxiliary gutters shall meet JIC, EMP-1 standards, shall be sectional flanged oil-tight type with hinged covers, and shall be 8 inches in cross section unless otherwise specified.
- B. Troughs shall be painted steel, square in cross section, with screw covers. Use gasketed, weatherproof type for exterior applications.
- C. Fittings, tees, elbows, and couplings shall be as needed for configurations shown on the drawings.

2.8 MISCELLANEOUS PRODUCTS

- A. Provide watertight seals at penetrations through exterior walls or walls exposed to moisture. Acceptable manufacturers are type CSMC by O.Z. Gedney Co., Link Seal by Thunderline Corp., or equal.
- B. Provide waterproof firestops and seals in specified locations. Acceptable manufacturers are Flamemastic 71A, Vimasco No. 1-A, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General:
1. Existing boxes and raceways, exposed under this contract, shall be properly supported per NEC before cover approval.
 2. All conduit and wireway installations shall comply with NEMA, "Standards of Installation."

3. Cutting or notching shall be kept to a minimum, using only approved methods. Structural members shall not be disturbed or cut in any way without specific written approval from the Port, on a case-by-case basis. Patch and correct finished surfaces damaged by electrical work. Fire barriers shall be returned to their original condition using materials of equal or higher fire rating and specifically designed for that use.
4. Unless otherwise noted on the drawings, all conduit work in finished spaces shall be concealed. Exposed conduit is acceptable only when and where prior specific authorization for use is obtained from the Port.
5. Conceal all conduits in finished spaces and elsewhere so far as practicable. Concealed conduits shall run in a direct line with long sweep bends and offsets. Where conduit runs between junction boxes and/or devices, route conduit vertically below ceiling level. Where horizontal runs are required, route above ceiling level for future flexibility.
6. Route exposed conduit parallel or at right angles to structural building lines and neatly offset into boxes. Conduits attached directly to building surfaces shall closely follow the surfaces. Conduit fittings may be used to "saddle" under beams.
7. Where possible, do not install conduit above baggage conveyor or catwalk. Where conduit must cross above conveyor or catwalk, locate conduit perpendicular to the conveyor or catwalk and install tight to the structure and ceiling deck even if installation creates vertical bends in the conduit. When crossing above conveyor, the conduit bottom shall never be less than 34 inches above the conveyor bed.
8. Route conduit in existing racks whenever possible.
9. Cut conduits square, ream smooth, and draw fittings up tight with at least five threads fully engaged.
10. Conduits, whether exposed or concealed, shall be securely supported and fastened within 18 inches of each outlet, elbow, fitting, panel, etc. Support suspended conduits with metal ring or trapeze hangers on threaded, steel rods having a safety factor of four.
11. During construction, keep conduit and raceways closed with suitable plugs or caps to prevent entrance of dirt, moisture, concrete, or foreign objects. Raceways shall be clean and dry before installation of wire and at the time of acceptance.
12. Pack spaces around conduits with oakum and seal to prevent entrance of moisture where conduits are installed in sleeves or block-outs which penetrate moisture barriers.
13. Install intumescent material around ducts, conduits, etc. to prevent spread of smoke or fire where installed in sleeves or block-outs which penetrate rated fire barriers. The penetration sealing system shall be capable of passing a 3-hour test per ASTM E814 (UL 1479) and shall consist of a material capable of expanding when exposed to temperatures of 250-350°F. An alternate method utilizing intumescent materials in caulk and/or putty form may be used.
14. Provide GRSC on underground conduit runs at 60-degree and larger bends, and where conduits exit concrete.
15. Existing raceways exposed under this contract shall be properly supported per NEC before cover approval.

B. Conduit Runs Between Pull Boxes:

1. Limit the number of directional changes of the conduit to a maximum total of 270 degrees in any run between pull boxes.
2. Limit the number of directional changes of the conduit to a maximum of 180 degrees in any run between pull boxes for communications conduits, unless otherwise approved by the Port.
3. Limit conduit runs to 400 feet, less 100 feet for each 90 degrees of change in direction.

4. Avoid bends and offsets whenever possible. However, when bends and offsets are necessary, they shall be factory bends or bends made with a hickey or conduit bending machine. Heating, welding, or brazing the conduit for bends is not acceptable.
- C. Junction and Pull Boxes:
1. Where required for pulling cable and as necessary to meet NFPA No. 70, provide cast junction boxes or pull boxes. Pull boxes used for multiple conduit runs shall not combine circuits fed from different MCC's, switchboards, or switchgear.
- D. Conduit Terminations:
1. Conduit entering sheet steel boxes or cabinets shall be secured by locknuts on both the interior and exterior of the device and shall have an insulating grounding or bonding bushing constructed over the conduit end.
 2. Conduit entering top or sides of NEMA 3R, 4, and 12 boxes shall be terminated with a rain-tight hub having an insulated liner.
 3. Surface-mounted cast boxes and plastic enclosures shall have threaded hubs.
 4. Joints shall be made with standard couplings or specified unions.
 5. Metal parts of plastic or coated control stations and coated boxes shall be bonded to the conduit system.
 6. Running threads shall not be used in lieu of nipples, nor shall excessive thread be used on any conduit.
 7. The ends of conduit shall be cut square, reamed, and threaded with straight threads.
 8. Male threads on rigid steel conduit shall be coated with electrically conductive, zinc rich paint.
 9. Steel conduit shall be made up-tight, with thread compound.
- E. Conduit Support:
1. Exposed metallic conduit shall be run on supports spaced not more than 6 feet apart unless noted otherwise on the drawings, and shall be constructed with runs parallel or perpendicular to walls, structural members or intersections of vertical planes and ceiling.
 2. Exposed PVC conduit shall be run on supports spaced not more than 3 feet apart for conduits up to 1 inch, 5 feet apart for conduits 1 1/4 inches to 2 inches, and 6 feet apart for conduits 2 1/2 inches and larger.
 3. No conduit shall approach closer than 6 inches to any object which operates above the rated temperature of the cable insulation it contains.
 4. Conduit, except PVC, supported directly from the concrete structure shall be spaced at least 1/4 inch using one-hole, hot-dipped galvanized, malleable iron straps with nesting backs or, if three or more conduits are located in parallel run, they may be spaced from the wall approximately 5/8 inch to 1 inch by means of framing channel.
 5. Runs of individual conduit suspended from the ceiling shall be supported with galvanized carbon steel rod hangers. Where three or more conduits are suspended from the ceiling, steel racks shall be constructed.
 6. Conduit rack and tray supports shall be secured to concrete walls and ceilings by means of cast-in-place anchors, die-cast rust-proof expansion shields, or cast flush anchors. Wooden plugs, plastic inserts or gunpowder-driven inserts are not acceptable as a base to secure conduit supports.

F. Conduit Penetrations:

1. Conduit routed through floors, walls, or other concrete structures shall pass through cast-in-place openings wherever possible. In cases where cast-in-place openings are not possible, use appropriately sized holes which will not impair the structure's integrity. After completion, grout and caulk surface to be watertight and refinish to match existing surroundings.
2. Install watertight seals wherever conduits penetrate concrete wall panels or walls to the outdoors.
3. Install firestops and seals at penetrations through building floors, walls, or where required by fire codes.
4. Provide waterproof firestops and seals in specified locations.

G. Raceway Separation:

1. Whenever possible, separate signal raceways from AC power or control raceways a minimum of 12 inches.

H. Expansion Joints and Expansion Couplings:

1. At expansion joint crossings and where noted on the drawings, verify maximum design deflection. Use expansion coupling fittings. At crossings of expansion joints with 1 1/2-inch conduit and smaller, flex conduit may be used where acceptable.

I. Liquid-Tight, Flexible Metal Conduit:

1. Use liquid-tight in accordance with JIC standards and the following:
 - a. Where specified or indicated on the drawings.
 - b. Where flexibility is required for electrical raceways on equipment.
 - c. For motor mounts.
2. The maximum length of conduit shall be 24 inches for conduits 1 1/2 inches or smaller and 36 inches for conduits 2 inches or larger. The terminating fittings and sealing shall be as specified.

J. Non-Metallic Conduit:

1. Elbows, offsets, or 60-degree and larger bends in direct buried or concrete embedded conduit runs shall be galvanized rigid steel. The final length of conduit runs which rise up through concrete slabs or curbs shall be galvanized rigid steel, provided with grounding bushing.
2. Make connections with waterproof solvent cement.
3. PVC conduit entering fiberglass boxes or cabinets shall be secured by threaded bushings on the interior of the device and shall be terminated with a threaded male terminal adapter having a neoprene O-ring. Joints shall be made with standard couplings.

K. Galvanized Rigid Steel Conduit (GRSC):

1. GRSC embedded in concrete below grade or in damp locations shall be made watertight by painting the entire male thread with metal primer paint before assembly.

3.2 INSTALLATION OF RACEWAYS FOR COMMUNICATIONS

- A. Comply with TIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

- B. Communications conduit bends shall be large-radius field bends or manufactured conduit sweeps and long-radius elbows. Do not install cast type fittings or sharp bends.
- C. Installation in Equipment Rooms:
 - 1. Protect existing telephone terminals and equipment which will remain in service during construction from mechanical injury and dust entry.
 - 2. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 3. Install cable runway to route cables if conduits cannot be located in these positions.
 - 4. Secure conduits to backboard when entering room from overhead.
 - 5. Extend conduits 6 inches above finished floor or 12 inches down from ceiling, terminating in insulating bushings.
 - 6. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.3 INSTALLATION OF RACEWAYS AND BOXES FOR FIRE ALARM.

- A. Fire alarm conduit and boxes installed in concealed locations or located in stairwells, storage rooms, electrical rooms, mechanical rooms, and utility rooms shall be factory-painted red.
- B. Exposed fire alarm conduits in finished spaces shall be painted to match adjacent wall and ceiling finishes.

3.4 BOXES

- A. Installation:
 - 1. Mount boxes and outlets at center line, at heights shown on the drawings.
 - 2. Install outlet boxes, sized by code, large enough to accommodate all wires, fittings, and devices.
 - 3. Install multi-gang boxes as required to accept devices with no more than one device per gang.
 - 4. Equip all metallic boxes with grounding provisions.
 - 5. Flush wall switch, and receptacle outlets used with conduit systems shall be a minimum of 4 inches square, 1 1/2 inches or more deep, with a one- or two-gang plaster ring mounted vertically. Where three or more devices are at one location, use a one-piece multiple gang tile box or a gang box with a suitable device ring.
 - 6. Wall bracket and ceiling, surface-mounted lighting fixture outlets shall be a minimum of 4 inches square and 1 1/2 inches deep with a 3/8-inch fixture stud where required. Wall bracket outlets shall have a single-gang opening where required to accommodate fixture canopy. Provide larger boxes or extension rings where the quantity of wires installed requires more cubic capacity.
 - 7. Boxes for communication systems shall be a minimum of 4 11/16 inches square and 3 1/2 inches deep. Provide communication outlet boxes with a one-gang plaster ring mounted vertically.
 - 8. Boxes for special systems shall be suitable for the equipment installed. Coordinate size and type with the system supplier.

9. Install pull boxes where shown on the drawings or required by code. Use galvanized boxes of the size required by code with removable covers installed so that covers will be accessible after work is completed.
10. Install boxes flush with finished surfaces or not more than 1/8-inch back, and install boxes level and plumb. Long screws with spacers or shims for mounting devices are not acceptable. Do not expose combustible materials to wiring at outlets.
11. Extend covers for flush mounted boxes in finished spaces a minimum of 1/4-inch beyond the box edge to provide a finished appearance. Finish edge of cover to match cover face.
12. Mount cast boxes or plaster trims for weatherproof outlets horizontally.

3.5 CONDUIT TYPE REQUIREMENTS

- A. Galvanized Rigid Steel Conduit (GRSC). Uses permitted:
 1. Direct-buried.
 2. Embedded or encased in concrete.
 3. Exiting concrete (extend GRSC 18 inches beyond penetration).
 4. Exposed in buildings from floor level to a height of 8 feet, except as noted below.
 5. Exposed to weather, corrosive, or hazardous conditions, including interior exposures.
- B. Electrical Metallic Tubing (EMT). Uses permitted:
 1. In dry, protected locations.
 2. Exposed at a height more than 8 feet above floor level, or more than 18 inches above floor level in HVAC equipment rooms, utility tunnels, communication equipment rooms, electrical rooms, or unoccupied spaces, unless otherwise noted on the drawings.
- C. Flexible Metal Conduit.
 1. Use where flexibility is necessary, as at motors, transformers, recessed light fixtures, etc. Flexible conduit terminations at motors, transformers, etc., shall be limited to 18 inches. Use flexible conduit for other purposes only after obtaining Port approval.
- D. Polyvinylchloride Conduit (PVC), Schedule 40. Uses permitted:
 1. Embedded or encased in concrete (use GRSC where conduits exit concrete work).
 2. Direct-buried 18 inches or more below grade.
- E. Metal Raceway.
 1. Use in dry, protected locations for equipment requiring multi-connection wiring or where subject to physical damage.

3.6 RACEWAY AND CONDUIT SIZES

- A. Size raceways and conduits as indicated on the drawings. Where no size is indicated, size as follows:
 1. Larger conduits shall be sized to code. Size for the quantity of conductors installed, based upon NEC tables.
 2. Conduit installed underground or in concrete shall be 1 inch or larger.
 3. Conduits shall be 3/4-inch minimum size with larger sizes as indicated on the drawings. Conduits with tenant lease space buildouts may use conduits smaller than 3/4-inch.
 4. Communications conduit runs may be combined as follows:
 - a. Two outlets: 1 1/4-inch size.

- b. Three outlets: 1 1/2-inch size.

3.7 FITTINGS

- A. Assemble metallic raceways and conduits in one continuous piece and secure to boxes, panels, etc. with appropriate fittings to maintain electrical continuity. All conduit joints shall be cut square and reamed smooth with all fittings drawn up tight.

3.8 PULL LINES

- A. Install nylon pull lines in all empty conduits where routing includes 25 feet or more in length or includes 180 degrees or more in bends.
- B. Where conduits requiring pull lines are stubbed out and capped, coil a minimum of 36 inches of pull line and tape at termination of conduit for easy future access. Label pull lines as to conduit starting or termination point or intended future use.

END OF SECTION 260533

SECTION 260545 – SEISMIC RESTRAINTS FOR ELECTRICAL RACEWAYS AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section describes seismic bracing, channel type elements, and bolting accessories.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 26, Electrical
- B. Section 260529, Hangers and Supports for Electrical Systems

1.3 REFERENCES

- A. The following are the referenced standards:
 - 1. SMACNA Sheet Metal and Air Conditioning Contractor's National Association
 - 2. AISC American Institute of Steel Construction
 - 3. ASTM American Society for Testing and Materials
 - 4. AWS American Welding Society
 - 5. IBC International Building Code
 - 6. ICC International Code Council
 - 7. OSHPD Office of Statewide Health Planning and Development
 - 8. OSSC Oregon Structural Specialty Code

1.4 QUALITY ASSURANCE

- A. General Requirements:
 - 1. Provide seismic restraints for equipment, both supported and suspended, conduits, and cable tray systems.
 - 2. Bracing of conduits and cable trays in accordance with the provisions set forth in the SMACNA seismic restraint manual.
 - 3. Review and approve structural requirements for restraints, including their attachment to the building structure by a registered structural engineer in the same state as the project.
 - 4. Attachments to supported or suspended equipment must be coordinated with the equipment manufacturer.
- B. Bracing of Conduits:
 - 1. Provide seismic bracing of conduit as detailed below:
 - 2. Exception: Conduits suspended by individual hangers 12-inches or less in length, as measured from the top of the conduit to the bottom of the support where the hanger is attached, need not be braced.
 - a. Brace electrical conduits 2-1/2 inch nominal diameter or larger.

- b. Brace conduits located in electrical rooms, boiler rooms, mechanical equipment rooms, and refrigeration mechanical rooms that are 1-1/4-inch nominal diameter and larger.
- C. Suspended Equipment and Raceways:
 - 1. Cable Method: The seismic restraint shall consist of a combination of stranded steel aircraft cable with an added nut and neoprene and steel washer.
 - 2. Cable attachment details, cable size, and the neoprene and steel washers shall be sized by the manufacturer and are to be indicated in the shop drawings.
 - 3. Provide detailed shop drawings for approval in sufficient time to allow structural attachment work to be incorporated into the normal work sequence.
- D. Seismic restraints, including anchors to building structure, designed by a registered professional engineer licensed in the state of Oregon. Design includes:
 - 1. Number, size, capacity, and location of anchors for above-floor- or above-roof-mounted equipment. For curb-mounted equipment, provide design of attachment of both the unit to the curb and the curb to the structure. For units weighing greater than 2500 pounds, or curbs more than 10 feet long, provide substantiating calculations the curb can accept the prescribed seismic forces.
 - 2. Number, size, capacity, and location of seismic restraint devices and anchors for vibration-isolation and suspended equipment. Provide calculations, test data, or California OSHPD approval number verifying the horizontal and vertical ratings of the seismic restraint devices.
 - 3. Number, size, capacity, and location of braces and anchors for suspended raceways, bus ducts, and cable trays on as-built plan drawings.
 - a. Select a single seismic restraint system pre-designed to meet the requirements of the latest edition of the OSSC.
 - b. Details or designs from separate seismic restraint guidelines are not acceptable for use for a single suspended system element. Installation not addressed by the selected system shall be designed, detailed, and submitted along with the as-built plan drawings.
 - c. Maximum seismic loads shall be indicated on drawings at each brace location. Drawings shall bear the stamp and signature of the registered professional engineer licensed in the state of Oregon who designed the layout of the braces.
 - 1) Seismic brace attachments to bottom of floor deck or slab shall not exceed 500 lb (strength/LRFD level) vertical upward reaction, nor 1000 lb vertical downward reaction, per load spacing as defined in Section 260529. At 3" deck with 4½" concrete topping above, and 7" solid concrete slabs, these allowable loads may be doubled.
 - 2) Vertical upward reactions greater than above may be achieved by bridging the connection to engage multiple adjacent flutes. Flutes shall be defined as noted above.
 - 3) Seismic load criteria above may be considered independently from gravity hanger criteria.
- E. Supports, Hangers, and Anchors: Comply with the requirements of Section 26 05 29, Hangers and Supports for Electrical Systems, except anchor (expansion) bolts used for connection Level 3 have expansion anchor capacities equal to 50 percent of the ICC research report values.

- F. The seismic restraint and anchorage of permanent equipment and associated systems shall be in accordance with ASCE 7-16 and the 2025 Oregon Structural Specialty Code, with the following exception:
 - 1. Comply with ASCE but limited to component weight less than 25 lbs.

1.5 SUBMITTALS

- A. Product Data: Submit product data for products specified herein.
- B. Shop Drawings:
 - 1. Submit shop drawings complying with the requirements of the Quality Assurance article of this Section.
 - 2. Stamp shop drawings by a professional engineer licensed in the state of Oregon.
 - 3. Approve submittals prior to rack fabrication and installation.
- C. Calculations:
 - 1. Submit seismic calculations indicating restraint loadings resulting from the design seismic forces presented in the Quality Assurance article of this Section.
 - 2. Include proper anchorage details and when applicable and include consideration of the types of concrete.
 - 3. Certify by a professional engineer licensed in the state of Oregon.
 - 4. Calculations shall include consideration of localized stress effects on the supporting structure resulting from connections.
- D. Certifications:
 - 1. Submit certification of seismic restraint's and building structural member's capability to safely accept loads resulting from seismic forces calculated in the previous paragraph.
 - 2. Tests in three planes clearly showing ultimate strength and appropriate safety factors performed by independent laboratories and certified by a professional engineer licensed in the state of Oregon or calculations by a professional engineer licensed in the state of Oregon are acceptable.

PART 2 - PRODUCTS

2.1 SEISMIC BRACING:

- A. Steel fabrication, in accordance with AISC M011 Manual,
- B. Welding in accordance with AWS D1.1.
- C. Design and sizes as required.
- D. Fastenings, bracing, and assembly selected by a professional engineer licensed in the state of Oregon.
- E. Show that the maximum stress in any structural steel member will not exceed 18,000 psi.

2.2 CHANNEL TYPE ELEMENTS

- A. 12 gauge formed steel, 1-5/8-inch square prime painted or chromate dip finish. Use spring-in nuts with grooves.

2.3 BOLTING ACCESSORIES

- A. Machine bolts with semi-finished nuts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide support assemblies to meet the seismic zone indicated. Equipment shall be braced and anchored to conform to the requirements listed under the Quality Assurance article of this Section.
- B. Seismically brace raceways, cable trays, and suspended bus duct to conform to the requirements listed under the Quality Assurance article of this Section.
- C. Provide pipeline seismic flexible connectors where piping crosses building earthquake joints. Arrange raceways and connectors for the amount of motion required. Maintain continuity of the grounding system for each of the joints.
- D. Do not use powder-actuated inserts.
- E. Seismic Restraints:
 - 1. Attach to structural members of the building, which are capable of withstanding the design load of the seismic restraint.
 - 2. Ensure load capacity of the structural members is greater than or equal to the capacity of the seismic restraint.

END OF SECTION 260545

SECTION 260553 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Clearly and properly identify the complete electrical system to indicate the loads served or the function of each item of equipment connected under this work.
- B. Provide conduit and cable identification as shown in the attached labeling detail.
- C. Install Port-furnished arc flash warning labels.

1.2 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI Z535.4: Product Safety Signs and Labels
- B. NEC: National Electric Code
 - 1. NEC Article 110: Requirements for Electrical Installation
- C. OSHA: Occupational Safety and Health Administration

PART 2 - PRODUCTS

2.1 LABELS

- A. Pre-Printed: Permanent material pre-printed with black on white, with adhesive backing. Brady, 3M, or equal.
- B. Laminated Plastic: 3-ply laminated plastic, color as indicated, with 1/2-inch high white letters for low voltage and 1-inch high white letters for high voltage. Lamicoid, or equal.
- C. Plastic Tape: Black or red with white letters, adhesive backing, field-printed with proper tool. Dymo-tape, or equal.
- D. Marker Tape: Clear adhesive-backed tape with black letters, for device plates. Kroy, or equal.
- E. Wire Markers: White with black numbers, adhesive-backed tape on dispenser roll. Brady, 3M, or equal.
- F. Marker Pen: Black permanent marker suitable for writing on metallic surfaces.
- G. Clearance Warning Tape: 2-inch wide self-adhesive vinyl type, black/yellow stripes. Seton, Brady, or equal.

PART 3 - EXECUTION

3.1 LOW VOLTAGE SWITCHGEAR

- A. Label all low voltage switchboards and protective devices with laminated plastic labels indicating the function or the load served.
- B. Provide laminated plastic labels for all bussed spaces indicating the maximum ampere rating or size of future breaker or switch that may be installed in the space reserved.

3.2 BRANCH CIRCUIT PANELBOARDS AND LIGHTING CONTROL PANELS

- A. Indicate panel number, source, and if applicable, transformer number from which the panel is fed with laminated plastic labels attached to face trim. Indicate feeder source, feeder wire size, and feeder breaker or fuse size with laminated plastic labels on the inside of the panel door.
- B. Provide new or updated panel schedules using the Port's panel schedule template, available at <https://www.portofportland.com/Business/MasterSpecs>.
 - 1. New panelboards shall be provided with protective, clear transparent covers, accurately accounting for every breaker installed, including spares.
 - 2. A database of existing panel schedules is available online at <https://portofportland.sharepoint.com/sites/EDE/Equipment%20Schedules/>.
 - a. Existing panel schedules provided shall be verified with the panel schedules in the field and updated to reflect all known conditions at existing panelboards.
 - b. Provide hand-written markups to the printed copy of the panel schedule located in existing panelboards at the time of modification.
 - 3. Panel schedules shall use the actual loads and room designations per the as-built conditions and updated within 30 days of work area completion. When room designations are modified, populate the room number reference table in the Port's panel schedule template with old and new room designations. Provide a printed copy of the schedule at the panelboard and submit an electronic copy to the Port via email at electricalupdates@portofportland.com. Discard old copies of panel schedules in existing panelboards.

3.3 TRANSFORMERS AND UPS

- A. Label all transformers and UPS with laminated plastic labels indicating equipment number, source, and load.

3.4 EQUIPMENT

- A. Label all disconnect switches, individual circuit breakers, security and communications panels, relays, contactors, time switches, and indicating equipment with laminated plastic labels indicating equipment number, source, and circuit number.
- B. Where the controlling device is remote-mounted from the serving panel, include the serving panel designation and circuit number with additional plastic tape labels.

3.5 DEVICES

- A. All receptacle plates shall be marked in black permanent marker tape on the face of the plate, with the receptacles panel and branch circuit designation. The identification shall be made with clear self-adhesive tape with black 10-point letters. Apply the tape at the top of the device plate.
- B. Receptacles specified or noted on the drawings to be engraved, shall have the circuit information engraved in 3/16-inch letters on the front face of the plates. The alphabetic and numeric marking shall be made on the inside of the plate.
- C. Receptacles connected to a GFCI-protected circuit downstream from the protecting device shall be labeled "GFCI Protected."

3.6 CONDUIT AND CABLE

- A. Label all conduit runs and open cable wiring routed in cable tray or accessible ceiling spaces. Space labels a maximum of 50 feet apart and at least one per room. Place at entrances of all "J" boxes, distribution panels, MCC, panelboards, etc.
- B. Use laminated plastic labels as shown in the attached labeling detail.
- C. Complete installation of labels prior to ceiling installation.

3.7 OUTLET, PULL, AND JUNCTION BOXES

- A. Paint fire alarm and security access system outlets, pull, and junction boxes in accordance with the directions of their specific sections.
- B. Label all pull boxes and junction boxes for fire alarm, security, surveillance, and communications systems with plastic tape, red with white letters. Where boxes are recessed in finished areas, mount label on inside of cover.
- C. Label power junction boxes neatly by hand, indicating source and circuit number.

3.8 SYSTEMS

- A. Complex control circuits may utilize any combination of colors with each conductor identified throughout, using wrap-around numbers or letters. Use the number or letters shown where the drawings or operation and maintenance data indicate wiring identification.
- B. Label the fire alarm and communication equipment zones, controls, indicators, etc., with pre-printed labels or indicators appropriate for the equipment installed, as supplied or recommended by the equipment manufacturer.
- C. Label each end of pull wires left in empty conduits with tags or tape indicating location of other end of wire.

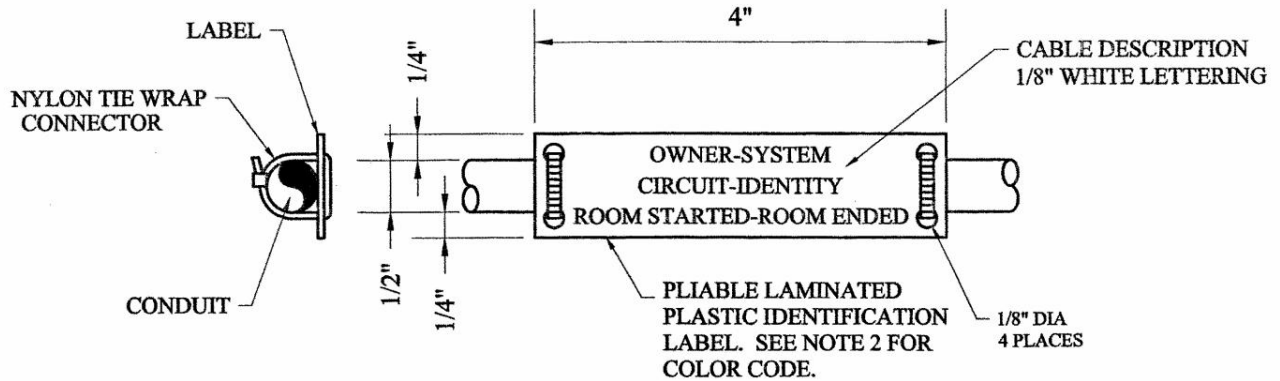
3.9 CLEARANCE WARNING TAPE

- A. Affix to floor clearance warning tape to define area in front and around electrical switchgear, panels, and motor control centers. Type layout shall conform to the requirements of NEC 110 and OSHA.
- B. Remove debris and clean area prior to installing tape.

3.10 ARC FLASH WARNING LABELS

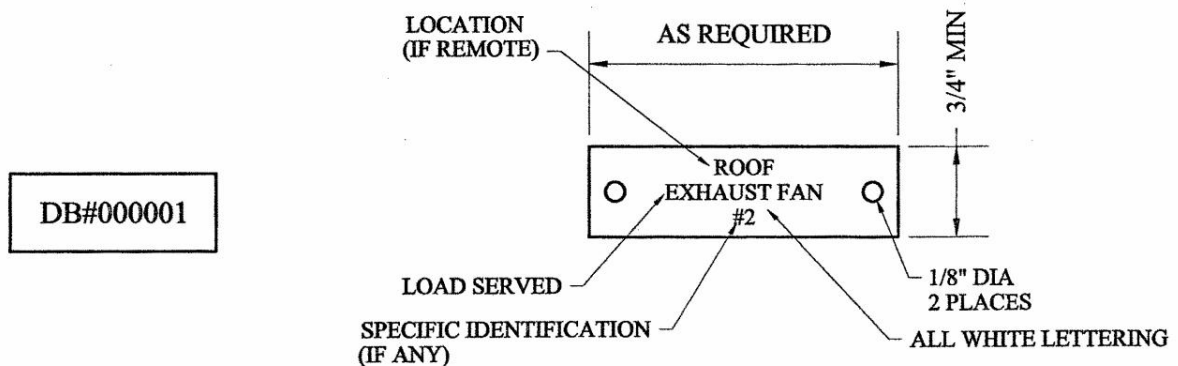
- A. A minimum of 4 weeks prior to anticipated substantial completion, submit the following information to the Port for the arc flash analysis on newly installed equipment:
 - 1. Feeder sizes for each piece of equipment including feeder type, length, configuration, and raceway type in which feeder is installed.
 - 2. Overcurrent protection equipment brand name, model number, and any breaker settings and/or fuse sizes. Provide information for all overcurrent devices including Port-owned equipment feeding new feeders and newly installed equipment.
 - 3. Equipment AIC rating.
- B. The Contractor shall install labels furnished by the Port.

PORT STANDARDS FOR ELECTRICAL EQUIPMENT IDENTIFICATION



CONDUIT & INNERDUCT IDENTIFICATION

SCALE: N.T.S.



CABLE LABEL

SCALE: N.T.S.

EQUIPMENT IDENTIFICATION

SCALE: N.T.S.

NOTES:

1. Use laminated labels at all interior and protected locations. Use professionally engraved, white enamel filled brass labels in all areas exposed to the weather and/or sunlight, and in environment air handling spaces.
2. Color code for labels shall be as follows:

Port	Blue
FAA	Yellow
Airlines	Green
Telco	Red
Other Tenants	Black
Emergency and Fire Alarm	White with Red Letters

3. Install conduit and innerduct labels at each end of the conduit run, at entrances of all duct banks, distribution panels, motor control centers, panel boards, etc. Provide a minimum of one label per room or space.
4. Install equipment labels with stainless steel #4 screws.
5. System examples: Power, Fire Alarm, HVAC, Communications, Signal, Telephone, Revenue Control
6. Label cables with preprinted label. Labels shall wrap around and shall have a reference number. At a minimum, label the cable at the cable start and end terminals, at intermediate points in runs where cable leaves a cable tray, and at all intermediate junction boxes and lay down locations.
7. Complete installation of labels prior to ceiling installation.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the general performance requirements of the lighting control systems. Types of controls covered in this section include:
 - 1. Photosensors and Daylight Dimming.
 - 2. Ceiling or Wall-Mounted Occupancy Sensors and Vacancy Sensors.
 - 3. Wall Switches, Control Stations, Dimmers, and Switch Packs.
 - 4. Note that some components in this section may not be used on this project.

1.2 RELATED SECTIONS

- A. Section 260500, Common Work Results for Electrical
- B. Section 260519, Low Voltage Electrical Power Conductors and Cables
- C. Section 260533, Raceway and Boxes for Electrical Systems
- D. Section 260553, Identification for Electrical Systems
- E. Section 262726, Wiring Devices
- F. Section 265000, Lighting
- G. Section 260993, Sequence of Operations for Lighting Controls

1.3 SUBMITTALS

- A. General:
 - 1. Shop drawings, samples, test data and certificates shall be submitted for approval in accordance with the requirements of the contract documents and general requirements. Lighting control system components shall not be shipped, stored, or installed into the work unless prior approval has been received, based upon the submittal of shop drawings, samples, catalogue cuts, test data, certificates or other material submitted for approval.
 - 2. Submit samples of all finishes and all visible faceplates and trim for components installed in finished spaces, when requested by the Port.
 - 3. After the final inspection, provide a complete set of as-built control drawings as part of the Operating and Maintenance Manual. See Part 3, below, for more information.

4. Contractor is required as a part of the specification, to provide pricing for the lighting control system for this project as a separate line-item bid. Pricing is to be broken down by *major components* with a total sum for equipment cost, less installation. This line item is to be separate from the lighting equipment pricing. This is a requirement of the contract documents due to the single name specification of the lighting control. If elements of specification Section 260923, Lighting Control Devices, are tied in any way to components of Section 265000, Lighting, the lighting pricing will be considered non-responsive, and not compliant.

B. Shop Drawings:

1. Submit a one-line diagram showing all components of the lighting control system. Show all panels, dimmers, controls, input and output jacks, and the interconnect wiring between all components.
2. Submit a dimming load schedule that clearly lists the actual loads per circuit, which circuits are wired for standby, and the corresponding circuit numbers (per the electrical drawings). Each load schedule shall be arranged (by zone and circuit number) to match as closely as possible the panels/schedules shown in these specifications or on the drawings.
3. Review the locations of sensors and equipment shown in the electrical drawings. Submit recommended layouts for sensors (photosensors, occupancy/vacancy sensors), lighting control panels and accessories for which revised locations would better meet the desired performance.
4. Submit standard cut sheets or catalogue data for all lighting control system components which includes performance data, and which clearly indicates compliance with the specifications.
5. Submit labeling templates for all multiple ganged switches or dimmers.
6. Each control manufacturer shall substantiate conformance to the specifications by submitting a written document included with the shop drawings, indicating that the equipment submitted meets the drawings and each line item in the specification, and if not, note any exceptions. Indicate how the proposed product exceptions still meet or exceed the intended performance described, specified, or provided by the "basis of design." Submit all relevant UL file cards or test reports which cover the equipment submitted, to demonstrate compliance with the specifications.
7. The Port reserves the right to change any of the zone designations for the lighting control circuits up until the date the final submittal responses are due back to the Contractor. These shall be considered "clarifications" as long as the overall quantity, wattage and number of zones and system elements remain the same or do not increase the equipment or cost. Zones designated as spares may be utilized at this time without incurring any additional costs to the project.

C. Closeout Submittals:

1. Provide start-up documentation that details the start-up procedure being performed including a process to follow, details on tests performed and an area that documents any test results. Reference General Commissioning Requirements, General Commissioning Requirements for other requirements.
2. Project Record Documents: Record actual installed locations.
3. Include testing reports.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Minimum 10 years' experience in manufacture of architectural lighting controls.
- B. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.
- C. Lighting Control System Components: Listed by UL specifically for the required loads. Provide evidence of compliance upon request.
- D. Prior to adjusting and calibrating daylighting control system and local photocell field adjustable settings, contact local manufacturer representative and arrange for representative to visit site to educate both field installer and the Port on the operation of the controls.
- E. Use manufacturer's published testing and adjusting procedures to adjust sensor time delay, daylight sensitivity, and passive infrared sensitivity to satisfaction of the Port.
- F. Source Quality Control:
 - 1. Perform full-function testing on all completed assemblies at end of line.
 - 2. Diagnostics and Service - Tiered control scheme for dealing with component failure that minimizes loss of control for occupant.
 - a. Bus Failure: Lights go to emergency level for safety.
 - b. Failure of One Sensor Type: Driver still controllable via other sensors.
 - c. Driver Failure: Only impacts one fixture - remainder of system operates as programmed.
- G. Conformance Verification: Each control manufacturer shall substantiate conformance to the specifications by submitting a written document included with the shop drawing submittal, indicating that the equipment submitted meets each line item in the drawings, specifications, and Sequence of Operations, and if not, note any exceptions. Indicate how the proposed product exceptions still meet the intended performance described, specified or provided by the "basis of design." Submit all relevant UL file cards or test reports which cover the equipment submitted, to demonstrate compliance with the specifications.
- H. Contractor's Quality Assurance:
 - 1. Note that this specification may contain information for the Port standard lighting control system that are not used on this project.
 - 2. Equipment Compatibility
 - a. All components of a particular type of lighting control system shall be fabricated or supplied and warranted by a single (primary) manufacturer, unless specifically noted otherwise in the contract documents.
 - 3. Regulatory Agencies:
 - a. Provide lighting control systems wired and installed in compliance with the current edition of all applicable city, state and national codes. Additionally, each lighting control system shall be listed by UL in its entirety, and each panel shall bear a UL label.
 - 4. Recognized Standards:
 - a. In addition to standards that may be referenced in Division 01, all items of equipment and individual components shall comply with the applicable standards of the following organizations:
 - 1) Underwriters Laboratories (UL).

- 2) National Electrical Code (NEC).
- 3) National Electrical Manufacturer's Association (NEMA).
- 4) United States Institute of Theater Technology (USITT).
- 5) Nationally Recognized Testing Laboratory (NRTL).
- 6) American National Standards Institute (ANSI).
- 7) American Society of Testing and Materials (ASTM).

1.5 DEFINITIONS

- A. AWG (American Wire Gauge): Is a standardized wire gauge system used since 1857 predominantly in North America for the diameters of round, solid, nonferrous, electrically conducting wire. Dimensions of the wires are given ASTM standard B258.
- B. DIN Rail: Is the metal rail of a standard type widely used for mounting circuit breakers and industrial equipment inside equipment racks.

1.6 GENERAL REQUIREMENTS

- A. Provide labor, materials, and equipment for the installation, testing, and calibration of lighting control systems as shown on the drawings and specified herein. Provide training for the Port's maintenance personnel as specified herein.
- B. Refer to drawings for dimensions and details. Check and verify dimensions and details on drawings before proceeding with the work. Report any inconsistencies or discrepancies at once to the Port. Should it appear that the work intended is not sufficiently detailed or explained on the drawings or in the specifications, apply to the Port for further drawings or explanations, as may be necessary. Conform to these explanations in the work. If any question arises about the true meaning of the drawings or specifications, refer the matter to the Port, whose decision is final and conclusive. Under no circumstances shall any request for extra compensation be honored where the basis of claim is such a clarification by the Port. In no case submit a bid, or proceed with any work with uncertainty. The intention of this specification and the accompanying or applicable drawings is to provide completely functioning lighting control systems. The Contractor for this work shall take full responsibility for this result.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Lighting control system components shall be delivered to the job site factory-assembled and wired to the greatest extent practical, in strict accordance with the approved shop drawings, samples, certificates and catalogue cuts, and shall be handled in a careful manner to avoid damage.
- B. Exposed finishes shall be protected during manufacture, transport, storage and handling. Delivered materials shall be identical to approved samples. Materials that become damaged shall be repaired and/or replaced as directed.
- C. Components shall be stored under cover, above the ground, in clean, dry areas, and shall be tagged and/or marked as to type and location.

- D. Where specified, packaging shall be 100 percent recycled, made entirely from post-consumer waste (100 percent post-consumer fiber content) as well as 100 percent recyclable.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide materials, equipment, appurtenances and workmanship for the work of this section conforming to the highest commercial standards, as specified and indicated on the drawings.
- B. One primary manufacturer shall be responsible for all components and shall provide a complete system that meets the project requirements.
- C. Manufacturer: Electronic Theatre Controls (ETC), to match existing system, no substitutions

3031 Pleasant View Rd.
Middleton, WI 53562

(608) 831-4116

2.2 LABELING

- A. Equipment shall be labeled according to the requirements of Section 260553, Identification for Electrical Systems.
- B. Remote equipment shall be labeled, like controllers or remote drivers in ceiling or another location per Port approval.
- C. Control equipment shall be clearly labeled to match zones as included on contract documents.

2.3 CEILING-MOUNTED OCCUPANCY SENSORS AND VACANCY SENSORS

- A. General
 - 1. Sensors shall have field adjustable controls for time delay and sensitivity that do not require physical access to the sensors.
 - 2. Basis of design is ETC Paradigm series ceiling sensors
 - 3. Sensors shall detect motion through one of three methods:
 - a. Ultrasonic: By emitting high frequency audio signals, and listening for a Doppler shift in the return signal.
 - b. Passive Infrared: By passively sensing changes in the infrared radiation received by the sensor from various zones in the room.
 - c. Dual technology sensors may be used if they prevent both false Ons (in occupancy sensing mode) and false OFFs (in vacancy sensing mode).
 - 4. Vacancy settings shall have a time delay from 0-30 minutes and shall be factory preset at the maximum allowed by relevant energy code (e.g., 20 minutes). To provide functional testing operation. Then, sensors shall be commissioned to the requirements for the Sequence of Operations prior to final acceptance.

5. When vacancy is detected and lights turn off, motion within the next 15 seconds shall automatically reactivate lights.
6. Sensors shall be Class 2 devices or wireless.
7. When requested, be able to provide customizable mask to block off unwanted viewing areas for all sensors.
8. Power failure memory: Controls shall incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and learned parameters saved in protected memory shall not be lost.
9. Designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC 801-2.
10. Coverage Patterns shall be tested and verified using the NEMA WD 7 guidelines.
11. When specified, “smart” sensors shall automatically adjust time delay and sensitivity settings based on learned activity, but only after normal occupancy, i.e., shall not be based on construction activity.
12. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation. Sensor shall be clearly visible throughout coverage range and flash each time motion is detected.
13. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed, and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
14. All adjustment mechanisms shall be concealed from view but shall be readily accessible to maintenance personnel using common hand tools.
15. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
16. Sensor shall be capable of detecting a small hand motions anywhere in an unobstructed room of at least 300 square feet when mounted 10’AFF. Additional sensors may be required in high ceiling applications in order to perform as intended. It is the manufacturers responsibility to lay out the positions and quantity of sensors that will be required for this specific project and to provide the appropriate BOM including quantity and location of sensors needed based on the project requirements at the time of bid. Any additional sensors needed shall be provided at no additional cost to the project if at time of acceptance, full functionality is not achieved. Electrical lighting drawings are diagrammatic and intended to communicate intent. Final layout will be based on manufacturer shop drawings. The contractor shall install any additional sensors required based on the shop drawings at no additional cost to the project.
17. Sensors shall be located to avoid turn-off due to motion in adjacent corridors.
18. Manufacturer’s gross rated area of coverage shall not be used as an indication of sensor coverage in a specific application. Coverage patterns shall be de-rated as recommended by manufacturer based on mounting height of sensor, furniture and partition locations, and finish of interior surfaces. Sensors shall be able to detect typical motion (e.g., walking in corridors; writing and computer use in offices) throughout the accessible portions of spaces lighted by controlled luminaries.
19. Contractor to provide manufacturer with drawings showing all sensor locations and types, as well as furniture locations, for all areas where occupancy sensors will be installed. Contractor to verify sensor quantity, layouts and aiming with manufacturer prior to ordering and installation of any sensors.
20. All sensors, control units, transformers, power packs, switch packs, and relays shall:
 - a. Be UL listed under section 508 Industrial Control Equipment or Appliance Control Devices and conform to all applicable portions of the National Electric Code.

- b. Be rated for operation in ambient air temperatures ranging from 50°F to 104°F.
 - c. Have manufacturer's replacement warranty of five years or longer.
 - d. Be fabricated by a manufacturer that has been continuously manufacturing occupancy sensors for at least five years.
 - e. Shall work with the specified lighting control system.
 - 21. All switching devices shall employ zero-crossing switching technology, or be otherwise designed to withstand the high inrush current caused by electronic ballasts. If not clearly indicated on submittals, the manufacturer shall provide data that substantiates compliance with this requirement.
 - 22. All visible components shall be finished in NEMA standard colors.
 - 23. The Port shall be free to choose between all standard colors offered by manufacturer for all visible components during submittal process.
 - 24. When requested, be able to provide customizable mask to block off unwanted viewing areas for all ceiling mounted sensors using infrared technology. Fresnel lenses of passive infrared sensors shall be "masked" as required to prevent the sensors from detecting motion outside the areas they are controlling. Manufacturer shall provide masking tape which matches the color of the sensor.
 - 25. Sensor shall be entirely solid-state, crystal controlled to within ± 0.005 percent frequency variation.
 - 26. Sensor shall have an LED, clearly visible throughout coverage range, which flashes each time motion is detected.
 - 27. Sensors shall have a concealed override switch or other provision that allows maintenance personnel to easily bypass the sensor in case of malfunction. Bypassing the sensor shall result in a continuous "on" signal being sent to connected power pack(s), so that the lights remain on.
- B. Infrared Occupancy/Vacancy Sensors:
- 1. Sensors shall be sensitive to small hand motions and sensitivity shall be adjustable.
 - 2. Dual technology sensors shall:
 - a. Utilize an operating frequency of 25 kHz or 40kHz that shall be crystal controlled to operate within plus or minus 0.005 percent tolerance.
 - b. Incorporate Doppler shift ultrasonic and passive infrared motion detection technologies. Products that react to noise or ambient sound shall not be considered.
- C. Calibration Settings
- 1. Occupancy sensors shall be factory calibrated and verified by the contractor to the desired settings. Verify such settings during the submittal phase.
 - 2. All sensors shall have readily accessible, adjustable settings for time delay and sensitivity. Settings shall be located remotely from the sensor, or ceiling controller.
 - 3. Ultrasonic ceiling sensors shall be set to "medium sensitivity", and 20 minute time delay.
- D. Power Packs for Use in Conjunction with Ceiling-Mounted Occupancy Sensors and Vacancy Sensors.
- 1. Power Packs are intended for use in conjunction with ceiling-mounted occupancy sensors. In addition to the requirements of Paragraph A, above, power packs shall meet or exceed the following criteria:
 - a. Provide power packs in quantities as required for control of circuits and zones indicated on the drawings.
 - b. Additional power packs are required for standby for fixtures. Designated constant-burn or emergency luminaires shall never be controlled by power packs.

- c. Power packs shall provide NEC Class 2 low voltage (nominal 15V-24V) power to ceiling-mounted occupancy sensors.
 - d. Power packs shall switch line voltage lighting loads on and off in response to signals received from the ceiling-mounted occupancy/vacancy sensors. Power packs shall have no minimum load requirements.
 - e. Each power pack shall be capable of powering and receiving control signals from multiple occupancy sensors. Provide 6 feet slack in the cable connecting each sensor with its power pack to allow for sensor relocation.
 - f. Multiple power packs shall be capable of working together in a master/slave arrangement to control multiple circuits together.
 - g. Power packs shall shield all sensors they power from the effects of inrush current.
- E. Momentary-Contact Electronic Control Switches for Use in Conjunction with Ceiling-Mounted Vacancy Sensors and/or Power Packs.
- 1. Momentary-Contact automatic control switches are intended for use in conjunction with ceiling-mounted occupancy sensors and power packs to make the ceiling-mounted sensors function as a manual-on, automatic-off “vacancy sensing” mode. In addition to the requirements of Paragraph A, above, momentary-contact automatic control switches shall meet or exceed the following criteria:
 - a. Provide momentary-contact automatic control switches in locations indicated on the electrical drawings, wall-mounted at standard switch height in compliance with Americans with Disabilities Act Guidelines. Wire momentary-contact automatic control switches in series between the power packs and the loads controlled by the power packs. Where three-way switching is required, wire momentary-contact automatic control switches in parallel with each other, or as recommended by manufacturer.
 - b. A momentary-contact automatic control switch is a tap-switch that operates as both a manual and automatic control device. Lighting associated with this switch requires that they be manually tapped in order to activate the lights or another control sequence (like photosensor control). Occupants may turn off the lights manually, but in no case, does this override the requirement for manual activation. If the signal coming to the power-pack of an occupancy sensor is indicative of lack of occupancy, and the lights are turned off, motion in the space within a 15-second grace period shall automatically reactivate the lights. If there is no activity during that 15-second period, the lights will be extinguished, and it shall be necessary to manually tap the switch to turn them back on.
 - c. A switch shall be capable of three-way, four-way, and five-way operation.
 - d. The switch shall operate silently.
 - e. Sentry-type toggle momentary contact switches are not acceptable.
 - 1) Provide a mechanical air-gap on/off function for all sensors.
 - 2) Shall accommodate loads from 0-800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180 degree coverage capability.
 - 3) Shall be able to have their visible plastic parts replaced, for color changes in the field, without removing the body of the control from the wall and without requiring special tools.
 - 4) Shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor’s longevity.
 - 5) Shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.

- 6) Where specified, switches shall feature a universally recognized light bulb icon for end user ease of identification of use.
- 7) Where dimming is employed, manual ON switches shall enable that dimming function.

2.4 WALL-MOUNTED VACANCY SENSORS WITH SWITCHES AND/OR DIMMERS

A. Wall-Mounted Sensors

1. Provide a recessed bypass manual "override on" key on each sensor.
2. Provide a mechanical air-gap on/off function for all sensors.
3. Shall accommodate loads from 0-800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180 degree coverage capability.
4. Keypads shall be able to have their visible plastic parts replaced, for color changes in the field, without removing the body of the control from the wall and without requiring special tools.
5. Shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
6. Shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
7. Where specified, sensors shall feature a universally recognized icon for end user ease of identification of use.
8. Where specified, sensor packaging shall be 100 percent recycled.
9. Sensors shall be RoHS compliant.

B. Switchpacks

1. Control wiring between sensors and control units shall be Class 2, 18-24 AWG, stranded UL Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums.
2. Integrated, self-contained unit consisting internally of an isolated load switching control relay and a power supply to provide low-voltage power.

2.5 LOW VOLTAGE WALL STATIONS

A. Electronics:

1. Use manufacturer's recommended wiring for low voltage communication wiring. of switches.
2. Use 18 AWG wire for low voltage dry contact switches. Number of conducts is based on type of switch.

B. Functionality:

1. Upon button press, LEDs to immediately illuminate.
2. LEDs to reflect the true system status. LED state is programmable to reflect either relay state or button push state.
3. Allow for easy reprogramming without replacing unit.
4. Replacement of units does not require reprogramming.

C. Provide faceplates with Low Voltage Wall Stations.

D. Provide wall stations with field replaceable/updatable labeled buttons. Appropriate button, zone and scene descriptions furnished prior to fabrication.

- E. Multiple digital wallstations may be installed in a room by simply connecting them to the Room Controller local network. No additional configuration will be required to achieve multi-way switching.
- F. Scene wallstations scene control shall be adjustable through a simple interface or handheld control for flexibility of lighting scenes. This personal remote shall allow individual zone control, scene control and scene setting capabilities. [
 - 1. ETC Unison Paradigm Inspire

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not install cover plates or other finished components until completion of work, plastering, painting and general clean-up.
- B. New relay panels for this project will be tied to the TCORE system Port network infrastructure by the installing contractor.
- C. Mount lighting controls and wall jacks at heights and locations indicated in the contract drawings, to comply with ADA, or as directed by the Port.
- D. Ground non-current-carrying parts of all electrical equipment in accordance with UL and NEC provisions.
- E. Run separate neutrals for all zones and branch load circuits.
- F. Utilize temporary faceplates for any controls awaiting final labeled faceplates, for a clean and completed appearance.
- G. Take full responsibility for the supports required for the lighting control components. Ascertain the structural reliability of supports provided under other sections of the specification. Reinforce the walls as required to support wall-mounted dimming and relay panels.

3.2 COMMISSIONING

- A. Contractor shall take responsibility for a complete and operational lighting control system that is calibrated to the satisfaction of the Port.
- B. Keys: Provide the Port with four sets of keys for every lockable enclosure or cabinet during transfer of Operation and Maintenance Manual. All locks are to be keyed alike as to provide a single configuration between lockable enclosures.

- C. Training: At the Port's convenience, the controls manufacturer's factory technician shall provide a minimum of two hours of supplemental expertise and training concerning the installation, characteristics, operations and maintenance of the preset lighting control systems. Such training shall take place only after all systems have been inspected and finally calibrated, as required above, and after the operation and maintenance manual with documented calibration settings has been provided to the Port and approved. Refer to Div 01 for additional requirements.
- D. Video: The Contractor shall video-tape the training session, and shall provide the Port with two copies of the training videotape or electronic MP3 file. Alternative formats are acceptable if mutually agreed upon. If manufacturer provides videos containing the same information, these may be used if tailored to the specific project components. All control products shall be represented in visual, graphic or animated format.
- E. Calibration of Lighting Controls:
 - 1. Occupancy/Vacancy Sensors – Occupancy sensors shall be calibrated by the factory or Contractor to the specified settings, and to meet the mandatory requirement of the relevant energy code, prior to move-in.
 - a. On-Site Commissioning:
 - 1) Contractor shall set occupancy sensors to medium sensitivity and 20-minute time delay at time of installation unless otherwise stated in specification section 260993, Sequence of Operations for Lighting Controls.
 - 2) Contractor shall verify lights activate as indicated in specification section 260993, Sequence of Operations for Lighting Controls, dim to defined level where partial-off is utilized and turn off as after defined set time delay after room is vacated.
 - 3) All occupancy sensor system(s) shall be completely commissioned by the manufacturer's factory authorized technician, who will verify all adjustments and sensor placement.
 - 2. Photocells – Photocells shall be calibrated by the factory or Contractor to the specified settings, and to meet the mandatory requirement of the relevant energy code, prior to move-in.
 - a. On-Site Commissioning:
 - 1) Contractor shall set to initial set point levels and calibration based on specification section 260993, Sequence of Operations for Lighting Controls.
 - 2) Contractor shall verify photocell reacts to daylight by dimming lighting in zones indicated on contract documents.
 - 3) All photocell(s) shall be completely commissioned by the manufacturer's factory authorized technician, who will verify all adjustments and sensor placement.
 - 3. Network Devices – Network Devices shall be configured by the factory or Contractor to the specified settings and network addresses as issued by Port IT, prior to move-in.
 - a. On-Site Commissioning:
 - 1) Contractor shall verify all network settings match the settings provided by Port IT coordination for Lighting Control VLAN access for each device.
 - 2) All network device(s) shall be completely commissioned by the manufacturer's factory authorized technician, who will verify all settings and locations.
 - 4. Control Stations –Control Stations shall be configured by the factory or Contractor to allow zonal and group control of lighting as indicated by specification section 260993, Sequence of Operations for Lighting Controls and contract documents, prior to move-in.

a. On-Site Commissioning:

- 1) Contractor shall verify each button triggers the zone(s)/group(s) as defined by specification section 260993, Sequence of Operations for Lighting Controls and contract documents.
- 2) Contractor shall verify all control override(s) return to normal control on sensor/schedule timeout.
- 3) All control station(s) shall be completely commissioned by the manufacturer's factory authorized technician, who will verify all settings and locations.

END OF SECTION 260923

SECTION 260993 – SEQUENCE OF OPERATIONS FOR LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes:
 - 1. Abbreviations and Definitions
 - 2. General Controls Approach
 - 3. Space-by-Space Sequence of Operations
- B. Supplemental Documentation Included “260993 Sequence of Operations for Lighting Controls Supplemental Document-SOO MAP” is for reference only and in the case of discrepancies, this specification section and the Control Zone Schedule take precedence.

1.2 RELATED SECTIONS

- A. Section 260500, Common Work Results for Electrical
- B. Section 260519, Low Voltage Electrical Power Conductors and Cables
- C. Section 260533, Raceway and Boxes for Electrical Systems
- D. Section 260553, Identification for Electrical Systems
- E. Section 262726, Wiring Devices
- F. Section 265000, Lighting

1.3 ABBREVIATIONS AND DEFINITIONS:

- A. BACNET Protocol for integration with BAS/BMS/EMS
- B. BAS / BMS / EMS Building Automated System, Building Management System, Energy Management System
- C. D Dimming Wall Switch
- D. FC Footcandles. The metric for measuring light levels / illuminance levels
- E. GUI Graphic User Interface
- F. LCP Lighting Control Panel
- G. LonWorks Protocol for integration with BAS/BMS/EMS

- H. OS/VS Occupancy Sensor / Vacancy Sensor
 - 1. Occupancy sensors provide automatic on and automatic shut-off.
 - 2. Vacancy sensors provide automatic shut-off only and require manual-on.
- I. PC Photocell
- J. RS RS-232 Connection for AV Integration
- K. SC Scene Control
- L. TC Time Clock, or astronomical Time Clock
- M. WS Wall Switch
- N. WS/O Wallbox Occupancy Sensor Switch
 - 1. Wall Switch with integrated Occupancy Sensor
- O. Daytime Begins 30 minutes before sunrise per astronomical time clock.
- P. Evening Begins 30 minutes before sunset per astronomical time clock.

1.4 SYSTEM DESCRIPTIONS

- A. General Controls Approach:
 - 1. Relays are identified on the drawing plans with the notation ZXX-XXX along with the luminaire type designations.
- B. Emergency Egress:
 - 1. Lights indicated as emergency will override dimming to 100% of output setpoint during normal power.
 - 2. Provide UL924 devices for emergency lights such that during normal power conditions the lights function (switch, dim by WS, dim by Photocell, etc.) with the rest of the lights in the associated zone, and such that during emergency power conditions the lights override to 100% of output setpoint.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SPACE-BY-SPACE SEQUENCE OF OPERATION

- A. Each of the following letter designations in this section correlates to a Sequence of Operation type as shown on the lighting control zone schedule column identified as SOO on the drawings.
- B. Sequence of Operation Front of House Restrooms
 - 1. Local User Control:
 - a. N/A

2. Network/Master Override User Control:
 - a. LightDesigner for Paradigm
3. Dimming:
 - a. Yes. Each luminaire type / layer of light to be separated for individual dimming control per zoning as indicated on plans and schedules. Various lengths of same fixture families can be combined, downlights in contiguous area may be combined, unless noted.
4. Time Clock / Occupancy Control:
 - a. Daytime / Evening:
 - 1) General Lighting:
 - a) Scheduled ON/OFF by Time Clock.
 - b) Partial Off of General Lighting by any Occupancy Sensor:
 - c) Occupancy Sensor Time Delay:
 - (1) 20 minutes to Unoccupied state
 - (2) 10 minutes to OFF state
 - d) Occupied: Increase lighting to 100% of output setpoint.
 - e) Unoccupied: Dim general lighting (type L1 and type L4) in all user rest rooms, to 35% of output setpoint.
 - f) Type L3 will be time clock controlled only
 - g) Type L4 in all user restroom stalls will be on/off with occupancy sensor inputs by group.
 - 2) Accent Lighting
 - a) Automatic ON/OFF by any Occupancy Sensor.
 - 3) Floor to Ceiling Enclosed Individual Stalls
 - a) Automatic ON/OFF by all Occupancy Sensors.
5. Daylight Harvesting:
 - 1) N/A

C. Sequence of Operation for Internally Illuminated Signage

1. Local User Control:
 - a. No local control station(s).
2. Network/Master Override User Control:
 - a. LightDesigner for Paradigm
3. Dimming:
 - a. Yes, for each dimmable sign type and location to be separated for individual dimming control.
4. Time Clock / Occupancy Control:
 - a. Daytime / Evening:
 - 1) Scheduled ON/OFF by Time Clock.
 - b. Space is intended for 24/7 operation. Verify hours of operation with Port prior to programming.
5. Daylight Harvesting:
 - a. N/A
6. Initial Light Level Setting:
 - a. Daytime: 75%
 - b. Evening: 50%
 - c. Values to be confirmed in signage mock-up.

D. Other Spaces:

1. Sequence of operations will be provided upon written request for all spaces not listed. Reprogramming may be required of some spaces on site after installation to tune the system and meet the Port, daylight, and energy management needs. Provide additional programming for reconfiguration up to 24 hours at no additional cost to the Port.

END OF SECTION 260993

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes wiring devices, plates, and blank plates for outlet boxes.

1.2 SUBMITTALS

- A. Submit product data, and shop drawings.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Wiring devices shall be specification grade, with special devices as noted on the drawings. Should the drawings indicate a device other than those listed herein without reference to catalog number, such device shall be of the same grade and manufacturer as specified below. Furnish a matching cap for all special purpose devices that do not have the common 120V NEMA 5-15R or 5-20R configuration.
- B. All lighting switches and duplex receptacles installed shall be by the same manufacturer and shall be identical in appearance, unless noted otherwise.

2.2 WALL SWITCHES

- A. Acceptable Manufacturers: Arrow-Hart, Bryant, Eagle, General Electric, Hubbell, Leviton, Pass & Seymour, Sylvania, or equal.
- B. Line Voltage Switches: 20 ampere, 277V, quiet type, grey exposed finish, back and side wired, Hubbell 1221 series.
- C. Lighted Handle Switches: 20 ampere, 120V or 277V, red handle with neon pilot light, Hubbell 1221 PL series.
- D. Momentary Contact Switches: 15A, SPDT, center off, grey exposed finish, Hubbell 1556-T.
- E. Key Switches: 20A, SPST, lock type, Hubbell 1201-L with 1209 key.

2.3 DIMMERS

- A. Acceptable Manufacturers: Lutron, Prescolite, or equal.

- B. General: Solid state silicone gated with RFI filter. Linear slide control with positive on/off switch for standard wall box mounting.
 - 1. Incandescent Dimmers: Single manual local control with lamp debuzzing coil, 600 to 2000-watt capacity, 120V, white finish. Sizes as indicated on the drawings. Lutron Nova N series.
 - 2. Fluorescent Dimmers: Single manual local controls, 10, 20 or 30 F40 lamp capacity with low end dimming adjustment, 120V, white finish. Lutron NF series.

2.4 RECEPTACLES

- A. Acceptable Manufacturers: Arrow-Hart, Bryant, Eagle, General Electric, Hubbell, Leviton, Pass & Seymour, Sylvania, or equal.
- B. General Application Duplex: 3-wire, 2-pole grounding, NEMA 5-20R, grey nylon exposed finish, back and side wired, Hubbell 5362 series.
- C. UPS System Duplex: 3-wire, 2-pole grounding, NEMA 5-20R, black nylon exposed finish, back and side wired, Hubbell 5362 series.
- D. Emergency System Duplex: NEMA 5-20R, lighted red nylon exposed finish, back and side wired, Hubbell 8300-R series.
- E. Ground Fault Interrupting Duplex: Feed through, NEMA 5-20R, grey nylon exposed finish, Hubbell GF-5362 series.
- F. Special Purpose Receptacles: As noted on the drawings. Provide with NEMA configurations.

2.5 PLATES

- A. Acceptable Manufacturers: Arrow-Hart, Appleton, Bryant, Eagle, General Electric, Hubbell, Leviton, Pass & Seymour, Sylvania, or equal.
- B. Flush Finish Plates: .040-inch thick, type 302 stainless steel, brush finish. Provide engraving as indicated on the drawings.
- C. Surface Galvanized or Cadmium Plated Steel: 1/2-inch raised industrial type with openings appropriate for device installed.
- D. Receptacle Weatherproof: Gasketed cast aluminum, double lift, cover mounted horizontally with hinges up, 3-1/4-inch internal depth, lockable. UL listed for wet locations with cord plug inserted. Red Dot Code Keeper Extra-Duty While-in-Use Cover series, or equal.
- E. Switch Weatherproof: Gasketed cast aluminum switch operator. Appleton FSK series.
- F. Tamperproof: Flush cast aluminum locking cover plate, cylinder type lock, master keyed, Pass & Seymour 4600 series.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Devices and finish plates shall be installed plumb with building lines. Wall-mounted receptacles shall be installed vertically at the centerline height shown on the drawings.
- B. Install finish plates and devices after final painting is complete. Scratched or splattered finish plates and devices will not be accepted.
- C. Special plugs, such as cord caps furnished with the receptacles, shall be furnished in their cartons.

3.2 COORDINATION

- A. The drawings indicate the approximate location of all devices. Refer to architectural elevations, sections, and details for exact locations.
- B. Work with the equipment installer to coordinate the locations and methods of connection to devices mounted in or near cabinets, counters, benches and similar equipment.

3.3 FIELD TESTING

- A. Receptacles shall be tested for line-to-neutral, line-to-ground and neutral-to-ground faults. Correct any defective wiring.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide switches as indicated on the drawings, in the specifications and where required by the National Electrical Code, even though not indicated. Provide fused or non-fused switches as shown on the drawings and as required by equipment manufacturer or circuit requirements.
- B. This section describes the following individually mounted, enclosed switches and circuit breakers:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers.
 - 4. Molded-case switches.
 - 5. Low-voltage and current-limiting fuses
 - 6. Enclosures.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 260529, Hangers and Supports for Electrical Systems
- B. Section 260553, Identification for Electrical Systems

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. HD: Heavy duty.
- C. RMS: Root mean square.
- D. SPDT: Single pole, double throw.

1.4 REFERENCES

- A. CFR: Code of Federal Regulations
 - 1. 29 CFR 1910.7: Definition and Requirements for a Nationally Recognized Testing Laboratory
- B. NEC: National Electric Code
- C. NECA: National Electrical Contractors Association
 - 1. NECA 1: Standard Practice of Good Workmanship in Electrical Construction

- D. NEMA: National Electrical Manufacturers Association
 - 1. NEMA FU 1: Low-Voltage Cartridge Fuses
 - 2. NEMA PB 1.1: General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 V or Less
 - 3. NEMA PB 2.1: General Instructions for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 V or Less
- E. NETA: International Electrical Testing Association
 - 1. NETA ATS: Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems
- F. NFPA: National Fire Protection Association
 - 1. NFPA 70: National Electric Code
- G. OR-OSHA: Oregon Occupational Safety and Health Administration
- H. UL: Underwriters Laboratories
 - 1. UL 198C: Standard for Safety for High-Interrupting-Capacity Fuses, Current-Limiting Types
 - 2. UL 198D: Class K Fuses
 - 3. UL 198E: Class R Fuses
 - 4. UL 198H: Class T Fuses

1.5 SUBMITTALS

- A. Product Data: Submit 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, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current rating.
 - 4. UL listing for series rating of installed devices.
 - 5. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Field quality-control test reports including the following:
 - 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.
- C. Operation and Maintenance Data: Include data for enclosed switches and circuit breakers in operation and maintenance manuals. In addition to items specified in Division 01, include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OR-OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- 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.
- D. 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.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NON-FUSIBLE SWITCHES

- A. Acceptable Manufacturers:
 - 1. General Electric Co., Electrical Distribution & Control Division.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D/Group Schneider.
 - 4. Eaton Cutler-Hammer.
 - 5. Pre-bid approved equal.
- B. Fusible Switch: NEMA KS 1, Type HD, quick-make, quick-break, dual-rated with electrical characteristics as required by the system voltage and the load served. Include clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Nonfusible Switch: NEMA KS 1, Type HD, quick-make, quick-break, dual-rated with electrical characteristics as required by the system voltage and the load served. Include lockable handle with capability to accept two padlocks and interlocked with cover in closed position.

2.2 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

- A. Acceptable Manufacturers:
 - 1. General Electric Co., Electrical Distribution & Control Division.
 - 2. Siemens Energy & Automation, Inc.
 - 3. Square D/Group Schneider.
 - 4. Eaton Cutler-Hammer.
 - 5. Pre-bid approved equal.

- B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
 - 1. 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.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 - 4. GFCI Circuit Breakers: Single- and two-pole configurations with 30-mA trip sensitivity.
- C. Molded-Case Circuit-Breaker Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
- D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- E. Molded-Case Switch Accessories:
 - 1. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and material of conductors.
 - 2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
 - 3. Auxiliary Switch: One SPDT switch with “a” and “b” contacts; “a” contacts mimic circuit-breaker contacts, “b” contacts operate in reverse of circuit-breaker contacts.

2.3 LOW-VOLTAGE AND CURRENT-LIMITING FUSES

- A. Conform to NEMA FU 1. Time delay and non-time delay options shall be as shown on the drawings.
- B. Provide equipment with a complete set of properly rated fuses when the equipment manufacturer utilizes fuses in the manufacture of the equipment, or if current-limiting fuses are required to be installed to limit the ampere-interrupting capacity of circuit breakers or equipment to less than the maximum available fault current at the location of the equipment to be installed.
- C. Fuses shall have a voltage rating of not less than the phase-to-phase circuit voltage, and shall have the time-current characteristics required for effective power system coordination.
- D. Cartridge Fuses: Cartridge fuses, current-limiting type, Class RK1,RK5,RK9 shall have tested interrupting capacity not less than 100,000 amperes. Fuse holders shall be the type that will reject Class H fuses.
 - 1. Fuses shall conform to UL 198C.

2. Class K fuses shall conform to UL 198D.
 3. Class R fuses shall conform to UL 198E.
 4. Class T fuses shall conform to UL 198H.
- E. Transformer Circuit Fuses: Transformer circuit fuses shall be Class RK1 or RK5, current-limiting, time-delay with 200,000 amperes interrupting capacity.

2.4 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
1. Outdoor Locations: NEMA 250, Type 3R.
 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.
- B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.
- C. Comply with mounting and anchoring requirements specified in Section 260529.
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 260553.
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Section 260533.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Prepare for acceptance testing as follows:
 - 1. Inspect mechanical and electrical connections.
 - 2. Verify switch and relay type and labeling verification.
 - 3. Verify rating of installed fuses.
 - 4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.
- C. Perform the following field tests and inspections and prepare test reports:
 - 1. Test mounting and anchorage devices according to requirements in Section 260529.
 - 2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
 - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

- A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.
- B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes specific lighting requirements.

1.2 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI C62.41: Surge Voltages in Low-Voltage AC Power Circuits.
 - 2. ANSI C82.2: Methods of Measurement of Fluorescent Lamp Ballasts.
 - 3. ANSI C82.11: High-Frequency Fluorescent Lamp Ballasts.
- B. FCC: Federal Communications Commission
 - 1. FCC Part 18: Industrial, Scientific, and Medical Equipment.
- C. UL: Underwriters Laboratories.
 - 1. UL 935: Standard for Fluorescent-Lamp Ballasts.
- D. IES:
 - 1. LP-8-2: The Commissioning Process Applied to Lighting and Control Systems.

1.3 SUBMITTALS

- A. "Pre-Bid Approved Equal" Submittal Requirements:
 - 1. To be considered, submit the following specific information and product samples:
 - a. A sample of each type of proposed luminaire, identical in construction and ratings to that specified.
 - b. Complete photometric data, including coefficient of utilization curve, iso footcandle curves, and distribution data in tabular form for each type of luminaire proposed.
 - c. Ballast and Power Supply (LED driver) data, including manufacturer's name, model number, wiring diagram, lamp type and watts for which the unit is capable of operating, power factor and current crest factor.
 - 2. Equality shall be determined by the following luminaire characteristics:
 - a. Performance:
 - 1) Distribution.
 - 2) Utilization.
 - 3) Average brightness/maximum brightness.
 - 4) Spacing to mounting height ratio.
 - 5) Visual comfort probability.

- b. Construction:
 - 1) Engineering.
 - 2) Workmanship.
 - 3) Rigidity.
 - 4) Permanence of materials and finishes.
- c. Installation Ease:
 - 1) Captive parts and captive hardware.
 - 2) Provision for leveling.
 - 3) Through-wiring ease.
- d. Maintenance:
 - 1) Relamping ease.
 - 2) Replacement of ballast and lamp sockets.
- e. Appearance:
 - 1) Light tightness (including but not limited to light leak, component connectivity).
 - 2) Neat, trim styling.

B. Submit the following contract submittal requirements:

- 1. Shop drawings.
- 2. Product data.
- 3. Photometric reports that include:
 - a. Candlepower distribution curves.
 - b. Coefficient of utilization table.
 - c. Zonal lumen summary.
 - d. Certification of lamp ballast compatibility.
 - e. Operation and maintenance data.
 - f. Operational sample upon request.

1.4 WARRANTY

- A. Electronic ballasts and drivers shall be warranted against defects in materials and workmanship for a minimum of five years. The warranty shall include either a \$1000 replacement labor allowance if replaced by the Port, or complete replacement including labor by an agent of the manufacturer.

1.5 QUALITY ASSURANCE

- A. General
 - 1. All fixtures and assembled components shall be new, of good quality, and be approved by and bear the label of UL for the applicable location and conditions (wet, damp, dry, etc.) or other approved testing agencies, i.e. CSA, ETL, unless otherwise specified in writing.
 - 2. All fixtures shall meet all required local, state and/or national building, electrical and energy codes and regulations.
- B. LED Fixtures:
 - 1. LED luminaire manufacturer shall have a minimum of five years' experience in the manufacture and design of LED products and systems and no fewer than one hundred North American installations.

2. Unless otherwise specified, all LED luminaires and power/data supplies shall be provided by a single manufacturer to ensure compatibility.
3. All components, peripheral devices and control software shall be provided by and shall be the responsibility of a single entity. All components shall perform successfully as a complete system and shall operate as described in the Lighting Fixture Schedule and Sequence of Operations.

1.6 RELATED SECTIONS

- A. Section 260500, Common Work Results for Electrical.
- B. Section 260519, Low Voltage Electrical Power Conductors and Cables.
- C. Section 260533, Raceway and Boxes for Electrical Systems.
- D. Section 260553, Identification for Electrical Systems.
- E. Section 260923, Lighting Control Devices.
- F. Section 262726, Wiring Devices.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Recessed luminaires shall have trims that fit neatly and tightly to the surfaces on which they are installed, without leaks or gaps. Where necessary, install heat resistant non-rubber gaskets to prevent light leaks or moisture from entering between luminaires' trim and the surface to which they are mounted.
- B. Luminaires installed under canopies, roofs, or open areas and similar damp or wet locations shall be UL listed and labeled as suitable for damp or wet locations.
- C. Aligners shall be ball type with nominally 45-degree movement either side of center. Provide white stem aligner canopies where installed in finished areas.
- D. Luminaires shall be new and complete with mounting accessories, junction boxes, wiring whips, trims, and lamps.
 1. All components shall be the specified color, have same optical qualities and meet original specification as original FA pendant component. Additional stock shall be provided thru Acuity CALS lighting and be packaged for storage in clearly marked boxes that indicate the luminaire component type and original luminaire type designation.

2.2 LAMPS

- A. LED lamps that are integral into the housing; light bars, diodes, boards and other, to be rated and tested for use in the fixture specified and compatible with the driver tested and compatible with that fixture.
- B. Color Rendering Index (CRI):
 - 1. 80 or higher for ambient lighting in common spaces.
 - 2. 90 or higher for accent lighting in common spaces.
 - 3. 95 or higher for art lighting.
 - 4. As indicated in the luminaire schedule.
- C. Correlated Color Temperature (CCT) per luminaire schedule: Color consistency not to exceed a +/- tolerance of greater than three MacAdam Ellipses over the life of the luminaire.
- D. Adjustable Lamp Mechanisms: Include aiming stops which can be permanently set to position lamp vertically and rotationally.
- E. High power LED luminaire thermally protected using one or more of the following thermal management techniques: metal core board, gap pad, and/or internal monitoring firmware.
- F. Operating Temperature:
 - 1. -22 degrees F to 115 degrees F.
 - 2. Operate below manufacturer's published die junction temperatures when operated at 1W at 350 mA in an elevated ambient of 46 degrees C.
- G. Utilize quick-connect connections to replaceable boards to meet ANSI and UL/ETL and NEMA requirements.
- H. Screw-In Base Replacement LED Lamps
 - 1. Manufacturer to provide wattage restriction label on socket, equivalent to specified wattage on LED replacement lamp.
 - 2. LED replacement lamps not to be placed in air-tight enclosures or in insulated air tight (ICAT) rated luminaire enclosures without dedicated heat dissipation and thermal management of the luminaire system.

2.3 POWER SUPPLIES (LED DRIVER)

- A. UL recognized under the component program and modular for simple field replacement.
- B. Rate for use with the LED array specified:
 - 1. Warranty array and driver as an assembly.
 - 2. 5 year full replacement, non-pro-rated warranty is required on electronic components.
- C. Luminaires requiring more than one driver are not permitted, unless specified in the luminaire schedule as an assembly.

- D. Power supplies used in enclosed and gasketed luminaires listed for use in wet locations, Type 1 construction. In custom luminaire assemblies, all driver wiring is to be “quick disconnect” style such that a failed component can be replaced in the field and the remaining components will continue to operate. This includes any specialized control protocol included in the custom assembly.
- E. Rate for the expected ambient temperature in which they are installed.
 - 1. Exterior installed power supplies rated to start the lamps at 0 degrees F.
- F. Operate for a (+/- 10 percent) supply voltage of 120V through 277VAC at 60Hz.
- G. Power Factor: 0.9 minimum.
- H. Lifetime minimum:
 - 1. 50,000 hours at full load and 77 degrees F ambient.
 - 2. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
- I. Minimum time between failures (MTBF) greater than 300,000 hours at full load and 77 degrees F ambient, in accordance with MIL-HDBK-217.
- J. Driver and luminaire electronics deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10).
 - 1. Flicker index to be less than 5 percent at frequencies below 1000 Hz.
- K. Label systems using tandem wired luminaires shall be labeled accordingly. Locate label in the lamp compartment of each luminaire and identify the function of that luminaire. Do not make the label visible from room.
- L. Total Harmonic Distortion less than 20 percent and meet ANSI C82.11 maximum allowable THD requirements at full output. Imbalance current is not allowed to exceed full output THD at any point in the dimming curve.
- M. Meet or exceed $30\text{mA}^2\text{s}$ at 277VAC for up to 50Ws of load and 75A at $240\mu\text{s}$ at 277VAC for 100 watts of load.
- N. Withstand up to a 1,000V surge without impairment of performance as defined by ANSI C62.41 Category A.
- O. Housing shall have circuit diagrams and lamp connections applied thereto.
- P. Reduction of Hazardous Substances (RoHS) compliant.
- Q. Provide no light output when the analog control signal drops below 0.5 V, or the DALI/DMX digital signal calls for light to be extinguished and consume 0.5 watts or less in this standby. Control deadband between 0.5V and 0.65V included to allow for voltage variation of incoming signal without causing noticeable variation in fixture to fixture output.

- R. Support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
1. Adjustment of forward LED voltage, supporting 3V through 55V.
 2. Adjustment of LED current from 200mA to 1.05A at the 100 percent control input point in increments of 1mA.
 3. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.
- S. Remote: Driver may be remote mounted up to 300-feet depending on power level and wire gauge. Contractor to verify locations proposed with the Architect prior to any rough in.
- T. Dimming Drivers:
1. Dimming power supplies controlled by a common controller provided by the same manufacturer.
 2. Manufacturer to have minimum 5 years' experience in manufacturing of dimmable electronic lighting drivers.
 3. LED dimming to be equal in range and quality to a commercial grade incandescent dimmer. Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment.
 - a. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
 4. Provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 percent relative light output, or 100 – 1 percent light output and step to 0 percent where indicated. Driver responds similarly when raising from 0 percent to 100 percent.
 - a. Driver to be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
 5. Track evenly across multiple fixtures at light levels, and provide input signal to output light level that allow smooth adjustment over the entire dimming range.
 6. Limit inrush current.
 7. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
 8. Ability to configure a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels.
 9. Basis of Design Product: eldoLED or subject to compliance with specified requirements of this section, one of the following:
 - a. eldoLED.
 - b. Philips.
 - c. Osram Sylvania.
 - d. Tridonic.
 - e. General Electric.
 - f. Or equal.
 10. Dimming Protocols:
 - a. If not otherwise noted on the luminaire schedule, dimming LED drivers to be 0-10V.
 - 1) Must meet ESTA E1.3 for RGBW LED drivers.
 - 2) 0-10V input protected from line voltage miswire, and immune and output unresponsive to induced AC voltage on the control leads.

- U. Drivers to have additional wiring ports for future mesh network integration similar to casambi radio equipment or other similar technology.
- V. DMX drivers (if used) are to be RDM two way communication

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Luminaires shall be assembled and installed according to the manufacturers' instructions, the drawings, and these specifications.
- B. After installation, the units shall be clean and lamped with the specified lamp.
- C. Determine ceiling types in each area and provide suitable accessories and mounting frames where required for recessed luminaires. Luminaire catalog numbers do not necessarily denote specific mounting accessories for type of ceiling in which a luminaire may be installed.
- D. Lighting that is installed in removeable ceiling panels shall be installed such that the ceiling panel can be removed with the light in place in the panel.
- E. Any lighting that includes a dimming driver shall have the control wiring installed to the switch or control device regardless if the intent is to dim the light at the time of installation. This will allow the dimming to be available in the future.
- F. Wear gloves for installation of parabolic reflectors to leave luminaires clean and with every lamp in operation at the time of acceptance. If luminaires are deemed dirty at completion of the work, the Contractor shall clean them at no additional cost to the Port.
- G. Level luminaires, align in straight lines, and locate as shown on the drawings. The final decision as to adequacy of support and alignment will be given by the Port. The fixtures shall be supported by separate means from the building structure and not from the ceiling system, ductwork, piping, or other systems. Any luminaire installed on a sloped ceiling is to have adequate adjustment at the ceiling to allow the luminaire to be level with the floor below the installation. Any ball aligner or other equipment to allow this adjustment is to be included in the base bid.
- H. Aim luminaires to provide the lighting pattern for which the luminaire is designed and as directed.
- I. Manufacturer's labels or monograms shall not be visible after luminaire is installed but shall be included for future reference.
- J. When lamping tungsten halogen luminaires, wear silk gloves to insert lamps.
- K. Tungsten halogen luminaires shall not be energized during construction to prevent dust build up on lamp, socket, and lamp chamber. Lamping shall occur as last stage of construction.

3.2 FIRE RATING COVER

- A. Provide protective coverings for all luminaires recessed in fire-rated ceilings. Covering materials shall provide a UL-listed fire rating assembly for the rating of the room in which the lights are installed.
- B. Coordinate locations from the drawings.
- C. Luminaires shall be listed for use in fire-rated cover.

3.3 TESTING

- A. Test lighting circuits and meet the requirements specified in Section 260500, Common Work Results for Electrical.
- B. Lighting systems shall be operationally tested. Utilize a light meter to confirm that light levels agree favorably with the design, which was based on the luminaire specified. Light meter utilized must have been calibrated at the factory within the last 6 months, or shall be new.
- C. Should results prove unacceptable and cause is attributed to the Contractor, the costs of corrections and subsequent additional testing shall be the Contractor's responsibility.

3.4 COMMISSIONING

- A. Light Level Verification / Functional Testing:
 - 1. After final adjustments and calibration, the contractor shall include measured values of light levels for normal operation and emergency egress operation on a prescriptive grid of points as indicated in the commissioning templates for verification of light levels per , Sequence of Operations for Lighting Controls as noted on the drawings.
 - a. Measurements of light levels shall be taken by the contractor for exterior and interior circulation to occur in the typical path of travel.
 - b. Measurements of light levels for enclosed spaces with workstations or similar - application to be measured by the contractor at the task level as determined by the design team.
 - c. Light levels to be measured by the contractor in the prescriptive method as noted in Sequence of Operations for the space type. Footcandle (FC) measurements to take precedent where both FC and percentage of output (%) are indicated.
 - d. Measurements to be taken by the contractor with leveled receptor head at 36" AFF and unobstructed view of electric light source, unless otherwise noted.
 - e. Measurements to occur at night-time with no daylight contribution.

END OF SECTION 265000

SECTION 270553 - IDENTIFICATION FOR TELECOMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes labeling requirements for a complete telecommunications system, including the following.
 - 1. Horizontal link/cable.
 - 2. Telecommunication outlets.
 - 3. Telecommunications hardware.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 260500, Common Work Results for Electrical Systems
- B. Section 260553, Identification for Electrical Systems
- C. Section 271000, Structured Cabling

PART 2 - PRODUCTS

2.1 LABELS

- A. Pre-Printed: Permanent material pre-printed with black on white, with adhesive backing. Brady, 3M, or equal. No Dymo-tape or hand-written labels will be allowed. For use at the following locations:
 - 1. Telecommunication outlet faceplates.
 - 2. Individual horizontal cables.
 - 3. Rack-unit (RU) identification of network room equipment racks.

PART 3 - EXECUTION

3.1 LABEL INSTALLATION

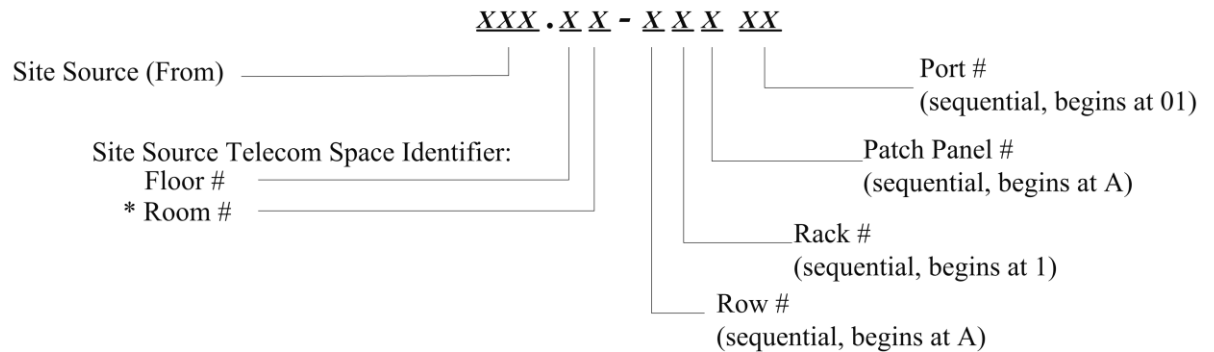
- A. Horizontal Link/Cable:
 - 1. Label each horizontal link/cable at the rear of both the outlet and patch panel locations using the appropriate cable name as indicated.
 - 2. At the outlet location, label the cable at 2 inches from the termination point. This will be visible by removing the outlet cover.
 - 3. At the patch panel location, label the cable on a visible part of the cable within 4 inches of the termination point.

- B. Telecommunication Outlet Faceplates:
1. Label each faceplate appropriately as indicated. Affix the label to the labeling area at the top of the faceplate.
 2. The port ID area of the faceplate shall reflect the equipment row, network rack number, patch panel ID and patch panel port number.

3.2 LABEL NAMING CONVENTION

A. Horizontal Link/Cable

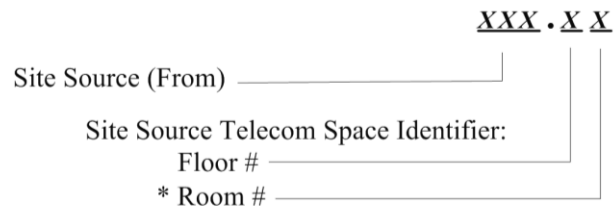
Example: **TRM.3X-A5B01**



* Confidential; Provided by Port for specific construction activity

- B. Telecommunication Outlet Faceplate Label
1. For the labeling area at the top of the faceplate:

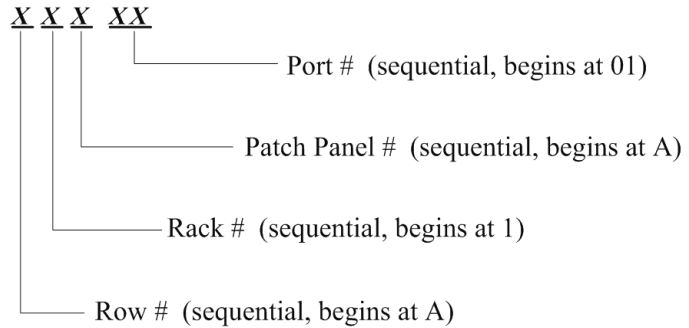
Example: **TRM.3X**



* Confidential; Provided by Port for specific construction activity

2. For the port ID area of the faceplate:

Examples: 4-port faceplate, **A5B01**, **A5B02**, **A5B03**, **A5B04** (each a minimum of 5 digits)



C. PDX

<u>Site Name</u>	<u>Abbreviation</u>
Concourse C	CCC
Concourse D	CCD
Main Terminal Bldg	TRM
Western Terminal Bldg	TRW

3.3 TELECOM SPACE IDENTIFIERS

A. PDX

<u>Site Name</u>	<u>Floor No.</u>	<u>Room No.</u> *	<u>Telecom Space Identifier</u> *
TRM	1	T1xxx	1X
	2	T2xxx	2X
	3	T3xxx	3X
TRW	1	T1Txxx	1X
	2	T2Txxx	2X
	3	T3Txxx	3X
	4	T4Txxx	4X
CCC	Tunnel	C-0x	0X
	1	C1xxx	1X
	2	C2xxx	2X
	3	C3xxx	3X
CCD	Tunnel	D-0x	0X
	1	D1xxx	1X
	2	D2xxx	2X
	3	D3xxx	3X

* There are multiple room numbers with associated telecom space identifiers not shown for security reasons. Information will be provided as required for specific construction activity.

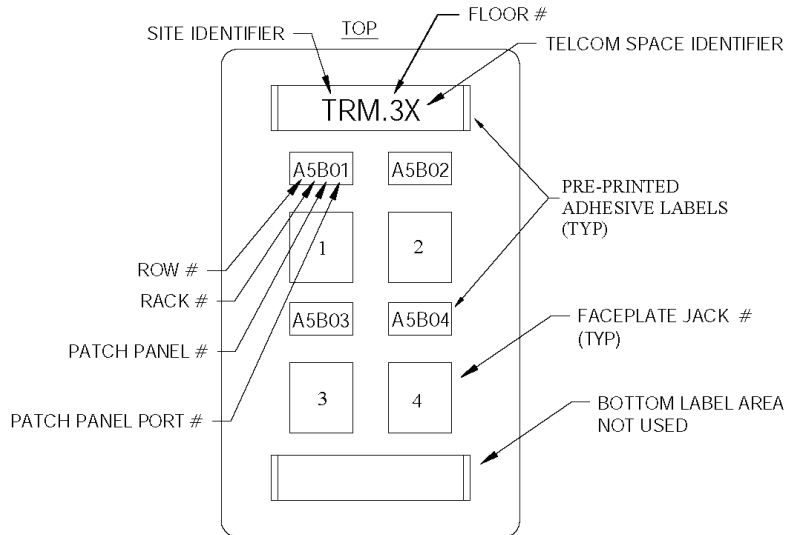
PORT STANDARDS FOR TELECOMMUNICATION LABELING

ROW/RACK/PATCH PANEL/PORT
SITE/FLOOR/SPACE

TRM.3X-A5B01

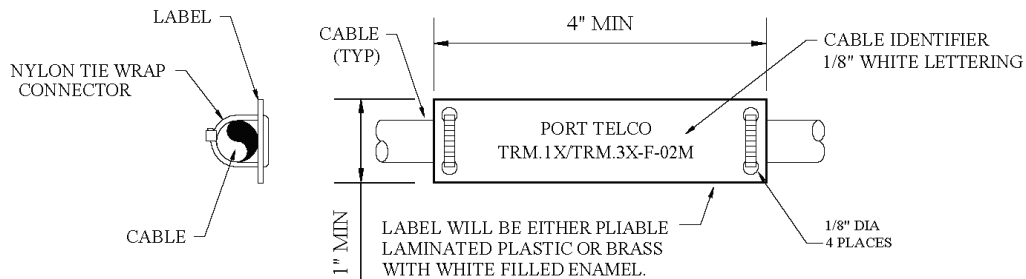
HORIZONTAL LINK/CABLE LABEL

SCALE: N.T.S.



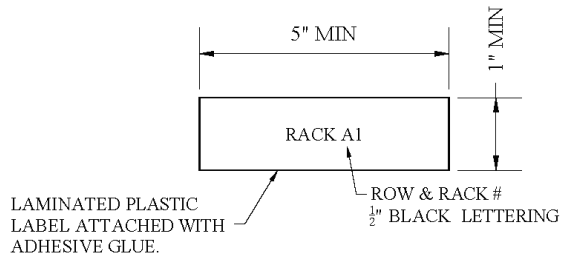
TELECOMMUNICATION OUTLET FACE PLATE

SCALE: N.T.S.



RISER/BACKBONE CABLE IDENTIFICATION

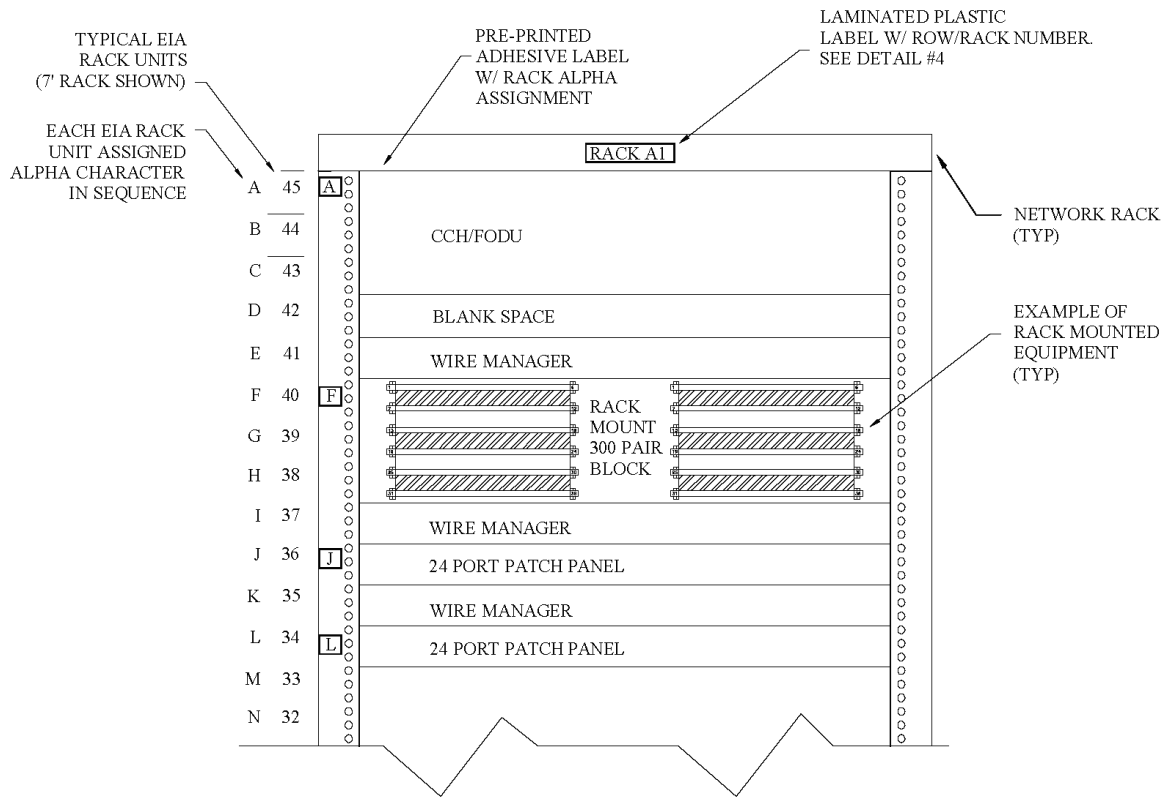
SCALE: N.T.S.



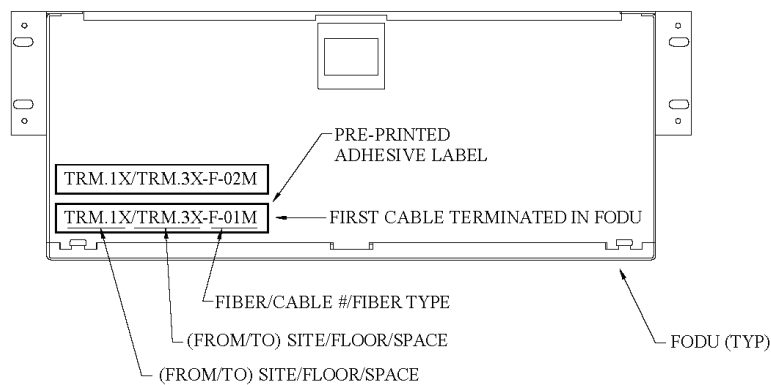
NETWORK RACK IDENTIFICATION

SCALE: N.T.S.

PORT STANDARDS FOR TELECOMMUNICATION LABELING



RACK IDENTIFICATION
SCALE: N.T.S.



FODU IDENTIFICATION
SCALE: N.T.S.

END OF SECTION 270553

SECTION 271000 – STRUCTURED CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes copper infrastructure for the communication and data network system.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 260526, Grounding and Bonding for Electrical Systems
- B. Section 260533, Raceway and Boxes for Electrical Systems
- C. Section 270553, Identification for Telecommunication Systems

1.3 REFERENCES

- A. Install equipment and materials in accordance with the applicable standards of the following organizations:
 - 1. ANSI: American National Standards Institute
 - 2. ANSI/TIA: American National Standards Institute and Telecommunications Industry Association
 - a. ANSI/TIA-568-C.1: Commercial Building Telecommunications Cabling Standard
 - b. ANSI/TIA-568-C.2: Balanced Twisted-Pair Telecommunications Cabling and Components Standard
 - c. ANSI/TIA-607-C: Generic Telecommunications Bonding and Grounding for Customer Premises
 - 3. BICSI: Building Industry Consulting Service International
 - 4. EIA: Electronic Industries Alliance
 - a. EIA-310: Cabinets, Racks, Panels, and Associated Equipment
 - 5. IBC: International Building Code
 - 6. IFC: International Fire Code
 - 7. NEC: National Electrical Code
 - 8. NEMA: National Electrical Manufacturers Association
 - 9. UL: Underwriters Laboratories

1.4 SUBMITTALS

- A. Submit product data for the following:
 - 1. Cable
 - 2. Cable management
 - 3. Patch panels
 - 4. Modular patch cords
 - 5. Jacks

6. Modular plugs
- B. Submit the quantity and lengths of modular patch cords to be provided by the Contractor in accordance with project requirements.
 - C. Shop Drawings: Prepare and submit coordination drawings detailing raceways and system components and materials in relation to other building systems and components. Drawings shall include, but not be limited to, the following:
 1. Floor plans detailing raceway and cabling installations.
 2. Enlarged network and equipment room plans showing room layouts including coordination drawings detailing all equipment to be installed by other trades within the enlarged area.
 3. Equipment rack and cabinet elevations for all termination locations.
 4. Detail drawings shall include clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
 5. Cable and equipment labeling schemes and sample labels as coordinated with the Port and in accordance Section 270553.
 6. See the drawings for completed telecommunications, backbone cabling, and horizontal cable matrix schedules. Complete these schedules upon field verification of installation locations of patch panels, racks, cabinets, etc., and submit to the Port for approval prior to commencement of work.
 - D. Submit Contractor qualifications, upon request, including:
 1. Contractor's current certification for the manufacturer's certified installer program.
 2. Manufacturer's Category 6A certifications for each technician performing installation on the project.
 3. Manufacturer's certificate of completion on the following course for each technician performing installation on the project:
 - a. Atlas-X1 Shielded Installation Training provided by Leviton Network Solutions.
 - E. Submit certified equipment calibration records performed by the equipment manufacturer stating that the equipment that will be used in the testing of copper cables installed as part of the work was calibrated within the past 6 months.
 - F. Product Data Manuals: Upon completion of the project, submit final product data manuals that include:
 1. A complete as-installed equipment list of all components installed with manufacturers' names and model numbers.
 2. A complete set of product data sheets for all products installed. Product data sheets shall be clearly marked, identifying the specific items installed.
 - G. Review of product data does not relieve the Contractor from responsibility for deviations from the drawings or specifications, unless the Contractor has, in writing, called attention to such deviations at the time of submission and obtained written approval from the Port.
 - H. As-Constructed Documents: Maintain real-time as-constructed documentation for the installed structured cabling system.
 1. Update and revise contract documents to record actual locations (as-installed) of all equipment, pull boxes, devices, raceways, cabling, outlets, and cable infrastructure components.

2. As-constructed drawings shall include:
 - a. Complete site plans, floor plans, and enlarged plans and site plans indicating placement and routing of as-installed raceways, junction boxes, racks, cabinets, cables, and communications outlet locations and types with labels and cabling facilities installed. Cabling shall include callouts detailing Port cable designation.
 - b. Complete structured cabling riser diagrams showing as-installed originations, destinations, and type of pathways for all cabling. Include cabling numbers, terminal block numbers and layouts, and other designations.
 - c. Equipment rack/cabinet and wallboard elevation drawings for each network room and cable termination location..
- I. Test Reports: The Contractor shall be responsible for recording all test data. Submit copies of all test results to the Port for review and approval no later than one week after completion of the testing.
 1. Prior to commencement of cable testing, submit a sample test report, with the assigned cable designation clearly indicated, of each test type to the Port for approval.
 2. Submit final test report schedules which confirm that the cabling infrastructure has been tested, labeled, and documented.
 3. Submit the test reports and schedules with the testing software program on CD-ROM or DVD.
- J. Submit operation and maintenance manuals. Content of each manual or chapter shall include, but not be limited to, the following:
 1. Description of system.
 2. Manufacturers' brochures. Include manufacturers' descriptive literature covering devices and equipment used in the system, together with illustrations, exploded views, and renewal parts lists. Edit the manufacturers' standard brochures so that the information applying to the actual installed equipment is clearly defined.
- K. Submit manufacturers' equipment guarantees or warranties for applicable systems and components.

1.5 QUALITY ASSURANCE

- A. The work shall be performed by Oregon Limited Energy Journeyman licensed technician(s).
- B. The structured cabling system shall be installed by a value-added reseller for the manufacturers specified and their respective products. Each of the Contractor's installing technicians shall have completed the manufacturer's training for the installation of shielded cabling systems (Atlas-X1 Shielded Installation Training) and be a certified member in good standing of the manufacturer installer program before, during, and through completion of the system installation.

1.6 WARRANTY

- A. Provide the following:
 1. Limited Lifetime Berk-Tek/Leviton materials warranty on parts and labor to repair/replace defective telecommunications copper station cabling materials and associated products.

- B. Passive components and products (cables, connectors, patch panels, and/or other associated components) shall come from the manufacturers listed above to offer an extended warranty on the structured cabling system being installed. The Contractor or the Contractor's installer shall be certified by Berk-Tek/Leviton to provide the materials warranty and shall meet all necessary requirements to make the Port eligible for the extended warranties. Upon completion, submit a certificate from the sponsoring manufacturer stating that the installed system is covered by the manufacturer's extended warranty for the minimum period applicable.
- C. The Port shall be named the owner of the warranty and guaranteed full and complete rights under the warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Communications products installed as part of this work shall be listed by a recognized testing laboratory or approved in writing by the inspection authority as required by governing codes and ordinances.
- B. Materials shall be new and of the best quality. The materials shall be manufactured in accordance with NEMA, ANSI, UL, or other applicable standards.
- C. Equipment and materials of the same general type shall be of the same manufacturer throughout the work to provide uniform appearance, operation, and maintenance.
- D. Cable jacket shall be plenum-rated and marked with the CMP designation where appropriate and as required by code for installation in plenum-rated areas.
- E. The structured cabling system components for the horizontal cabling shall consist entirely of products from CS6700 CAT6A Shielded System by Berk-Tek/Leviton, no substitutions.

2.2 HORIZONTAL CABLE – INTERIOR

- A. Horizontal cables shall be four-pair, shielded, twisted pair (F-UTP), #23 AWG solid copper conductors, paired, flame-retardant PVC jacket.
- B. Cable shall be pliant with no memory.
- C. Manufacturer: Berk-Tek LANmark-10G FTP Plenum cable (Part No. 10189548), no substitutions.
- D. Cable jacket shall be violet in color.

2.3 CABLE MANAGEMENT COMPONENTS

- A. Filler Patch Panels:
 - 1. Subsequent Patch Panels in a Rack: 1RU blank angled plate. Leviton 49254-BA1, no substitutions.

2.4 HORIZONTAL CABLE PATCH PANELS

- A. Design patch panels for installation on standard NEMA 19-inch equipment racks.
- B. Patch panels shall be certified by the manufacturer to ensure optimal channel performance of the structured cable system. Leviton Atlas-X1 Angled Shielded QuickPort 24 Port Patch Panel+ (Part No. 4S256-S24), no substitutions.

2.5 CATEGORY 6A MODULAR PATCH CORDS

- A. Provide Leviton CAT6A high-flex copper patch cords, Part No. H6A10-xxS, no substitutions.
 - 1. For field devices installed such as, but not limited to, interface terminal box (ITB) edge controllers, video surveillance cameras, flight information displays, gate operators, and biometric readers.
 - a. Provide one patch cord (installed by the Contractor) at the device end, length as required.
 - 2. For the total number of horizontal cables installed (including for field devices):
 - a. Provide one patch cord, 7 feet in length, for 60 percent of total horizontal cables installed.
 - b. Provide one patch cord, 10 feet in length, for 60 percent of total horizontal cables installed.
- B. Modular patch cords shall be certified by the manufacturer to ensure optimum channel performance for the structured cabling system. Leviton, no substitutions.
- C. Modular patch cords shall be grey in color.

2.6 JACKS

- A. Shielded jacks shall be purple, Leviton Atlas-X1 CAT6A Shielded QuickPort Connector Part No. 6ASJK-RP6, no substitutions.
- B. Unshielded jacks shall be purple, Leviton Atlas-X1 CAT6A UTP QuickPort Connector Part No. 6AUJK-RP6, no substitutions.

2.7 MODULUAR PLUGS

- A. Modular plugs shall be shielded CAT6A, tool-free, Part No. Leviton CAT6APLG-S6A, no substitutions.

2.8 OUTLETS

- A. One Port: Leviton, Part No. 41089-1IP, no substitutions, shall be used at Port-approved locations.
- B. Two Port: Leviton, Part No. 4S089-2IP, no substitutions.
- C. DIN Rail Mount: Signamax Keystone Industrial DIN Rail module, with side lids on the end units. Part Nos. KI-DIN-RMM and KI-DIN-RMM-SL, or pre-bid approved equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide services, labor, material, and components necessary for a complete and finished installation.
- B. Install equipment, patch panels, and termination blocks between 1 foot 6 inches AFF and 6 feet 6 inches AFF on equipment racks or backboards as appropriate.
- C. Install firestops and seals at penetrations through building floors, walls, or where required by fire codes.
- D. Field test cables prior to installation. Replace damaged cables.
- E. Inspect cable for sheath defects or other irregularities as it is pulled out. Upon detection of defects, stop pulling and repair or replace the cable section.
- F. Install cables continuously with no splices.
- G. Provide bonding for all equipment within telecom rooms in accordance with manufacturer's requirements.
- H. Provide vertical and horizontal cable management troughs as appropriate for the installation and as indicated on the drawings.

3.2 GROUNDING

- A. Comply with grounding specifications of EIA/TIA-607-C: Generic Telecommunications Bonding and Grounding for Customer Premises.

3.3 EQUIPMENT SUPPORT

- A. Each fastening device and support for communications equipment and racks shall be capable of supporting not less than four times the ultimate weight of the object or objects fastened to or suspended from the building structure and shall be installed to resist seismic forces as specified in the IBC for the ground motion accelerations corresponding to the project location.

- B. Powder-actuated or similar shot-in fastening devices will not be permitted for any communications work except when approved by the Port.

3.4 ALIGNMENT

- A. Install racks and equipment level and plumb, parallel with structural building lines. Communications enclosures shall fit neatly without gaps, openings, or distortion. Properly and neatly close unused openings with approved devices.
- B. Fit outlets with neat, appropriate trims, plates, or covers, without overhanging edges, protruding corners, or raw edges, to leave a finished appearance.

3.5 CUTTING AND PATCHING

- A. Include cutting, patching, and restoration of finishes. Surfaces damaged by this work shall be neatly patched and finished to match the adjacent construction, including paint or other finishes. Clean up and remove dirt and debris.
- B. Where equipment installations or connections require the installation of an access panel, provide a properly sized and installed access panel similar to those used for mechanical equipment access.
- C. Conduit fill shall not exceed NEC fill requirements.

3.6 PROTECTION OF WORK

- A. Protect communications work and equipment installed against damage by other trades, weather conditions, or any other causes. Equipment found damaged or in other than new condition will be rejected as defective.
- B. Communications equipment shall be kept covered or closed to exclude dust, dirt and splashes of plaster, cement, or paint, and shall be free of all such contamination on exterior and interior before acceptance. Enclosures and trims shall be in new condition, free of rust, scratches, and other finish defects. Properly refinish to new condition if damaged.

3.7 MAINTENANCE OF SERVICE

- A. Communication systems and equipment shall be maintained to functioning portions of the building throughout construction, during normal working hours of the building occupants. Outages to occupied areas shall be kept to a minimum and require pre-approval from the Port. The Contractor will be liable for any damages resulting from unscheduled outages or for outages not confined to the prearranged times.

3.8 HORIZONTAL CABLE

- A. Install cables in cable tray or conduit. Install conduit in accordance with Section 260533.

- B. Dress cables neatly in cable trays and tie down at corners and changes in cable tray elevation using hook and loop fastener, strap or wrap. Install cables in center spine cable tray so that the cable tray is balanced.
- C. Verify cable lengths prior to installation. Provide notification of cables exceeding 290 feet, do not install cables that exceed 290 feet without prior Port approval.
- D. Install pull string in all conduits.

3.9 TERMINATIONS

- A. Terminate horizontal cables on modular jacks inserted in patch panels, faceplates, or surface mount boxes.
- B. All four pairs of each horizontal cable shall be terminated in T568B pinout standard order on the jack.
- C. Lay out cables on the patch panel as indicated on the cable matrix drawings.

3.10 TESTING

- A. Upon completion, test systems to show that equipment installed operates as designed and specified. Submit testing plans for review prior to testing. Plan system tests for as many at one time as possible to work into construction phasing. The Port may witness tests at its option and if so, schedule tests 48 hours in advance.
- B. A written record of performance tests shall be compiled, dated, witnessed, and submitted along with operating and maintenance data, prior to substantial completion.
- C. Test reports shall certify that wiring is complete, passes all test criteria, is fully operational, and that the work has been completed as specified.
- D. Provide all forms, instrumentation and test equipment, loads, and other consumables required.
- E. Copper CAT6A Horizontal Cable Testing:
 - 1. Test after jacks are inserted and faceplates correctly mounted and labeled.
 - 2. Following the final inspection tests and certification by the Contractor, post-certification may be performed through an independent field verification program or testing service. The Port, at its discretion, may require the Contractor to return to the site, at no additional cost to the Port, to assist with the determination of any certification discrepancies. If such a determination finds the materials, installation procedures, or final testing procedures to be out of compliance with this contract, the Contractor shall remedy the cause and re-test, at no additional cost to the Port.
 - 3. Test copper cables with test equipment designed to substantiate compliance with ANSI/TIA568-C.2. If the test equipment permits, program into the tester "Port of Portland" as the name of "Owner" and the correct cable number under "Circuit ID" appearing on each cable report page. Retain test results and submit.

4. Perform channel tests on horizontal cables and provide test results on the following electrical signal characteristics:
 - a. Wire Map
 - b. Length
 - c. Resistance
 - d. Propagation Delay
 - e. Delay Skew
 - f. Insertion Loss
 - g. Return Loss
 - h. Near-End Crosstalk (NEXT)
 - i. Powersum Near-end Crosstalk (PSNEXT)
 - j. Attenuation to Crosstalk Ratio Near-End (ACRN)
 - k. Powersum Attenuation to Crosstalk Ratio Near-End (PSACRN)
 - l. Attenuation to Crosstalk Ratio Far-End (ACRF)
 - m. Powersum Attenuation to Crosstalk Ratio Far-End (PSACRF)
5. Test cables to meet ANSI/TIA-568-C.2 standards on the permanent link, equipment outlet to patch panel. The cable installation and products will be deemed acceptable if the Contractor provides documentation substantiating compliance with the electrical signal characteristics of the ANSI/TIA-568-C.2 specifications for horizontal cables.
6. Approved CAT6A tester is Fluke Versiv with DSX5000 module, or equal.
7. Correct or replace copper cables and related hardware that fail the acceptance test. Re-test, as outlined in the testing procedures, cables requiring corrective action to meet compliance.
8. Submit cable test equipment reports on a compact disc using the latest version of the test equipment manufacturer's software, as well as a printed paper copy, for approval. Provide a copy of the test equipment manufacturer's most current release of the test equipment software to allow reading of the test data.

END OF SECTION 271000

SECTION 275116 - PUBLIC ADDRESS SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes a complete public address (PA) system that interfaces with the existing PDX public address system. A centralized public address and paging system will be used to broadcast and distribute flight and passenger information and background music (where appropriate) to all publicly accessible areas located in the PDX TCORE renovation and expansion areas.
- B. All components of the system shall be controllable through a microprocessor-based announcement control system that interfaces with the main airport paging system.
- C. Announcement and paging shall be provided to public areas zoned by function, and audio system circuiting shall allow reconfiguration and routing based on paging zone divisions and subdivisions.
- D. The paging system shall interface with the common use system. The system shall be configured so that the common use system can trigger pre-recorded boarding announcements from the paging control computer.
- E. The PA system is not a critical safety or mass notification system. It shall not be relied upon during emergency or fire situations to relay emergency messages. A separate fire alarm system shall be provided. An interface from the fire alarm system shall mute all PA inputs, which are deemed low priority during an emergency situation.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 260533, Raceway and Boxes for Electrical Systems
- B. Section 260553, Identification for Electrical Systems
- C. Section 271000, Structured Cabling
- D. Section 284600, Fire Detection and Alarm

1.3 SUBMITTALS

- A. Submit the following:
 - 1. Pre-Design Narrative: Prepare pre-design narrative of anticipated system design which shall include:
 - a. Proposed connection points to existing terminal building public address system.
 - b. Types of components and general locations of use.

2. Shop Drawings: Prepare shop drawings of system design. Shop drawings shall be new, prepared by the Contractor using CAD and backgrounds of the tenant drawings or PDX terminal lease plot drawings if required by the Port. All shop drawings shall be the same size, as approved by the Port, with title blocks, identifying drawing number and any reference drawings. Fully dimension all plans and elevations.
 - a. Shop drawings shall include, but not be limited to, the following:
 - 1) Complete floor plans with all systems included as part of the work of this section shown, at 1/8"=1'-0" scale.
 - 2) Sections of congested areas at 1/4"=1'-0" scale.
 - 3) Controls at scale to suit controls supplier.
 - 4) Fabricated equipment at not less than 1/4"=1'-0" scale.
 - b. Shop drawings shall indicate, but not be limited to, the following:
 - 1) Conduit routing and wiring.
 - 2) Control logic and riser diagrams.
 - 3) Schematic diagrams.
 - 4) Panel and rack elevations.
 - 5) Sequence of operation.
 - c. Installation and record drawings shall consist of reproducible drawings with all outlets, devices, terminal cabinets, conduits and wiring shown. Prints of these drawings shall be submitted to the Port for approval prior to starting installation.
 - d. At the completion of the work, incorporate all deviations from the shop drawings into the reproducibles to indicate "as built" conditions. Submit these shop drawings to the Port as record drawings for the system.
3. Product data with wiring schematics.
4. System Acceptance Tests:
 - a. System acceptance tests shall not be performed until an initial system checkout and an initial testing and tuning report has been completed and formally submitted by the Contractor. The system acceptance tests consist of the following:
 - 1) Take a physical inventory of equipment on site and compare to equipment lists in the contract documents.
 - 2) Demonstrate the operation of system equipment.
 - 3) Both subjective and objective tests will be required to determine compliance with the specifications. Provide test equipment specified for these tests.
 - b. In the event further adjustment is required, or defective equipment must be repaired or replaced, tests may be suspended or continued at the option of the Port.
 - c. If the need for further adjustments becomes evident during the demonstration and testing, continue work until the installation operates properly. Continued work shall include, but not be limited to, changes to or installation of resistive pads, readjustment of loudspeaker aiming, adjustment of system equalizers, programming changes to the control system, if these adjustments are required.
5. Operation and maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

- A. Meet the following performance standards with each system, unless restricted by the published specifications of a particular piece of equipment:
 1. Audio Signal:
 - a. Signal to Noise Ratio including crosstalk: 55 dB minimum.
 - b. Total Harmonic Distortion: 0.1% maximum from 20 Hz to 20,000 Hz.

- c. Frequency Response: + 1.0 dB, 20 Hz to 20,000 Hz.
- 2. Audio Reproduction:
 - a. Signal to Noise Ratio including crosstalk: 55 dB minimum.
 - b. Total Harmonic Distortion: 1% maximum from 30 Hz to 15,000 Hz.
- 3. System Frequency Response:
 - a. The following circuits, described on PA systems drawings, shall be tested as a minimum:
 - 1) For PA circuits comprising strictly 4", 4.5" or 6" diameter loudspeakers: +/- 7 dB response from 250 Hz to 2.5 kHz as measured on axis of loudspeakers at a 6' height.
- 4. Sound Output Capability:
 - a. Provide levels of not less than 72dB continuous (78 dB peak) within the nominal coverage areas employing as test signals several different samples of recorded speech/music and via microphones applied at each system input.
 - b. Each output zone shall be adjusted at the corresponding power amplifier and using the system software so that volume levels (using an appropriate pink noise source) from zone to adjacent zone are within 3dB of each other, before any ambient noise system auto-attenuation takes place.
 - c. Loudspeakers located near microphone stations in low ceiling areas may need to be tapped down to avoid possible feedback.
- 5. Hum and Noise:
 - a. Hum and noise of the system under normal operation as observed in normal patron location shall be minimum 10dB below the background noise levels measured with the system off in each 1/3 octave band from 20Hz to 20kHz.
- 6. Monitor/Test System: Shall perform routine, automatic diagnostic tests utilizing a self-generated test tone. Refer to manufacturer's instructions and recommendations for settings.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. The Contractor shall have a proven track record and minimum 10 years' experience in PA installation and shall be able to demonstrate experience of installing system in buildings of similar or greater complexity.
 - 2. The Contractor shall be licensed with all agencies having jurisdiction over the Contractor's work.
 - 3. The Contractor, when necessary, shall be certified by a manufacturer for the installation of that manufacturer's equipment.
 - 4. The Contractor shall have an in-place support facility within 50 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.
- B. Codes: Work shall be performed in accordance with applicable requirements of governing codes, rules and regulations including the following minimum standards, whether statutory or not:
 - 1. Uniform Building Code (UBC).
 - 2. National Electric Code (NEC).
 - 3. National Fire Protection Association (NFPA).
 - 4. Federal Communications Commission (FCC).
 - 5. Code of Federal Regulations (CFR).
 - 6. Other local codes and requirements.

- C. Standards: Equipment and materials specified shall conform to the current edition of the following standards where applicable:
 - 1. UL – Underwriters' Laboratories.
 - 2. ASTM – American Society for Testing Materials.
 - 3. NEMA – National Electrical Manufacturer's Association.
 - 4. ANSI – American National Standards Institute.
 - 5. ETL – Electrical Testing Laboratories.
 - 6. EIA – Electronic Industries Association.
 - 7. TIA – Telecommunications Industry Association.
 - 8. ISO – International Standards Organization.
 - 9. Sound Systems Engineering, 2nd Ed., Davis and Davis, Howard W. Sams Co., 1987.

1.6 COORDINATION

- A. Contractor shall furnish and install equipment mounting hardware.
- B. The mounting arrangement, brackets, metalwork, grills, colors and finishes of all loudspeakers shall be approved by the Port.
- C. The locations of loudspeakers, microphones, paging stations and other equipment indicated on the Drawings are approximate. See architectural drawings for actual location of loudspeakers, paging stations, ambient noise sensors and other equipment. Coordinate on-site and prior to installation, the locations of PA loudspeakers that need be moved a distance greater than 6" away from the location shown on the PA drawings.
- D. Prior to installation, check with other trades to ensure that the equipment can be installed in its designated location without impacting other trades, and that the physical space available is adequate for installation.

1.7 WARRANTY

- A. 12 months of remote software warranty against defects in programming.
- B. 12 months of manufacturer hardware warranty for hardware items supplied by the contractor with the Port managing the hardware warranty.
- C. 12 months of software support to include:
 - 1. 24 hours a day, 7 days a week, and 365 days a year access to SITA technical assistance center.
 - 2. Software point releases.
- D. After project completion, the public address system software and hardware will be warranted for one year. Warranty to include original equipment manufacturer return to factory repair/replacement for any hardware provided by the contractor. Port personnel will remove, return, and replace the equipment with a spare, as applicable. After devices has been repaired, the manufacturer will send the repaired equipment back to the Port to replenish spare inventory.

1.8 TECHNICAL SUPPORT

- A. Provide a technician knowledgeable in the installation and operation of the project's PA System to monitor system performance during the first seven (7) days the system is in operation. The technician shall be available on call to assist with any technical or operational issues that may arise.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The PA System described within this specification is based on an extension of the existing ComNet/SITA messaging and FIS system. Paging equipment shall match recent airport-wide upgrades, making use of networked audio components provided by Harman or equal.
- B. Ceiling and wall-mounted loudspeakers shall be manufactured by Atlas, Lowell, or equal.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. General System Description
 - 1. System shall be a professional quality, multi-function system to be used primarily for transmission and broadcast of audible paging messages.
 - 2. The system will extend operation in the new public areas and revise and/or replace PA systems serving existing areas shown as renovated and will function as a subsystem to the main PA system. It will utilize existing headend equipment as illustrated in the drawing package. New and existing systems equipment shall be totally integrated and function as one single system. Contractor shall survey the existing PA system as required and shall provide all equipment and cabling necessary for a complete and upgraded system. Contractor shall upgrade existing system as required in this specification section.
 - 3. Announcements will originate from existing paging microphone/PBX phone locations.
 - 4. The system shall be entirely software driven. No analog controls may exist anywhere in the system that could allow unauthorized adjustments. This shall apply to both leased and common use areas within the scope of this specification.
 - 5. Existing microprocessors shall manage and control all system functions and hardware including microphone communication stations, announcement queuing, telephone interfaces, distribution of emergency announcements, local announcements, terminal announcements, background music distribution, announcement recording, and messaging.
 - 6. Visual display of mandatory FAA PA announcements will be via the FIS system (by others) and will integrate via network connection with the audio paging system. The ADA consultant shall review visual paging coverage and content for compliance with the most recent ADA guidelines.
 - 7. Audio and Visual Paging Control
 - a. Existing audio visual headend will operate as installed.

B. Zoning:

1. The extension of the PA system shall be divided into loudspeaker zones to allow for selection of the areas to receive broadcasts. Zones shall be divided into circuits for appropriate amplification as shown on drawings. Zone numbering follows from existing terminal, or in absence of existing zone information, shall be numbered as follows:
 - a. Zone 1: C2039
 - b. Zone 2: D2221, D2222, D2223
 - c. Zone 3: D2664, D2646, D2647, D2648, D2650
 - d. Zone 4: T1732, T1733, T1734
 - e. Zone 5: T2TC66
 - f. Zone 6: T2TD44
 - g. Zone 7: T2TQ48
 - h. Zone 8: T2TQ69
 - i. Zone 9: T2TS35
2. Loudspeaker zone numbering does not equate to, and shall not be confused with, fire detection zone numbering.
3. See drawing for detailed locations of zones and circuits.

C. Connections to other systems

1. The PA shall interface to the following systems.
 - a. Fire alarm.
 - b. PABX system – Phone system by others.
 - c. Visual paging.

D. System Inputs and Priority

1. Priorities should follow existing protocols.

E. System Security

1. Intent
 - a. All components of the signal paths from the microphone capsules to the primary transformer tapping of each loudspeaker shall be automatically and continuously monitored.
 - b. All items below are assumed to be implemented within the existing headend system. Contractor shall confirm system compliance.
2. Uninterruptible Power Supply
 - a. The system shall connect to the dedicated UPS system in the telecom room that will provide power to the PA racks in the event of a power failure of the main electrical system for a minimum duration of 10 minutes.
3. System Surveillance
 - a. All components of the signal paths from the microphone to the primary transformer tapings of all loudspeakers, defined as the 'critical signal paths', shall be automatically and continuously monitored. Surveillance shall be in segments, enabling fast identification of the fault location, e.g. input stages, routing, amplifiers, and loudspeaker lines.
 - b. The surveillance system shall be inaudible in operation.
 - c. Failure of any signal processor or other central component within a critical signal path shall result in manual substitution by airport personnel.
 - d. Failure of any amplifier channel within a critical signal path shall result in the manual substitution by airport personnel.

- e. The correct operation of the system software by any microprocessor within the system shall be monitored by internal self-checking procedures and by an appropriate monitoring (e.g. watchdog) circuit.

2.3 GENERAL EQUIPMENT AND MATERIAL REQUIREMENTS

- A. This specification defines an extension to a multi-functional PA system. Microprocessors and digital processing in the existing headend shall control the system's operation and controls.
- B. Some of the equipment listed below is part of the existing PA system and therefore not in contract (NIC) and provided by others.
- C. The PDX Restroom expansion PA system is assumed to contain the following PA components, which when integrated together with existing PA system, form a complete system for airport public address announcement and message management. The systems are assumed to meet the requirements listed in the following section, to be confirmed by the contractor. Full system should include:
 - 1. Digital signal processing.
 - 2. Power amplifiers.
 - 3. Loudspeakers.
 - 4. Cables.
- D. DIGITAL SIGNAL PROCESSING
 - 1. Networked audio and digital signal routing, equalization and gain control shall be provided with analog input cards for ambient microphone inputs as shown on drawings. BSS or equal.
- E. POWER AMPLIFIERS
 - 1. Class D power amplifiers with the following features:
 - a. Output Power: 300 watts RMS minimum per channel, as required for speaker load. 70 volt line output.
 - b. Frequency Response: 20 - 20,000 Hz +1 dB.
 - c. Total Harmonic Distortion: 0.01 percent at 1 kHz.
 - d. Built-in protection circuitry.
 - e. Rack-mountable.
 - f. Networked audio topology with auxiliary analog audio inputs as required.
 - 2. Acceptable Manufacturers: Crown DCi series, or equal.
- F. LOUDSPEAKERS
 - 1. Type PA2 paging announcement loudspeakers shall be ceiling mount units located and mounted as shown on drawings. They shall include a 4.5-inch diameter, coaxial driver loudspeaker. This loudspeaker will be a distributed constant voltage (70.7 volt) model equipped with an appropriate transformer, baffle, and backbox with mounting hardware. Frequency response of the loudspeaker will be 90 Hz to 20 kHz ± 5 dB, with a sensitivity of 90 dB measured at 1 Watt/1 Meter. The power handling shall be 32 Watts.

G. CABLES

1. Loudspeaker (where marked 16 AWG on drawings): Cabling in conduit, two conductor, stranded tinned copper, unshielded twisted pair, 16 AWG, PVC jacket. Belden 6200UE, or equal.
2. Loudspeaker (where marked 12 AWG on drawings): Cabling in conduit, two conductor, stranded tinned copper, unshielded twisted pair, 12 AWG, PVC jacket. Belden 8477, or equal.

H. SCHEDULE OF VALUES

Equipment Description	Manufacturer	Model
PA2: Ceiling Loudspeaker	Atlas IED	FAP43T-W

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install loudspeaker enclosures as required.
- B. Final loudspeaker terminations shall be made under the direct supervision of the equipment supplier.
- C. Install equipment per manufacturers' recommendations and as detailed on the drawings. Adjust loudspeaker taps for uniform sound coverage.

3.2 WIRING

- A. Install system with all conduits, outlet boxes, enclosure fittings, connectors, and accessories necessary to ensure a complete operating system in compliance with applicable codes and regulations.
- B. Install conduits, outlet pull, and junction boxes in accordance with Section 260533, Raceway and Boxes for Electrical Systems.
- C. Wire and Cable:
 1. Install all wiring in metal conduit or within equipment. Install conductors in accordance with Division 26. Cables within equipment shall be carefully cabled, laced, and tagged with E-Z code markers indicating circuit number and type. Cable runs connecting with existing system networks shall be tagged according to Port marking standard. Use markers on all power conductors at each outlet, pull box, and at each equipment enclosure.
 2. Do not install microphone wiring in any conduits carrying speaker wires.
- D. Outlet pull and junction boxes shall be labeled with "PA" permanently marked in black.

3.3 POWER AND GROUNDING

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

3.4 TESTING

- A. Test communication circuit cable and wiring for continuity, shorts, and grounds by use of an ohmmeter prior to energizing circuits.
- B. Provide all instruments, equipment, and personnel necessary for testing of electrical installations and ensure such personnel are available during final testing to make immediate adjustments. Maintain written records of all test results, with data carefully and accurately assigned to the cable identification as specified. Perform all testing in the presence of the Port unless specifically waived. Submit a copy of all test data to the Port.
- C. A factory-trained manufacturer's representative shall supervise the final testing of the system. Testing shall be subject to Audio Engineering Society Standards.
- D. Audio System:
 - 1. Loudspeaker Line Impedance: Measure the impedance at 250 Hz, 1 kHz, and 4 kHz and the resistance of each loudspeaker line leaving the sound equipment rack with the line disconnected from its normal driving source. For lines to full range distributed loudspeaker systems, measure the magnitude of impedance at 1 kHz.
 - 2. Hum and Noise Level:
 - a. Measure the hum and noise levels of the overall system for each microphone input channel and line level input channel.
 - b. Adjust gain controls for optimum signal to noise ratio so that full amplifier output will be achieved with 0 dBm at a line level input.
 - c. Terminate line level inputs with shielded resistors of 150 and 600 ohms, respectively, for these measurements.
 - d. Disconnect the loudspeaker lines and terminate the power amplifier outputs with power resistors for these measurements. The value of the load resistor shall be within 5% of the nominal load impedance of the amplifier under test. The power rating of the resistor shall equal the power rating of the amplifier.
 - 3. Frequency Response of the System:
 - a. Measure the frequency response of the audio systems as described in Part 1. Adjust gain controls and equalizers to provide the octave band sound levels as specified.
 - b. Programmable Equalizers: Provide necessary controller with full audio spectrum display for the adjustment of programmable equalizers during system checkout.
 - 4. Uniformity of Coverage: Measure octave band of pink noise test signal, centered at 4 kHz, played through loudspeaker system.
 - 5. Power Output and Signal Level Adjustment within System:
 - a. Measure the electrical distortion of the overall system for each line level input channel.
 - b. Adjust gain control as for the tests specified herein.

- c. Apply a 1 kHz sine wave signal from an oscillator having less than 0.5% total harmonic distortion at the input tested, at a level required to produce full amplifier output. Note that a pad with 150 ohm output impedance is required for driving the microphone level input in accordance with the EIA standard.
 - d. Use a distortion analyzer to measure the output level and the total harmonic distortion of the amplification and control equipment. In the absence of a distortion analyzer, a high input impedance-measuring device such as a DMM may be used to measure the output level. Lack of clipping or apparent deformation of a sine wave input signal at the power amplifier output, as seen on the oscilloscope, may serve as evidence that distortion of amplification and control equipment is within acceptable limits.
 - e. Make measurements with loads actually incurred in the system operation. Power amplifier loads shall be power resistors equal to the nominal load impedance of the output terminals used in the system.
6. Loudspeaker Polarity
- a. Perform polarity checks of loudspeaker lines by means of a polarity tester or use DC source at one end of each line and a voltmeter at the other end. Loudspeaker lines shall be identically polarized with respect to color-coding.
 - b. Test polarity of the loudspeakers using a sine wave test signal warbled about 500 Hz. The listener shall be located on axis of the loudspeaker. Switch the loudspeakers from nominally in polarity to nominally out of polarity with respect to the selected loudspeaker. With the loudspeakers in proper polarity, the quality and clarity of the music or speech should be greater, and the warble test signal should clearly come to the surrounding space from the loudspeaker.
7. Freedom From Parasitic Oscillation and Radio Frequency Pickup:
- a. With systems set up for each mode of operation specified in the functional requirements, check to ensure that systems are free from spurious oscillation and radio frequency pickup, in the absence of audio input signal and when the system is driven to full output at 100 Hz.
 - b. Employ an oscilloscope having at least 5 MHz bandwidth for these checks.
 - c. Apply slow sine wave sweep from 50 Hz to 5 kHz at a level of 6 dB below rated power amplifier output voltage to each system. Listen carefully for buzzes, rattles and objectionable distortion.
 - d. Correct causes of these defects unless the cause is clearly from other than the sound amplification system's equipment and installation, in which case bring the cause to the attention of the Contractor.
8. Acoustic gain before feedback: Locate acoustic source (4-inch loudspeaker/pink noise generator) two feet from system microphone. Measure at system microphone position and at most distant listener position at ear level. Present comparison.
9. Audio Test Signal Paths: Verify operation from source inputs (for microphones, audio tape units, video tape units, etc.) through ADAs, mixers, switchers, etc., to signal destinations.
10. Verify operational functions of the control system and interfaced devices.
11. Adjust ambient noise sensing system to meet manufacturer requirements and tolerances for accurate operation.

3.5 TRAINING

- A. Provide operation and maintenance training for Port personnel.
 - 1. Conduct a minimum of three maintenance training sessions (one for each shift). Maintenance training sessions shall include a walk-through of the completed facilities identifying the location and means of access to every device.
 - 2. Conduct training sessions for two operator levels.
 - a. Operator training. Provide a minimum of three refresher and system update training sessions (one for each shift) of on-the-job training.
 - b. Supervisor training. Provide a system update training session for supervisory functions.
 - 3. Training sessions shall be given by a fully qualified, trained representative of the equipment manufacturer who is thoroughly knowledgeable of the specific installation.

3.6 MODIFICATIONS TO EXISTING PROGRAMMING

- A. Room or Gate Number Changes: Where existing room or gate numbers are shown on the drawings to be updated, provide updates to all paging system programming to reflect the new room or gate numbers. This includes, but is not limited to all aspects of the programming such as the device databases, device and alarm descriptors, control programs, reports, user interface graphics, etc.
- B. Notify the Port upon completion of this work so that other Port-managed systems, such as computer aided dispatch, can be updated.

END OF SECTION 275116

SECTION 275129 – EMERGENCY TELEPHONE SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes emergency telephone systems.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Division 26, Electrical
- B. Division 27, Communications

1.3 REFERENCES

- A. ANSI: American National Standards Institute
- B. NEMA: National Electrical Manufacturers Association
- C. UL: Underwriters' Laboratories

1.4 SUBMITTALS

- A. Submit product data for the following:
 - 1. Emergency phones.
 - 2. Emergency beacons.
 - 3. Communication cables.
 - 4. Power cables.
- B. Submit operation and maintenance manuals.
 - 1. Content of each manual or chapter shall include, but not be limited to, the following:
 - a. Description of system.
 - b. Manufacturers' brochures.
 - 1) Include manufacturers' descriptive literature covering devices and equipment used in the system, together with illustrations, exploded views, and renewal parts lists. Manufacturers' standard brochures shall be edited so that the information applying to the actual installed equipment is clearly defined.
- C. Submit manufacturers' equipment guarantees or warranties for applicable systems and components.

1.5 QUALITY ASSURANCE

- A. The work shall be performed by Oregon Limited Journeyman Limited Energy licensed technicians.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Communications products shall meet OAR 479.720.
- B. Materials shall be new and of the best quality. The materials shall be manufactured in accordance with NEMA, ANSI, UL, or other applicable standards.
- C. Equipment and materials of the same general type shall be of the same manufacturer throughout the project to provide uniform appearance, operation, and maintenance.

2.2 MATERIALS

- A. Emergency Phone:
 - 1. Automatic noise canceling (ANC).
 - 2. Phone line powered.
 - 3. Marine grade 316 stainless steel.
 - 4. Non-volatile memory, no batteries required
 - 5. Automatically lights the "Call Connected" LED.
 - 6. Flush mounts with a double gang electrical box.
 - 7. Labeled with "PUSH FOR HELP" with Grade 2 Braille label for the visually impaired
 - 8. Approved Manufacturers: Viking E-1600-32A
- B. Emergency Beacons:
 - 1. Four programmable flash patterns.
 - 2. Polycarbonate blue lens.
 - 3. Six programmable beacon and strobe brightness settings.
 - 4. Approved manufacturers: Viking SL-2
- C. Phone Relay Module:
 - 1. Selectable relay closure times.
 - 2. Programmable access code.
 - 3. Normally open or normally closed relays.
 - 4. Approved Manufacturers: Viking RC-2A
- D. Power Supply
 - 1. Input: 115VAC.
 - 2. Transformer output: 12VDC or 24VDC selectable outputs.
 - 3. Enclosure: NEMA 1, 19 gauge steel enclosure with 3/4" and 1" knockouts.
 - 4. UL Listed
 - 5. Approved Manufacturers: Altronix AL125UL
- E. Communication Cables: CAT6A provided by Division 27.

- F. Power Cables: Copper, minimum #14 AWG, provided by Division 26.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide services, labor, material, and components necessary for a complete and finished installation.
- B. Install emergency phone system complete with housing, blue lights, power supply, and all miscellaneous items required for a complete operation system connected to the Port's communication systems.
- C. Inspect cable for sheath defects or other irregularities as it is pulled out from the reel. Upon detection of defects, stop pulling and replace the cable section.

3.2 MAINTENANCE OF SERVICE

- A. Communication systems and equipment shall be maintained to functioning portions of the building throughout construction, during normal working hours of the building occupants. Keep outages to occupied areas to a minimum and prearrange them with the Port. The Contractor will be liable for any damages resulting from unscheduled outages or for outages not confined to the prearranged times.

3.3 TESTING

- A. Upon completion, systems shall be tested to show that equipment installed operates as designed and specified. Submit testing plans for review prior to testing. Plan system tests for as many at one time as possible to work into construction phasing. Tests shall be done in the presence of the Port, and shall be scheduled 48 hours in advance.
- B. A written record of performance tests shall be compiled, dated, witnessed, and submitted along with operating and maintenance data, to the Port prior to substantial completion.
- C. Test reports shall certify that wiring is complete, passes all test criteria, is fully operational, and that the work has been completed as specified.

END OF SECTION 275129

SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes:
 - 1. Fire alarm wire and cable.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 078400, Firestopping
- B. Section 260526, Grounding and Bonding for Electrical Systems
- C. Section 260533, Raceway and Boxes for Electrical Systems
- D. Section 260553, Identification for Electrical Systems

1.3 REFERENCES

- A. BICSI: Building Industry Consulting Service International
 - 1. BICSI ITSIM Ch. 4: Pulling Cable
 - 2. BICSI ITSIM Ch. 6: Cable Termination Practices
- B. NECA: National Electrical Contractors Association
 - 1. NECA 1: Standard Practice of Good Workmanship in Electrical Construction
- C. NEMA: National Electrical Manufacturers Association
 - 1. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Max)
- D. NFPA: National Fire Protection Association
 - 1. NFPA 70: National Electric Code
 - 2. NFPA 72: National Fire Alarm and Signaling Code
 - 3. NFPA 262: Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
- E. TIA: Telecommunications Industry Association
 - 1. TIA 568-B.1: Minimum 4-Pair Sc-TP Patch Cable Bend Radius
- F. UL: Underwriters Laboratories:
 - 1. UL 83: Thermoplastic-Insulated Wires and Cables
 - 2. UL 1581: Reference Standard for Electrical Wires, Cables, and Flexible Cords
 - 3. UL 1655: Standard for Community-Antenna Television Cables
 - 4. UL 1666: Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

1.4 SUBMITTALS

- A. Submit the following materials:
 - 1. Product Data: Submit for each type of product indicated.
 - 2. For coaxial cable, submit the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
 - 3. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
 - 4. Maintenance Data: For wire and cable to include in maintenance manuals.
 - 5. Cable test data per testing requirements of Part 3.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers:
 - 1. Belden CDT Inc., Electronics Division.
 - 2. West Penn Wire/CDT, a division of Cable Design Technologies.
 - 3. Or equal.

2.2 FIRE ALARM WIRE AND CABLE

- A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- B. Initiating Device Circuits: Twisted, unshielded pair, No. 16 AWG size as recommended by system manufacturer.
- C. Speaker Circuits: Twisted, shielded pair, No. 14 AWG size as recommended by system manufacturer.
- D. Strobe Circuits: No. 12 AWG THHN, red indicating positive and black indicating negative.
- E. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 14 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated terminals.
 - 4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
 - 6. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
 - 7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
 - 8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. Pulling wire and cable into conduit or trays shall be completed without damaging or putting undue stress on the cable insulation. UL listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable. Raceway construction shall be complete, cleaned, and protected from the weather before cable is placed.
- D. Separation from EMI Sources:
 - 1. Separation between cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
 - 2. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
 - 3. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
 - 4. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
 - 5. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.2 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal raceway according to Section 260533.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.
- C. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

3.3 CONNECTIONS

- A. Comply with requirements in Section 281300 for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Section 282300 for connecting, terminating, and identifying wires and cables.
- C. Comply with requirements in Section 284600 for connecting, terminating, and identifying wires and cables.

3.4 POWDER-ACTUATED FASTENERS

- A. Powder-actuated fasteners are not allowed.

3.5 FIRESTOPPING

- A. Comply with requirements in Section 078400.

3.6 GROUNDING

- A. For low-voltage wiring and cabling, comply with requirements in Section 260526.

3.7 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and labeling of all components.
 - 3. Test cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination.
 - a. Instruments used for continuity measurements shall have a resolution of 0.1 ohms and an accuracy of better than 0.1 percent of reading plus 0.3 ohms. A 500-volt megohmmeter shall be used for insulation resistance measurements.
 - 4. Coaxial Cable Tests: Comply with requirements of TIA testing practices and procedures.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 EXISTING CIRCUITS

- A. Confirm the destination and purpose of each existing circuit before connecting to new equipment and new wiring. Connections shown on the one-line diagram drawing are the preferred connections. In any cases where drawings conflict, the conflict will be resolved by the Port.
- B. Remove existing terminations with as much existing cable as possible. Existing cable length may require different routings within manhole vaults than are shown on the drawings. Do not unnecessarily cut off any existing cable length.

END OF SECTION 280513

SECTION 280553 - IDENTIFICATION FOR FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes labeling requirements for a fire alarm system including, but not limited to, the following:
 - 1. Initiating devices.
 - 2. Input and output modules.
 - 3. Notification appliances and circuits.
 - 4. Fire alarm wire and cable.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 260500, Common Work Results for Electrical Systems
- B. Section 260553, Identification for Electrical Systems
- C. Section 284600, Fire Detection and Alarm

1.3 REFERENCES

- A. ANSI: American National Standards Institute
 - 1. ANSI Z535.4: Product Safety Signs and Labels.
- B. ISO: International Organization for Standardization.
- C. NFPA: National Fire Protection Association
 - 1. NFPA 3: Standard for Commissioning of Fire Protection and Life Safety Systems.
 - 2. NFPA 70: National Electrical Code (NEC).
 - 3. NFPA 72: National Fire Alarm and Signaling Code.
 - 4. NFPA 170: Standard for Fire Safety and Emergency Symbols.

1.4 SUBMITTALS

- A. Coordinate with the Port to obtain the latest version of the Fire Alarm Device Schedule for the project. Enter device bar codes and warranty start dates for audible and visual notification appliances and circuits into the schedule. Submit to the Port for review and approval prior to commencing work.
- B. Submit a sample UV-resistant vinyl tape label.

PART 2 - PRODUCTS

2.1 LABELS, GENERAL

- A. Pre-Printed: Permanent material pre-printed white labels with adhesive backing or wire sleeve. Brady, 3M, or equal. Dymo tape or hand-written labels are not allowed.
- B. Laminated Plastic: 3-ply laminated plastic, professionally engraved, with 1-inch high red letters. Lamicaid, or equal. Font shall be Arial in capital letters. Attach labels using appropriate adhesive glue.
- C. UV-Resistant Vinyl Tape: Self-adhesive, thermal transfer 4" x 6" UV-resistant vinyl label. White background with a 1" yellow stripe. Cascade Labeling High-Tack Industrial Label Tape, or equal.

PART 3 - EXECUTION

3.1 INITIATING DEVICES

- A. Use pre-printed labels with red text.
- B. Indicate the device logical address, which includes fire alarm control panel number, card number, and initiating device logical address (see example below), and the device barcode and serial number. After installation, place all labels on the device and in clear view and recognition from the floor level.
- C. Input and Output Modules: Place all labels on the module itself or on the bottom of the gang box cover. Do not cover LEDs.

3.2 NOTIFICATION APPLIANCES

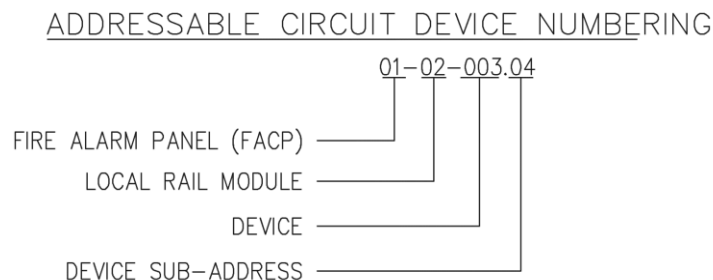
- A. Use pre-printed labels with black text.
- B. Indicate the notification appliance circuit and device position on circuit. Apply notification appliance label to the most visible part of the device. Do not cover serial numbers.

3.3 FIRE ALARM WIRE AND CABLE

- A. Label each cable with pre-printed label at 2 inches from the termination point using the appropriate cable name as indicated.
 - 1. Input cables: Pre-printed labels with red letters.
 - 2. Output cables: Pre-printed labels with black letters.
- B. Complete installation of labels prior to installation of ceiling tiles.

3.4 LABEL NAMING CONVENTION

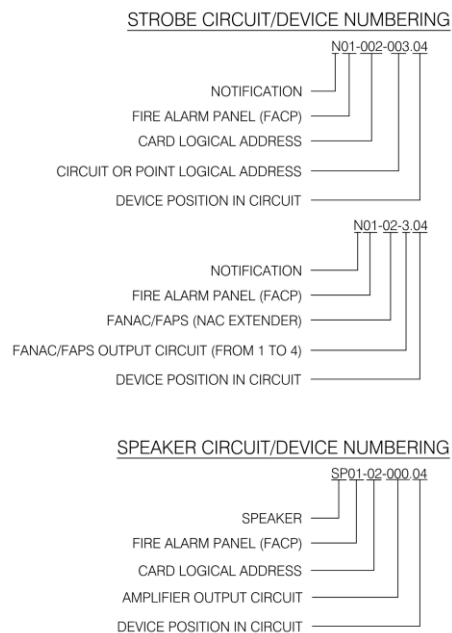
A. Addressable circuit device numbering:



B. FANAC identifier:

AREA IN FRONT OF THIS ELECTRICAL PANEL MUST BE KEPT CLEAR FOR 36 INCHES AT ALL TIMES. OSHA-NEC REGULATIONS	
FANAC-PP-XX	
TBL: ACT:	Out 1: Out 2: Out 3: Out 4:
Electrical Source: Printed On: Comments:	

C. Notification appliances circuit identifier:



END OF SECTION 280553

SECTION 284600 — PDX FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide expansion and modifications to the existing Edwards EST3 fire alarm system and FireWorks network. Performance of the system modifications shall meet all performance aspects of the existing Edwards EST3 system in addition to the requirements stated within these specifications or shown on the drawings.
- B. Providing all system design, permits, labor, equipment, materials, installation, programming, testing, commissioning, and other services required to furnish a fully functional, code-compliant fire alarm system that is tested and accepted by the authority having jurisdiction (AHJ) and in accordance with the contract documents.

1.2 REFERENCES

- A. Abbreviations and Acronyms:
 - 1. ADA: Americans with Disabilities Act
 - 2. AED: Automated External Defibrillators
 - 3. AHJ: Authority Having Jurisdiction
 - 4. AAN: Audio Annunciation Network
 - 5. EOL: End of Line
 - 6. EFSO: Emergency Fuel Shutoff
 - 7. EPO: Emergency Power Off
 - 8. FAAP: Fire Alarm Annunciator Panel
 - 9. FACU: Fire Alarm Control Panel
 - 10. FAN: Fire Alarm Network (connecting FACUs)
 - 11. FASSP: Fire Alarm System Service Provider
 - 12. FWN: FireWorks Network (connecting servers and clients)
 - 13. HVAC: Heating Ventilating and Air Conditioning
 - 14. LCD: Liquid Crystal Display
 - 15. LED: Light Emitting Diode
 - 16. NAC: Notification Appliance Circuit
 - 17. NRTL: Nationally Recognized Testing Laboratory
 - 18. PDX: Portland International Airport
 - 19. SLC: Signal Line Circuit
- B. References:
 - 1. ANSI: American National Standards Institute
 - 2. Edwards: EST3 Seismic Application Guide
 - 3. FCC: Federal Communications Commission
 - a. FCC Part 15: Radio Frequency Devices
 - 4. IBC: International Building Code
 - 5. OSSC: Oregon Structural Specialty Code
 - 6. ISO: International Organization for Standardization

7. NICET: National Institute for Certification in Engineering Technologies
8. NFPA: National Fire Protection Association
 - a. NFPA 3: Standard for Commissioning of Fire Protection and Life Safety Systems
 - b. NFPA 70: National Electrical Code
 - c. NFPA 72: National Fire Alarm and Signaling Code
 - d. NFPA 101: Life Safety Code
 - e. NFPA 170: Standard for Fire Safety and Emergency Symbols
9. UL: Underwriters Laboratories
 - a. UL 268: Smoke Detectors for Fire Alarm systems
 - b. UL 864: Standard for Control Units and Accessories for Fire Alarm Systems
10. Port of Portland:
 - a. Fire Alarm Device Schedule
 - b. Fire Alarm Standard Symbols

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 260500, Common Work Results for Electrical
- B. Section 260533, Raceway and Boxes for Electrical Systems
- C. Section 280513, Conductors and Cables for Electronic Safety and Security
- D. Section 280553, Identification for Fire Alarm Systems

1.4 SYSTEM DESIGN REQUIREMENTS

- A. The contract documents indicate the general nature or requirements of the fire alarm system, but do not necessarily show all components required. The Contractor shall provide a complete fire alarm system design and installation, as required, to meet applicable codes, appeals, and requirements under this section. The system shall consist of, but not be limited to the following components as required:
 1. Single-coil fire alarm speakers.
 2. Audible/visual alarm devices.
 3. Smoke and Heat Detectors:
 - a. Area and duct smoke detection shall be provided in accordance with NFPA 72 requirements. In addition, smoke detection shall be provided at ducts and at the ceiling in all new spaces and rooms or where indicated on the drawings.
 - b. Heat detectors shall be provided in areas where smoke detection is not appropriate due to ambient and environmental conditions.
 - c. Provide interface with clean agent fire suppression system or pre-action fire sprinkler systems as specified in Division 21.
 4. Monitor modules, installed in a fail-safe manner, required to power and/or interconnect devices supplied under other divisions, including but not limited to:
 - a. Monitor end switches (if applicable) or status of HVAC dampers after activation.
 - b. Fire suppression supervisory and flow switches.
 - c. Automated external defibrillators (AED).
 5. Conduit and cabling.

B. Automatic Operation Functions:

1. Upon activation of any fire alarm initiating device, fuel shutdown switch, AED enclosure door switch, standalone fire suppression system, or sprinkler system water flow switch, the following shall automatically occur:
 - a. The alarm condition shall be annunciated visually by a flashing red “Common Alarm” LED in the FACU. The FACU LCD shall indicate the appropriate circuit and device in the alarm.
 - b. The alarm shall be graphically displayed on the FireWorks network.
2. Upon activation of any duct smoke detector or area smoke detector, initiate shutdown of the HVAC system(s) and close fire smoke dampers within the HVAC zone of origin to prevent smoke from spreading through the HVAC system.
3. Upon activation of a sprinkler valve supervisory switch or other supervisory condition, the following sequence shall be initiated:
 - a. The supervisory condition shall be annunciated visually by a flashing supervisory LED in the FACU. The supervisory condition shall be differentiated from a trouble condition on the circuit. The FACU LCD shall indicate the appropriate circuit and device in a supervisory condition.
 - b. The supervisory condition shall be graphically displayed on the FireWorks network.
4. Upon activation of a combination of fire sprinkler system water flow and any fire alarm initiating device within the same fire sprinkler system zone of origin, the system shall respond automatically as follows:
 - a. Activate all alarm notification appliances within the fire sprinkler zone of alarm origin. The alarm signals shall sound continuously until manually silenced by authorized personnel. It shall be possible to acknowledge the alarm at the FACU, FAAP, or FireWorks without silencing the alarm notification appliances.
 - b. Release power to secured egress doors as necessary to facilitate the evacuation of the fire sprinkler zone of alarm origin. Reapply power to secure doors immediately upon a return to normal of both alarm conditions.
 - c. Automatic alarm responses shall not depend on manual intervention by system operators, or on the performance of the FireWorks network or any component attached to it.
 - d. If communication between the FAN and FWN is interrupted for any reason, the FACUs shall continue to function in a stand-alone capacity, activating fire alarm notification appliances and other programmed operations.
5. Upon activation of a fire alarm initiation device located in an elevator lobby, machine room, or elevator shaft, initiate elevator control functions, capture the elevators cab(s), and return them to the enplaning level (Primary Elevator Recall), unless the fire is on the enplaning level, then the elevators shall be returned to the deplaning level (Alternate Recall).
 - a. Activation of a top of shaft or machine room initiating device shall cause the fireman’s hat light to flash in the elevator cab; any other activation of lobby initiation devices shall cause the fireman’s hat light to illuminate continuously.
 - b. Any activation of the recall function shall be accompanied by a continuous tone emanating from the elevator cab control panel. Upon activation of the recall function, the elevator shall remain in the recalled state until the associated FACU is reset and the proper elevator key is used to release the cab(s) to normal service.
 - c. Upon activation of either recall function, the elevator shall remain in this recalled state until the associated FACU is reset and the proper elevator key is used to release the cab(s) to normal service. Any activation of the recall function shall be accompanied by a continuous tone emanating from the elevator cab control panel.

C. Manual Operation Functions:

1. At any time, even without an alarm condition on an initiating circuit, the operator shall have the following manual capabilities at the FACU using the user interface located behind a key-locked cover:
 - a. Initiate the general alarm signal.
 - b. Silence the local audible signal. This shall also cause the LED(s) to cease flashing and to be on continuously.
 - c. Silence the alarm signals.
 - d. Disable the central station (Remote Station) transmitter.
 - e. Reset the FACU after all initiating devices have been restored to normal.
 - f. Disconnect any individual initiating or indicating circuit from the alarm sequence. This action shall light a "Disconnect" LED and cause a trouble condition.
 - g. Perform a complete operational test of the system microprocessor with a visual indication of satisfactory communications with each board.
 - h. Test all panel LEDs for proper operation without causing a change to the condition on any zone.
2. It shall be possible to command test, reset, and silence the alarm from both the FACU and the main operating console.

D. System Supervision Functions:

1. Upon application of primary power or reapplication following a power failure, the FACU shall automatically energize all circuitry and shall automatically be in a normal supervisory condition.
2. In the normal supervisory condition, only the green "Power" LED indicating the presence of primary power, and the green "Run" LED indicating the normal operation of the microprocessor and memory data, shall be illuminated. All initiating devices and notification appliance circuits shall be electrically supervised.
3. Upon power failure, the system shall sound an audible trouble signal. Standby power shall be automatically provided by the system's batteries. The system's batteries and power supply shall be sized to provide 4 hours of supervisory operation with the capability of sounding the general alarm for at least 15 minutes at any time during the 4 hours following the loss of AC power. Following restoration to normal AC power, the trouble indicators shall be automatically reset.
4. An open circuit in an initiating loop shall cause the common trouble LED at the FACU to be lighted. The trouble audible at the FACU shall sound.
5. Other circuit faults in the system shall light the common trouble LED and sound the audible trouble signal at the FACU. The LED assigned to the specific fault shall light at the FACU. Individual LEDs shall be provided for central station (Remote Station) disconnect, initiating device or notification appliances circuit disconnect, a ground fault on any extended system wiring, low battery voltage, and fault on any initiating or signaling circuit.
6. Operation of a momentary "Silence" switch shall silence the audible trouble signal, but the visual "Trouble" LEDs shall remain on until the malfunction has been corrected and the system reset. To prevent the system from being inadvertently left in an abnormal condition, the "Silence" function shall be such that a new trouble condition will re-initiate the sequence above.

1.5 SUBMITTALS

- A. Product Data: Submit a bill of materials for all products utilized. For each type of product, include furnished options and accessories.
 - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Fire Alarm Shop Drawings:
 - 1. Following approval of the pre-design narrative, prepare and submit shop drawings of the system design utilizing AutoCAD or Revit with the Port's standard fire alarm legend and current project backgrounds provided by the Port or the Contractor. Drawings shall be in accordance with the latest version of the Port's CAD and BIM Standards Manual, available for download on the Port's public website at www.portofportland.com.
 - 2. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - 3. Shop drawings shall indicate, but not be limited to, the following:
 - a. Floor plans to indicate fire alarm devices and equipment locations. Show address of all addressable devices, size and route of cable and conduits, and point-to-point wiring diagrams. Floor plans shall be legible and drawn at a scale of 1/8" = 1'-0" minimum. Coordinate with FASSP for drawing scale and drawing numbers.
 - b. Schematic and riser diagrams.
 - c. Voice/alarm signaling-service equipment amplifier power calculation and single-line connection diagram.
 - d. Include calculations for determining the requirements for:
 - 1) Spacing and sensitivity of detectors.
 - 2) Spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
 - 3) Voltage drop for NACs: Provide actual voltage measurements as a basis of calculating voltage drop on existing NACs.
 - 4) Battery sizing.
 - 5) Audio loss calculations for speaker circuits.
 - e. Sequence of operation in the form of a cross-functional matrix describing all programed functions for each individual alarm initiating device. For example, indicate specific HVAC unit(s) to be shut down, specific baggage handling control system zone(s) to be shut down, etc.
 - 4. Shop drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire alarm system design.
 - b. NICET Level IV Fire Alarm certified engineering technician.
- C. Preliminary Test Plan (PTP):
 - 1. Following approval of the shop drawings and product data, prepare and submit a preliminary testing plan. The PTP shall include the following, at a minimum:
 - a. A narrative description of the scope of work and the equipment to be tested.
 - b. A copy of the approved shop drawings.
 - c. A list of the equipment provided by others that is to be monitored or controlled by the fire alarm system including, but not limited to:
 - 1) Access controlled egress doors.
 - 2) AED enclosure doors.
 - 3) Baggage handling system equipment.
 - 4) Clean agent releasing systems.

- 5) Emergency fuel shutoff switches (EFSO).
 - 6) Elevators.
 - 7) HVAC equipment such as air handling units and fire/smoke dampers.
 - 8) Passenger boarding bridge fire alarm devices.
 - 9) Sprinkler risers and heat trace controllers.
 - d. A preliminary test script for the known device types included in the scope narrative, shop drawings, and list of equipment provided by others.
 - e. A preliminary schedule showing the durations of fire alarm system testing activities including:
 - 1) Pre-testing.
 - 2) Submittal and review of the final acceptance test plan.
 - 3) Final acceptance testing to be witnessed by the Port and its representatives.
 - 4) AHJ witness testing.
- D. Final Acceptance Test (FAT) Plan and Testing Forms:
1. Following approval of the PTP, prepare and submit a final acceptance test plan and testing forms.
 2. FAT plan and forms shall be in accordance with all NFPA 72 requirements. Integrated testing shall be in accordance with NFPA 3 and NFPA 4. The test forms shall include all applicable information as described in the sample forms included in NFPA 72, Chapter 7. Following are the Port's additional submittal requirements:
 - a. Record or red-line drawings showing the as-built condition of the system.
 - b. As-installed FireWorks graphic screens.
 - c. Detailed test scripts describing all steps to be followed for each test. Include the following, at a minimum:
 - 1) Verification of all device locations, device tags or labels, and device address labels.
 - 2) Verification of proper annunciation of all initiating devices at the FACU and on FireWorks graphical displays.
 - 3) Verification of all initiating device and SLC functions including but not limited to alarm, trouble and supervisory notification.
 - 4) Verification of all notification appliances and NAC functions including but not limited to audible and visual signals, as well as circuit supervision.
 - 5) Verification of all control output functions such as HVAC shutdowns, baggage handling system shutdowns, emergency door release, elevator recall, etc.
 - d. Calculations used to determine the number of existing system devices to be tested above and beyond the devices installed or modified by the project in accordance with NFPA 72 under chapter 14 "Reacceptance Testing."
- E. System Record of Completion: Following execution of the FAT and correction of any identified deficiencies, submit completed testing forms indicating 100 percent passing results and including signatures or initials by testing personnel and witnessing personnel.
- F. Operation and Maintenance Data:
1. In addition to items specified in Section 013300, include the following:
 - a. Equipment tested.
 - b. Required frequency of testing and inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.

- e. Updated shop drawings indicating as-built conditions.
 - f. Bill of materials.
 - g. Abbreviated operating instructions for mounting at FACU and FAAP.
 - h. Certificate of completion.
 - i. Software and firmware operational documentation:
 - 1) Program Software Backup: Electronic SDU and FireWorks project files.
 - 2) Device address list.
 - 3) Screenshots of software application and modified graphic screens in electronic PDF format.
- G. PDX Maintainables Fire Alarm Drawings (AutoCAD or Revit): Upon completion of the work, submit updated sheets to the PDX Maintainable Fire Alarm drawing set showing all changes to the system.

1.6 CODES AND APPROVALS

- A. Obtain necessary approvals from local authorities for materials to be supplied, methods of installation, and system operations as required herein and by the local authorities.
- B. All electronic equipment shall conform to the requirements of FCC regulation Part 15, Section 15 governing radio frequency electromagnetic interference and be so labeled.

1.7 QUALITY ASSURANCE

- A. All fire alarm components and services under this contract shall be furnished by Convergent Technologies. No substitutions will be permitted.
- B. All components shall be listed by a qualified testing agency both in individual components and as a system and installed in accordance with NFPA and OSSC requirements.
- C. Installation shall be supervised or installed by personnel with a minimum NICET Level 2 certification. Personnel shall be trained and certified by and in good standing with the manufacturer.
- D. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All fire alarm system components furnished under this contract shall be fully addressable and compatible with the existing Port fire alarm system and shall integrate directly with the FACUs currently installed. All devices shall report fully through the FACU to the Fireworks graphic monitoring system through the FACU network or FireWorks network with no compromise to the operation, as determined by the Port. Features such as detector sensitivity analysis, status indication, device reporting, and device programming shall be fully functional as intended by the manufacturer.

2.2 MANUFACTURER

- A. All fire alarm products shall be manufactured by Edwards System Technology, no substitutions, unless otherwise noted.

2.3 INITIATING DEVICES – DETECTORS

- A. Multicriteria Smoke Detector:
 - 1. Smoke Detector:
 - a. Model: Edwards SIGA-OSHD, no substitutions.
 - 2. Duct Smoke Detector:
 - a. Model: Edwards SIGA-SD, no substitutions.
 - b. Remote Alarm LED: Edwards SIGA-LED, no substitutions.
 - c. Test Station: Edwards SIGA-DTS, no substitutions.
- B. Heat Detector:
 - 1. Fixed Temperature:
 - a. Model: Edwards SIGA-HFD, no substitutions.
 - 2. Rate of Rise Temperature:
 - a. Model: Edwards SIGA-HRD, no substitutions.
 - 3. Rate Compensation Heat Detectors:
 - a. Model: 302 series, or pre-bid approved equal.
- C. Detector Bases:
 - 1. Standard Base:
 - a. Model: Edwards SIGA-SB, no substitutions.
 - 2. Detector Base with Isolator:
 - a. Model: Edwards SIGA-IB, no substitutions.

2.4 MANUAL PULL STATIONS

- A. Intelligent, Single Action Pull Station:
 - 1. Model: Edwards SIGA-270, no substitutions.
- B. Intelligent, Double Action Pull Station:
 - 1. Model: Edwards SIGA-270, no substitutions.
- C. Pull Station, Outdoor Application:
 - 1. Model: Edwards MPSR1-SHTW-GE, no substitutions.

2.5 SIGNAL MODULES

- A. Single Input Module:
 - 1. Model: Edwards SIGA-CT1, no substitutions.
- B. Dual Input Module:
 - 1. Model: Edwards SIGA-CT2 or SIGA-MCT2, no substitutions.

- C. Single Input Signal Module:
 - 1. Model: Edwards SIGA-CC1 or SIGA-MCC1, no substitutions.
- D. Dual Input Signal Module:
 - 1. Model: Edwards SIGA-CC2 or SIGA-MCC2, no substitutions.
- E. Monitor Module:
 - 1. Model: Edwards SIGA-MM1 or SIGA-WTM, no substitutions.
- F. Control Relay Module:
 - 1. Model: Edwards SIGA-CR, SIGA-CRH or SIGA-MCR, no substitutions.

2.6 NOTIFICATION APPLIANCES

- A. All notification appliances which are supplied for the requirements of this specification shall be UL-listed for fire protective service and shall be capable of providing the “Equivalent Facilitation,” which is allowed under the Americans with Disabilities Act Accessibility Guidelines (ADA[AG]) and shall be UL 1971 and ULC S526-listed.
- B. Remote Booster Power Supplies:
 - 1. Model: Eaton, Wheelock PowerPath series, no substitutions.
 - 2. Inputs:
 - a. 120VAC with built-in battery charger and sealed lead acid, gel, or AGM type backup battery.
 - b. Capable of 2 Class A or 2 Class B NACs.
 - 3. Outputs:
 - a. Capable of 4 Class B or 2 Class A NACs. NAC outputs shall be 24VDC, 3 amps, power limited.
 - 4. Supervision:
 - a. Compatible with 12V or 24V FACU.
 - b. Automatic switchover to standby battery when AC fails.
 - c. Thermal and short-circuit protection with auto reset.
 - d. AC fail, battery presence and low battery conditions.
 - 5. Enclosure:
 - a. Minimum 14-gauge steel.
 - b. Locks: BHMA A156.11, E07121. Lock cylinders and keying where noted:
 - c. Equip locks with cylinders with full size interchangeable core pin tumbler inserts. Furnish only temporary inserts for the construction period. Permanent inserts will be furnished and installed by the Port.
- C. Self-Synchronized Strobes:
 - 1. Model: Eaton Eluxa model ELSTW (wall) and ELSTWC (ceiling), no substitutions.
 - 2. Characteristics: The strobe housing shall be white with red lettering. Strobes shall be synchronized to meet the requirements of ADA and NFPA standards. Strobes shall have lens markings oriented for wall mounting. Ceiling-mounted strobes shall have lens markings with correctly oriented lettering.

- D. Speakers:
 - 1. Model: Eaton Eluxa speaker model ELSPKW (wall) and ELSPKWC (ceiling), no substitutions.
 - 2. Characteristics: Speaker housings shall be white.
- E. Speaker/ Strobes:
 - 1. Model: Eaton Eluxa combination speaker-strobe model ELSPSTW (wall) and ELSPSTWC (ceiling), no substitutions.
 - 2. Characteristics: Speaker/strobes housing shall be white with red lettering. Strobes shall be synchronized to meet the requirements of ADA and NFPA standards. The strobe shall have lens markings oriented for wall mounting. Ceiling-mounted speaker/strobes shall have lens markings with correctly oriented lettering. Removal of an installed speaker/strobe to change the lens markings will not be acceptable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Work shall be performed in accordance with the requirements of NFPA 70 and NFPA 72.
- B. Fire alarm devices shall be accessible for periodic maintenance unless otherwise approved by the Port.
- C. Systems and system components listed to UL864 Control Units for Fire Protective Signaling Systems may be installed within a common conduit raceway system, in accordance with the manufacture's recommendations. System(s) or system components not listed to the UL864 standard shall utilize a separate conduit raceway system for each of the sub-systems.
- D. No wiring except life safety system circuits and system power supply circuits shall be permitted in the FACU enclosures.
- E. Devices containing end-of-line resistors shall be appropriately labeled. Devices shall be labeled such that removal of the device is not required to identify the EOL device.

3.2 PROTECTION AND REMOVAL OF EXISTING EQUIPMENT

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when putting into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of a new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring back to the source.
- C. Existing Fire Alarm Equipment to Remain: Provide protection for existing fire alarm equipment shown in the contract documents to remain. Where construction activities will create excessive dust, moisture, smoke, or other conditions that may damage equipment, consult with the Port to remove equipment temporarily or provide temporary protection such as plastic cover or bags.

3.3 INSTALLATION AND PROGRAMMING COORDINATION

- A. The Contractor shall schedule all fire alarm system programming downloads with the Port. The Contractor shall coordinate program downloads associated with this project with the program download requirements of other concurrent work at Portland International Airport, including, but not limited to the ongoing fire alarm system testing and maintenance functions, to minimize disruptions to the system. The Contractor shall incorporate known room number changes or corrections in the programming downloads. All programming shall be reviewed and tested prior to downloading to the existing system.
- B. Fire alarm devices shall be installed and activated within 1 calendar week of system programming and downloading the program changes to the FACU network and FWN. If devices are not activated within 1 calendar week, the Contractor shall, at its own expense, restore the system programming to the previous condition. The Contractor shall track trouble conditions due to construction activities and provide a report to the Port upon request.
- C. Notify the Port prior to FACU modifications, shutdowns, or de-energizing or energizing any fire alarm circuit.
 - 1. Work requiring de-energizing fire alarm circuits shall require 72 hours' advance notification.
- D. Safety Fire Watch: If an area defined by four or more detectors is out of service for more than 4 hours, then a fire watch shall be provided by the Contractor until the fire detection system is back in service for the specific area. If large occupied areas of the facility are not being monitored by the fire detection system, then the fire watch shall be responsible for monitoring the entire affected area on a regular basis. The purpose of the fire watch will be to notify the PDX Communications Center in the event that a fire occurs in the space. The person providing the fire watch may be a construction worker assigned to or working in the area, and shall be provided 24 hours per day, 7 days per week through the duration of the interruption.

3.4 INSTALLATION OF FIRE ALARM COMPONENTS

- A. Devices and appliances shall be mounted to or in an approved electrical box.
- B. Label system in accordance with Section 280553.
- C. Manual Pull Stations: Mount stations so that their operating handles are between 42 inches and 48 inches above the finished floor.
- D. Notification Appliances:
 - 1. Wall-mounted audio/visual devices shall be mounted so the entire lens is between 80 inches and 96 inches above the finished floor unless otherwise indicated on drawings.
 - 2. Each speaker/strobe's outputs shall be set to the wattage/candela value indicated for its specific location as shown on the drawings.
- E. Smoke Detectors:
 - 1. Smoke and heat detector heads shall not be installed until after construction clean-up is completed. Detector heads installed prior to construction clean-up shall be cleaned by the manufacturer or replaced.

2. Detectors located on the wall shall have the top of the detector at least 4 inches and not more than 12 inches below the ceiling.
 3. Install smoke detectors no closer than 3 feet from air handling supply air diffusers or return air openings.
 4. Locate detectors no closer than 12 inches from any part of a lighting fixture.
- F. Duct Smoke Detectors:
1. Install sampling tubes so they extend the full width of ducts exceeding 36 inches.
 2. Detectors shall be located to facilitate ease of maintenance.
 3. All penetrations near detectors located on/in return ducts shall be sealed to prevent air entry.
- G. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- H. Heat Detectors: Heat detectors shall be installed in strict accordance with their UL listing, the requirements of NFPA 72 and applicable manufacturer's recommendations.
- I. Control Relays:
1. Install the module within 3 feet from the device controlled.
 2. Orient the device mounting for best maintenance access.
 3. Provide a dedicated 24VDC circuit to feed all auxiliary relays required for inductive loads (auxiliary relays, door holders). Circuits shall be supervised via an end-of-line relay and addressable input module. Auxiliary relays shall not derive their power from the starter or load being controlled.
- J. Cable Installation:
1. FACU and FireWorks Networks (FAN and FWN) shall utilize NFPA 72 Class A wiring methods. AAN shall utilize NFPA 72 Class B wiring methods. Refer to Section 271000 for communication cabling requirements.
 2. NACs shall be supervised and power limited. NACs shall utilize Class B wiring methods unless otherwise indicated. Initial circuit loading shall not exceed 70 percent to allow for future system expansion. An NAC expander output shall not be used to initiate another NAC expander.
 3. SLCs shall be supervised and shall utilize NFPA 72 Class B wiring methods. SLCs shall be configurable for latched or non-latched operation and configurable to initiate alarm, supervisory, trouble, or monitor events.
 4. No T-taps will be allowed unless approved by the Port. The connection of a Port-approved T-tap shall be made under a DIN rail-mounted terminal block in an electrical enclosure and clearly labeled to indicate the circuit being tapped. The location of the tap shall be clearly indicated on the shop drawings and on the updated Fire Alarm System Maintainable Drawings.
 5. Terminations shall be made directly on the fire alarm device terminals. Connections shall be made directly to and from device terminal screws. Screw terminals shall have rising plates to terminate more than one wire, or each wire shall be terminated to individual screws or in a ring lug.
- K. Input Modules:
1. Install the module in a serviceable, conditioned location for best maintenance access. Clearly label module to indicate the device connected.
 2. Monitored device and EOL resistors shall be shown in the shop drawings.

- L. Isolation Modules: Isolation modules shall be installed on new SLCs in accordance with NFPA 72 and manufacturer's recommendation.

3.5 TRAINING

- A. Provide operation and maintenance training for Port personnel.
- B. Conduct a minimum of three maintenance training sessions (one for each shift). Maintenance training sessions shall include a walk-through of the completed facilities identifying the location, address, and means of access to every device monitored by the fire alarm system.
- C. Conduct training sessions for two operator levels.
 - 1. Operator training. Provide a minimum of three refresher and system update training sessions (one for each shift) of on-the-job training.
 - 2. Supervisor training. Provide a system update training session for supervisory functions.
- D. Training sessions shall be given by a fully qualified, trained representative of the equipment manufacturer who is thoroughly knowledgeable of the specific installation.

3.6 FINAL ACCEPTANCE TESTING AND REPORTS

- A. Upon completion of the system's installation and pre-testing, conduct a thorough installation and acceptance test of the system in accordance with the approved FAT Plan and Forms. Final acceptance testing shall be witnessed by the Port, or Commissioning Agent (CxAg), or Commissioning Authority (CxAu).
- B. Testing shall occur outside of standard business hours unless approved otherwise by the Port. Provide system record of completion with all signatures or initials once all deficiencies identified have been corrected.

3.7 AHJ TESTING

- A. Following the approval of final acceptance test by the Port, provide additional witness testing by the AHJ as required to obtain a certificate of occupancy.
- B. Notify the Port when the AHJ testing is to occur.

END OF SECTION 284600

FOR PORT USE ONLY

2026D012

CONCOURSE D ALL-USER RESTROOM REMODEL

7/16/2026

Location: PDX

PM: BRANNJ

CCM:

Type: Const.

Proj. No.: 103101

PE: FRANCB

SW: DOHERC