HGE ARCHITECTS INC

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PROJECT #22.01

PROJECT MANUAL

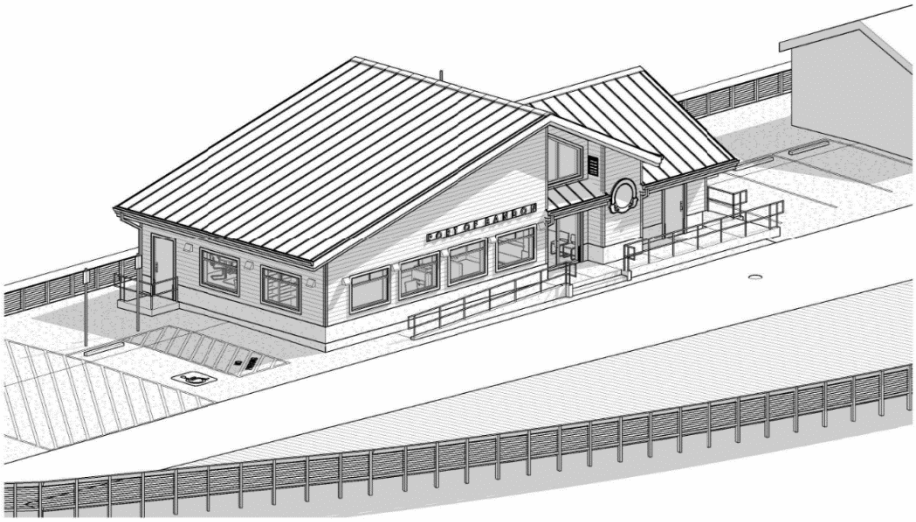
FOR

HIGH DOCK BUILDING

FOR

PORT OF BANDON

REGISTERED ARCHITECT
2840
JOSEPH A. SLACK
COOS BAY, OREGON
STATE OF OREGON



JUNE 2024

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SECTION 00-0101
PROJECT TITLE PAGE

PROJECT MANUAL

FOR:

PORT OF BANDON

HIGH DOCK BUILDING

BANDON, OREGON

DECEMBER 2023

PROJECT #22.01

PREPARED BY:

HGE ARCHITECTS, INC.

333 SOUTH 4TH STREET

COOS BAY, OREGON 97420

(541) 269-1166

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B. 32-1313 - Concrete Paving

C. 32-1713 - Parking Bumpers

D. 32-1723 - Pavement Markings

END OF SECTION

SECTION 00-1113
ADVERTISEMENT FOR QUOTES

THE PORT OF BANDON IS REQUESTING PHASE 1 SUB-QUOTES FOR THE HIGH DOCK PORT OFFICE BUILDING, AT OR BEFORE JULY 23, 2024 AT 5:00 PM.

CONSTRUCTION DOCUMENTS FOR THIS WORK MAY BE EXAMINED AT THE OFFICE OF HGE ARCHITECTS, INC., 333 S. 4TH ST., COOS BAY, OR; THE PORT OF BANDON OFFICE, 390 1ST STREET SW, BANDON, OR; OR ON THE HGE WEBSITE AT HTTPS://HGE1.COM/BIDDING-AREA/.

QUOTES MAY BE SUBMITTED TO THE ARCHITECT VIA ELECTRONICALLY: GENERAL@HGE1.COM, OR MAIL/HAND DELIVERY: HGE ARCHITECTS, INC., 333 SOUTH 4TH STREET, COOS BAY, OR, 97420. QUOTES SHALL BE IDENTIFIED AS: QUOTE FOR PORT OF BANDON HIGH DOCK BUILDING.

THE PROJECT CONSISTS OF THE CONSTRUCTION OF AN APPROXIMATELY 1,870-SQUARE-FOOT, 22 FOOT HIGH, SINGLE-STORY OFFICE BUILDING LOCATED ON THE PORT OF BANDON'S EXISTING PRECAST CONCRETE HIGH DOCK STRUCTURE. THE BUILDING IS WOOD-FRAMED WITH EXTERIOR CONCRETE STEM WALLS AND CONTAINS SINGLE-USER PUBLIC TOILET ROOMS WITH SHOWERS, OFFICES, A CONFERENCE & BREAK ROOM, STAFF TOILET ROOM, AND OTHER SUPPORT SPACES. ASSOCIATED SITE IMPROVEMENTS INCLUDE UTILITY CONNECTIONS, CONCRETE ENTRY, STEPS, RAMP, AND PARKING.

PHASE 1 BUILDING TRADES REQUESTED FOR SUB-QUOTE AT THIS TIME: CONCRETE, PLUMBING, MECHANICAL, ELECTRICAL, AND ROOFING.

NO QUOTES WILL BE CONSIDERED UNLESS FULLY COMPLETED UPON THE OFFICIAL QUOTE FORM PROVIDED BY THE ARCHITECT, WITHIN THE PROJECT MANUAL. NO QUOTE WILL BE RECEIVED OR CONSIDERED BY THE OWNER UNLESS THE SUB-CONTRACT QUOTE CONTAINS A STATEMENT THAT THEY WILL COMPLY WITH THE PROVISIONS OF ORS 279C.870 RELATING TO PREVAILING WAGES.

A NON-MANDATORY PRE-QUOTE MEETING WILL BE HELD ON THURSDAY, JULY 11, 2024, 11:00 A.M, AT THE PROJECT SITE AT 390 1ST STREET SW, BANDON, OR 97411 TO ADDRESS PROJECT QUESTIONS.

JEFF GRIFFIN, PORT MANAGER

PORT OF BANDON

BANDON WESTERN WORLD THE WORLD NEWS

JULY 5, 2024

END OF SECTION

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SECTION 00-4100
QUOTE FORM

THE PROJECT AND THE PARTIES

1.01 TO:

Owner: **PORT OF BANDON**

1.02 FOR: PORT OF BANDON - HIGH DOCK BUILDING

1.03 DATE: _____ (SUBCONTRACTOR TO ENTER DATE)

1.04 SUBMITTED BY:

NAME OF FIRM *(PLEASE PRINT)*: _____

1.05 GENERAL

A. The Subcontractor declares that they have carefully examined the Contract Documents for the construction of the proposed improvements; that the Subcontractor has personally inspected the contemplated construction area, that the Subcontractor has satisfied themselves as to the quantities of materials, items of equipment, possible difficulties, and conditions of work involved.

B. By signing this Proposal, the Subcontractor certifies that the provisions required by ORS 279C.800 to 279C.870 relating to prevailing wage rates shall be included in this Contract, are understood by the Subcontractor, and will be complied with during the Work.

C. The subcontractor(s) performing work as described in ORS 701.005(2) will be registered with the Construction Contractors Board in accordance with ORS 701.035 to 701.055 before the subcontractor(s) commence work under the Contract.

D. Subcontractor certifies that the provisions required by ORS 279C.836, unless exempt under Sections (4), (7), (8), or (9), before starting work on this Contract, or any subcontract hereunder, Contractor and all subcontractors shall have on lfile with the Construction Contractor's Board a public works bond with corporate surety authorized to do business in the State of Oregon in the amount of $30,000.

E. The Subcontractor agrees that if this Proposal is accepted, the Subcontractor will, within ten (10) calendar days after receiving contract forms, execute the Agreement between Owner and Subcontractor as specified.

1.06 QUOTES:

A. The undersigned Subcontractor, in submitting their quote, authorizes the Owner to evaluate the bid and make a single award on the basis of the bid.

B. After having examined all of the contract documents as prepared by HGE ARCHITECTS, Inc., we do hereby propose to furnish labor and materials to complete the work required by said documents for the following fixed sum *(fill in lump sum amount for each bid unit, in written words in space provided, and in numerals within parenthesis)*:

QUOTE PACKAGE 1, CONCRETE:

_____Dollars

and _____ Cents ($_____) complete.

QUOTE PACKAGE 2, PLUMBING:

_____DOLLARS

AND _____ CENTS ($_____) COMPLETE.

QUOTE PACKAGE 3, MECHANICAL:

_____DOLLARS

AND _____ CENTS ($_____) COMPLETE.

QUOTE PACKAGE 4, ELECTRICAL:

_____DOLLARS

AND _____ CENTS ($_____) COMPLETE.

QUOTE PACKAGE 5, ROOFING:

BASIC BID:

_____DOLLARS

AND _____ CENTS ($_____) COMPLETE.

ALTERNATE BID:

_____DOLLARS

AND _____ CENTS ($_____) COMPLETE.

Subcontractor further agrees to be bound by the entire Contract Documents, including:

Notice to Subcontractors
Issued Addenda
Quote Form (this document)
Contract for Construction: Owner-Contractor Agreement - AIA 101
Technical Specifications
Plans/Drawings
Issued Change Orders and Architects Supplemental Instructions
All Applicable State and Federal Laws

1.07 OWNER RIGHTS

A. The Owner reserves the right to reject any or all quotes and to waive all informalities.

1.08 ADDENDA

A. The following Addenda have been received. The modifications to the Construction Documents noted below have been considered and all costs are included in the Quoted Sum.
   1. Addendum # _____ Dated _____.
   2. Addendum # _____ Dated _____.
   3. Addendum # _____ Dated _____.

1.09 QUOTE FORM SIGNATURE(S)

A. Name of Firm *(please print):*_____

B. Mailing Address:_____

C. Physical Address *(if different):*_____

D. Construction Contractor Board Registration Number:_____

E. Telephone Number:_____

F. Fax Number:_____

G. Email Address:_____

H. Signature *(if quote is by a partnership, one of the partners must sign):*

_____

I. Name and Official Capacity of Signatory *(please print):*

_____

J. If Corporation, Attest *(Secretary of Corporation):*

_____

K. SEAL (if Corporation):

END OF SECTION

SECTION 01-1000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Port of Bandon - High Dock Building.

B. Owner's Name: Port of Bandon.

C. Architect's Name: HGE ARCHITECTS, Inc..

D. The Project consists of the construction of an approximately 1,870-square-foot, 22 foot high, single-story, building structure located on the Port of Bandon's existing precast concrete High Dock structure. The building is wood-framed with exterior concrete stem walls and contains single-user public toilet rooms with showers, offices, a conference & break room, staff toilet room, and other support spaces. Base bid on this project includes a standing seam metal roof with an alternate bid of an asphalt shingle roof. Associated site improvements include utility connections, a concrete walk with steps and ramp, and parking.

1. Quote Package 1, Concrete:
   a. This scope of work includes: underslab insulation; coordination with Plumbing & Electrical subcontractors for underslab piping and conduit placement; rebar placement; forming & pouring of concrete radiant floor slab with thickened footings connected to the existing High Dock structure as shown on Sheet A2.1 & S2.1; forming & pouring of concrete stem walls, see Sheet A5.1; forming & pouring of site concrete including steps & ramp, as shown on Sheets A1.2 & A1.3.
   b. See Structural Sheets S0.1-S7.3 and Spec Sections 03-1000 Concrete Forming and Accessories, 03-2000 Concrete Reinforcing, 03-3000 Cast-In-Place Concrete, 07-2100 Thermal Insulation, 32-1123 Aggregate Base Courses, and 32-1313 Concrete Paving. Coordinate with MEP drawings and specifications
2. Quote Package 2, Plumbing:
   a. This scope of work includes: connection to existing utilities beneath the existing High Dock structure as shown on Sheet A1.1; coordination with Concrete subcontractor for underslab conduit placement; plumbing of toilets, sinks, showers, floor drains, hosebibs, and water heaters; plumbing fixtures complete.
   b. See Plumbing Sheets P1.0 - P6.0 and Spec Sections 22-0500 Plumbing Materials and Methods, 22-0700 Plumbing Insulation, 22-1000 Plumbing Piping and Pumps, 22-3000 Plumbing Equipment, and 22-4000 Plumbing Fixtures.
3. Quote Package 3, Mechanical:
   a. This scope of work includes: installation of above-ceiling ductwork, energy recovery ventilator unit (ERV), and associated wall grilles and louvers; radiant floor system complete; installation of radiant floor system manifolds, all complete.
   b. See Mechanical Sheets M2.0 - M6.2 and Spec Sections 23-0500 HVAC Materials and Methods, 23-0548 Mechanical Sound and Vibration Control, 23-0590 Testing, Adjusting and Balancing, 23-0700 HVAC Insulation, 23-2100 Hydronic Piping and Pumps, 23-2500 HVAC Water Treatment, 23-3000 Air Distribution, 23-4000 HVAC Air Cleaning Devices, and 23-8000 Terminal HVAC Equipment.
4. Quote Package 4, Electrical:
   a. This scope of work includes: connection to existing utilities beneath the existing High Dock structure as shown on Sheet E1.0; coordination with Concrete subcontractor for underslab conduit placement; installation of lighting, power and data, complete.

b. See Electrical Sheets E1.0 - E3.0 and Spec Sections 26-0500 Basic Electrical Materials & Methods, 26-0510 Raceways, Boxes & Conductors, 26-2400 Service Entrance, Distribution and Grounding & Bonding, 26-2730 Wiring Devices, Floor Boxes & Controls, 26-5100 Lighting Fixtures, and 27-2500 Telephone and Computer Data.

5. Quote Package 5, Roofing:
   a. This scope of work includes: coordination with Owner for rough framing; installation of roof weather barriers and roof insulation; installation of standing seam metal roof (Base Bid) or hand-tabbed asphalt shingle roof (Alternate Bid) complete per Spec Section 01-2300 Alternates.
   b. See Sheet A2.4 Roof Plan, Details on Sheets A5.1 and A5.2, and Spec Sections 07-2100 Thermal Insulation, 07-2500 Weather Barriers, 07-3113 Asphalt Shingles (Alternate Bid), 07-6100 Sheet Metal Roofing (Base Bid), 07-6200 Sheet Metal Flashing and Trim, and 07-9005 Joint Sealers.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price..

1.03 WORK BY OWNER.

A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. Some items include:
   1. Movable cabinets.
   2. Furnishings.
   3. Small equipment.
   4. Dental equipment as noted.
   5. Exam tables.
   6. Phone system.

B. Owner will supply the following for installation by Contractor:
   1. Freestanding computer rack (bolted to floor and overhead braced) computer cabling patch panel.

1.04 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Arrange use of site and premises to allow:
   1. Work by Others.
   2. Work by Owner.

C. Provide access to and from site as required by law and by Owner:
   1. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Time Restrictions:
   1. Limit conduct of especially noisy exterior work to the hours of 7:30 am to 5:30 pm.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01-2300
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

1.02 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

1.03 SCHEDULE OF ALTERNATES

A. Alternate No. 1:
   1. Base Bid Item: Sheet Metal Roofing, see Section 07-6100 & Drawings. Refer to Roof Assembly description Sheet A2.4.
   2. Alternate Item: Asphalt Shingle Roofing, see Section 07-3113 & Drawings. Refer to Roof Assembly description Sheet A2.4.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01-3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

D. Submittals for review, information, and project closeout.

E. Number of copies of submittals.

F. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01-7000 - Execution and Closeout Requirements: Additional coordination requirements.

B. Section 01780 - Closeout Submittals: Project record documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. General Contractor, contractor's superintendent(s) and major subcontractors.

C. Agenda:
   1. Distribution of Contract Documents.
   2. Designation of personnel representing the parties to Contract, Owner, Contractor, and Architect.
   3. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   4. Scheduling. Contractor to present and review schedule.
   5. Submittals. Contractor shall present and review submittal log and schedule.

D. Record minutes and distribute copies within three days after meeting to participants, with emailed electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum two-week intervals.

B. Architect will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's superintendent.
   5. Major subcontractors.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Maintenance of progress schedule.
   7. Corrective measures to regain projected schedules.
   8. Planned progress during succeeding work period.
   9. Maintenance of quality and work standards.
   10. Effect of proposed changes on progress schedule and coordination.
   11. Other business relating to work.

E. Record minutes and distribute copies within three days after meeting to participants, with emailed electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01-3216

A. Submit updated schedule at each construction progress meeting.

3.04 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01-7800 - Closeout Submittals.

3.05 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01-7800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.06 SUBMITTAL PROCEDURES

A. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Do not submit (Material) Safety Data Sheets for materials or products.

B. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

C. Samples Procedures:
   1. Transmit related items together as single package.
   2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

D. Transmit each submittal with approved form.

END OF SECTION

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SECTION 01-4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing and inspection agencies and services.

B. Control of installation.

C. Defect Assessment.

1.02 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TESTING AND INSPECTION

A. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.

2. Perform specified sampling and testing of products in accordance with specified standards.
3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
   a. To provide access to Work to be tested/inspected.
   b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
   c. To facilitate tests/inspections.
   d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.03 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION

SECTION 01-7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Surveying for laying out the work.

C. Cleaning and protection.

D. Starting of systems and equipment.

E. Demonstration and instruction of Owner personnel.

F. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

G. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01-1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01-3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01-4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01-5000 - Temporary Facilities and Controls: Temporary interior partitions.

E. Section 01-5713 - Temporary Erosion and Sediment Control: Additional erosion and sedimentation control requirements.

F. Section 01-7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

G. Section 07-8400 - Firestopping.

1.03 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

1.04 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in Oregon and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.05 PROJECT CONDITIONS

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

D. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
   1. Minimize amount of bare soil exposed at one time.
   2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
   3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
   4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

E. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

G. Utilize recognized engineering survey practices.

H. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.

3. Building foundation, column locations, ground floor elevations.

J. Periodically verify layouts by same means.

K. Maintain a complete and accurate log of control and survey work as it progresses.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.04 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is 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 new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing.

D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

F. Restore work with new products in accordance with requirements of Contract Documents.

G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07-8400, to full thickness of the penetrated element.

I. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.

3. 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.

3.05 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.06 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.07 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and Owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.08 DEMONSTRATION AND INSTRUCTION

A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

C. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

3.09 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.10 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.11 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.12 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

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SECTION 01-7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

D. Evidence of Payments and Release of Liens.

1.02 RELATED REQUIREMENTS

A. Section 01-3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01-7000 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:
   1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract drawings.
   3. Contractor to submit clean set of Drawings, transfering all changes that occurred during construction from the working job set of Drawings to a clean set of Drawings. Submit to Architect for review and approval.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

F. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

G. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

H. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

I. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

J. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

K. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

L. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
   1. General Warranties:
      a. Provide one-year warranty as described in the General Conditions, Article 3.5. Warranty period shall commence on the date of the fully executed Certificate of Substantial Completion.
      b. Weather-tight warranty: The Contractor shall, and hereby does, warranty flashings, roofing, and all other work which is a component part of the roofing to be weather-tight under ordinary wear and usage for a period of two years from and after Substaintial Completion of the building. This is an extension of the general one year warranty described above. Further, the Contractor shall warranty that it will make good without delay all defects of labor and materials without additional cost to the Owner.
   2. Additional Warranties: See individual technical specification sections for written warranties for specific projects of work.
   3. Warranty period shall begin upon Substantial Completion, or if a Certificate of Substantial Completion is not issued or if Work which is to be covered by warranty is not then complete, Warranty Period shall begin upon the date of Final Acceptance or on the date appearing on the final Certificate for Payment to the Contractor, whichever is earlier.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

3.07 EVIDENCE OF PAYMENTS AND RELEASE OF LIENS

A. Submit with Final Application for Payment the following:
   1. Contractor's Affidavit of Payment of Debts and Claims: AIA G706.
   2. Contractor's Affidavit of Release of Liens: AIA G706A, with
      a. Consent of Surety to Final Payment (AIA G707) with accompanying Power of Attorney.
      b. Contractor's release or waivers of liens.
      c. Separate releases or waivers of liens for subcontractors, suppliers, and others with lien rights against property of Owner.

END OF SECTION

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SECTION 03-1000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.02 RELATED REQUIREMENTS

A. Section 03-2000 - Concrete Reinforcing.

B. Section 03-3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).

C. ACI 347R - Guide to Formwork for Concrete; 2014.

D. PS 1 - Structural Plywood; 2009.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on void form materials and installation requirements.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Chamfer outside corners of walls.

D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

E. Comply with relevant portions of ACI 301, ACI 318, and ACI 347R.

2.02 WOOD FORM MATERIALS

A. Softwood Plywood: PS 1, C Grade, Group 2.

2.03 FORMWORK ACCESSORIES

A. Form Ties: Removable type, stainless steel metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

C. Filler Strips for Chamfered Corners: Rigid plastic type; 1/2 by 1/2 inch size; maximum possible lengths.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Align joints and make watertight. Keep form joints to a minimum.

3.03 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

3.04 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

3.05 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01-4000 - Quality Requirements.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.06 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

END OF SECTION

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SECTION 03-2000
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03-3000 - Cast-in-Place Concrete.

B. Testing Agency Requirements.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).

B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.

C. ACI SP-66 - ACI Detailing Manual; 2004.

D. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

F. CRSI (DA4) - Manual of Standard Practice; 2009.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).

1. Deformed billet-steel bars.
2. Unfinished.

B. Reinforcement Accessories:
1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing as follows:
1. Supported Slabs and Joists: 3/4 inch, not exposed to ground or weather.
2. Walls (exposed to weather or backfill): 2 inch.
3. Footings and Concrete exposed to ground or weather: 3 inch.

E. Comply with applicable code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01-4000 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

END OF SECTION

SECTION 03-3000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Concrete floors and slabs.

C. Concrete stem walls.

D. Joint devices associated with concrete work.

1.02 RELATED REQUIREMENTS

A. Section 01-4000 - Quality Requirements.

B. Section 03-1000 - Concrete Forming and Accessories: Forms and accessories for formwork.

C. Section 03-2000 - Concrete Reinforcing.

D. Section 03-3511 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.

E. Section 07-9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

F. Section 32-1313 - Concrete Paving: Sidewalks, curbs and gutters.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).

D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.

F. ACI 306R - Cold Weather Concreting; 2010.

G. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.

H. ACI 347R - Guide to Formwork for Concrete; 2014.

I. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.

K. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.

L. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

M. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.

N. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

O. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2007.

P. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.

Q. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

R. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2014.

S. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.

T. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.

U. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2014.

V. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011.

W. COE CRD-C 572 - Corps of Engineers Specifications for Polyvinylchloride Waterstop; 1974.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
   1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

C. Mix Design: Submit proposed concrete mix design.

D. Test Reports: Submit report for each test or series of tests specified.

E. Sustainable Design Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 306R when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
   2. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   3. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface. Fill all voids after cones have been removed.

2.02 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 03-2000.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.

C. Lightweight Aggregate: ASTM C330/C330M.

D. Fly Ash: ASTM C618, Class C or F.

E. Calcined Pozzolan: ASTM C618, Class N.

F. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

G. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:
   1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited.
   2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   3. Manufacturers:

a. Stego Industries, LLC; Stego Wrap 15-Mil Vapor Barrier: www.stegoindustries.com/#sle.
b. Substitutions: See Section 01-6000 - Product Requirements.

2.06 BONDING AND JOINTING PRODUCTS

A. Waterstops: PVC, complying with COE CRD-C 572.
1. Configuration: As indicated on drawings.
2. Type: Ribbed Centerbulb
3. Size: Nine (9) inches.
4. Manufacturers:
a. SIKA USA; Greenstreak Flexible PVC Waterstop; usa.sika.com
b. JP Specialties, Inc.; Earth Shield PVC Waterstop; www.jpspecialties.com
c. Substitutions: See Section 01-6000 - Product Requirements.

B. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

C. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.

2.07 CURING MATERIALS

A. Moisture-Retaining Sheet: ASTM C171.
1. Curing paper, regular.

2.08 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

C. Normal Weight Concrete:
1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days:
a. 3,000 pounds per square inch at miscellaneous interior curbs and pads.
b. 4,000 psi at interior slabs on grade.
c. 4,500 psi at walls, columns, and beams exposed to weather.
2. Concrete should be a minimum of a 6-sack mix.
3. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.
4. Water-Cement Ratio: Maximum 40 percent by weight.
5. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
6. Maximum Slump: 4 inches.
7. Maximum Aggregate Size: 3/4 inch.

2.09 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

C. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Notify Architect and Owner's Independant Testing Agency not less than 24 hours prior to commencement of placement operations.

C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

3.04 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

E. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch in 10 feet.
   2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
   3. Under Carpeting: 1/4 inch in 10 feet.

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
   2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
   3. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.07 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than seven days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
   1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
   2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
      a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.
      b. Spraying: Spray water over floor slab areas and maintain wet.
      c. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.
   3. Final Curing: Begin after initial curing but before surface is dry.
      a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01-4000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

H. Slab Testing: Cooperate with manufacturer of specified moisture vapor reducing admixture (MVRA) to allow access for sampling and testing concrete for compliance with warranty requirements.

3.09 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

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SECTION 03-3511
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

B. Joint filler.

C. Clear coatings.

D. Clear penetrating sealers.

1.02 RELATED REQUIREMENTS

A. Section 03-3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

1.04 MOCK-UP

A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.

B. Mock-Up Size: 10 feet square.

C. Locate where directed.

D. Mock-up may remain as part of the work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.06 FIELD CONDITIONS

A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.

B. Do not finish floors until interior heating system is operational.

C. Maintain ambient temperature of 50 degrees F minimum.

1.07 WARRANTY

A. See Section 01-7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two-year period commencing on the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

A. Unless otherwise indicated, all concrete floors are to be finished using high gloss sealer.

B. Joint Filler:
   1. Use at following locations: Refer to Room Finish Schedule for floors noted as Concrete Sealer.
   2. Product: SPAL-PRO Heavy Duty Semi-Rigid Plyurea Joint Filler, by Metzger/McGuire, www. metzgermcguire.com, 1-800-223-MM80.
      a. Rapid setting plyurea polymer liquid of 100% solids. Hardness Shore A86-90.
      b. Suitable for Industrial Concrete Floors.
      c. Tensile Strength: 970 psi.
      d. Tensile Elongation: 180%.
      e. Adhesion to Concrete: 350-400 psi.
   3. Or equivalant.

C. Color Coatings:
   1. Use at following locations: Refer to Room Finish Schedule for floors noted as Concrete Sealer. Refer to below.

D. Penetrating Clear Sealer:
   1. Use at following locations: Refer to Room Finish Schedule for floors noted as Concrete Sealer. Refer to below.

2.02 COATINGS

A. High Gloss Clear Coating: Transparent, non-yellowing, water- or solvent-based coating.
   1. Composition: Acrylic polymer-based.
   2. Nonvolatile Content: 15 percent, minimum, when measured by volume.
   3. Products:
      a. Proclaim Concrete Floor Coating, Buckeye International, Inc.
         1) Cirene Concrete Sealer - spray applied or mop application. Add Buckeye "Sparkle" cleaner as needed: 1 quart/10 gallons of Cirene.
         2) Proclaim Concrete Floor Coating - 4 coats.
         3) Install rubber base after coating work is complete.
      b. PROSOCO equivalant system.
      c. Substitutions: See Section 01-6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

D. Fill all joints, crack control joints and cracks with heavy duty semi-rigid plyurea joint filler, in strict accordance with manufacturer recommendations.

E. Rubber wall base to be installed AFTER coating work is complete.

F. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

END OF SECTION

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SECTION 05-5000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

B. All exterior steel/metal fabricated items to be stainless steel. Project site is in a highly corrosive coastal environment and stainless steel materials shall be used thru-out including fabricated items, bolts, washers, nuts, and all other steel items.

1.02 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2016.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

D. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

E. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2015.

F. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

G. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

J. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.03 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Stainless Steel, General: ASTM A666, Type 304.

E. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch minimum metal thickness, 1-1/2 inch diameter.

F. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

G. Stainless Steel Finish: No. 4 Bright Polished finish.

H. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Handrails, guardrails, structural brackets, hangers, fittings: stainless steel.

2.04 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 PREPARATION

A. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.02 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

3.03 TOLERANCES

A. Maximum Offset From True Alignment: 1/4 inch.

B. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 06-1000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Exposed timber structural framing.

C. Non-structural dimension lumber framing.

D. Rough opening framing for doors, windows, and roof openings.

E. Roof & interior wall sheathing.

F. Roofing nailers.

G. Preservative treated wood materials.

H. Miscellaneous framing and sheathing.

I. Communications and electrical room mounting boards.

J. Concealed wood blocking, nailers, and supports.

K. Miscellaneous wood nailers, furring, and grounds.

L. Wall sheathing with factory applied water-resistive and air barrier sheet.

1.02 RELATED REQUIREMENTS

A. Section 06-1600 - Sheathing

B. Section 06-1500 - Wood Decking.

C. Section 06-1753 - Shop-Fabricated Wood Trusses.

D. Section 06-1800 - Glued-Laminated Construction.

E. Section 07-2500 - Weather Barriers: Air barrier over sheathing.

1.03 REFERENCE STANDARDS

A. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

B. PS 1 - Structural Plywood; 2009.

C. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; 2010.

D. PS 20 - American Softwood Lumber Standard; 2010.

E. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2004, and supplements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Stud Framing (2 by 2 through 2 by 6):
   1. Species: Douglas Fir-Larch.
   2. Grade: No. 2.

D. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16):
   1. Species: Douglas Fir-Larch.
   2. Grade: No. 2 & Btr.

E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 EXPOSED DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings.

B. Surfacing: S4S.

C. Sizes: Nominal sizes as indicated on drawings, Rough (unsurfaced).

D. Moisture Content: S-dry or MC19.

E. Small Beam and Purlin Framing (2 by 6 through 4 by 16):
   1. Species: Douglas Fir.
   2. Grade: Select.

2.04 TIMBERS FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry (23 percent maximum).

C. Beams and Posts 5 inches and over in thickness:
   1. Grade: No. 2.

2.05 CONSTRUCTION PANELS

A. Roof Sheathing : APA PRP-108/APA PRPR-108, Form B455, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Span Rating: 19/32.
   2. Thickness: 5/8 inch, nominal.
   3. Edges: square.

B. Wall Sheathing, For Interior Applications: APA PRP-108/APA PRP-108, Form B455 Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Span Rating: 24/16.
   2. Thickness: 1/2 inch, nominal.

C. Wall Sheathing, For Exterior Applications: Oriented strand board structural wood panel with factory laminated water-resistive and air barrier layer.
   1. Sheathing Panel: PS 2, Exposure 1.
      a. Size: 4 feet wide by 8 feet long.
      b. Grade: Structural 1 Sheathing.
      c. Performance Category: 1/2 PERF CAT.
      d. Span Rating: 32/16.
      e. Edge Profile: Self-spacing profile.
   2. Integral Water-Resistive and Air Barrier: Sheet material qualifying as a Grade D water resistive barrier; complying with ICC-ES AC310.
   3. Water Vapor Permeance of Water Resistive and Air Barrier: 12 to 16 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure B.
   4. Maximum Allowable Air Leakage of Assembly, complying with ASTM E2357:
      a. Infiltration: 0.0072 cfm per square foot, maximum, at a pressure differential of 1.57 pounds per square foot.
      b. Exfiltration: 0.0023 cfm per square foot, maximum, at a pressure differential of 1.57 pounds per square foot.
   5. Exposure Time: Designed to resist weather exposure for 180 days.
   6. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.
   7. Seam Tape: Manufacturer's standard pressure-sensitive, self-adhering, cold-applied, seam tape.
   8. Liquid-Applied Flashing Membrane: Gun-grade, cold-applied, silyl-terminated polyether (STPE) liquid flashing membrane compatible with sheathing/weather barrier and self-adhering seam and flashing tape, and tested as part of an assembly meeting performance requirements. Follow manufacturer's recommendation for integration with self-adhering seam and flashing tape.Hardness, Shore A, ASTM C 661: 40 to 45.Total Solids: 99 percent.Tensile Strength, ASTM D 412: 75 psi.
      a. Hardness, Shore A, ASTM C 661: 40 to 45.
      b. Total Solids: 99 percent.
      c. Tensile Strength, ASTM D 412: 75 psi.
   9. Warranty: Manufacturer's standard 30 year limited system warranty of:
      a. Performance: Panel and tape resistance to water penetration; tape adhesion.
      b. Material: Free from manufacturing defects and panel delamination.
   10. Manufacturers:
      a. Huber Engineered Woods, LLC; ZIP System Roof/Wall Sheathing and ZIP System Seam Tape: www.huberwood.com/#sle.
      b. Substitutions: See Section 01-6000 - Product Requirements.

D. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.06 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Stainless steel at all locations.

B. Joist Hangers: Stainless steel, sized to suit framing conditions.

C. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

2.07 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
   1. Manufacturers:
      a. Lonza Group: www.wolmanizedwood.com/#sle.
      b. Viance, LLC: www.treatedwood.com.
      c. Osmose, Inc: www.osmose.com.
      d. Substitutions: See Section 01-6000 - Product Requirements.
   2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative to 0.40 lb/cu ft retention.
      a. Treat lumber exposed to weather.
      b. Treat lumber in contact with roofing, flashing, or waterproofing.
      c. Treat lumber in contact with concrete.

PART 3 EXECUTION

3.01 PREPARATION

A. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

B. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.

E. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Grab bars.
   4. Towel and bath accessories.
   5. Wall-mounted door stops.
   6. Joints of rigid wall coverings that occur between studs.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
   1. Nail panels to framing; staples are not permitted.

B. Wall Sheathing at Interior Applications: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails.

C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

D. Wall Sheathing with Laminated Water-Resistive Barrier and Air Barrier: Secure to framing as recommended by manufacturer and as indicated on Structural Drawings.
   1. Install with laminated water-resistive and air barrier on exterior side of sheathing.
   2. Use only mechanically attached and drainable EIFS and exterior insulation with wall sheathing with laminated water-resistive and air barrier.
   3. Apply manufacturer's standard seam tape to joints between sheathing panels. Use tape gun or hard rubber roller as recommended by manufacturer.

3.06 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.07 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

END OF SECTION

SECTION 06-1500
WOOD DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Softwood lumber structural wood decking.

1.02 RELATED REQUIREMENTS

A. Section 06-1000 - Rough Carpentry: Bearing support.

B. Section 06-1800 - Glued-Laminated Construction.

C. Section 09-9000 - Paints and Coatings: Field finishing.

1.03 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Samples of Wood Deck Exposed To View: Submit two samples, 6 by 12 inch in size illustrating wood grain, stain, and finish.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with at least three years of documented experience and certified by AITC.

B. Installer: Company specializing in performing work of the type specified in this section with minimum 5 years of experience.

PART 2 PRODUCTS

2.01 WOOD MATERIALS

A. Wood fabricated from old growth timber is not permitted.

B. Lumber T&G Decking: Fabricated to AITC 112.
   1. Species: Match species of glued-laminated members, graded under SPIB (GR) rules as AITC Select quality.
   2. Size: 2 by 6 inches, nominal.
   3. Pattern: AITC standard beveled V-joint with single tongue and groove.
   4. Moisture Content: 15 percent, maximum.
   5. Beveled edges.

2.02 ACCESSORIES

A. Fasteners and Anchors:
   1. Fastener Type and Finish: Stainless steel, typical throughout.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that support framing is ready to receive decking.

B. Use visually straight decking only - no racking.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 INSTALLATION - BOARD DECKING

A. Install decking perpendicular to framing members using the Random Length Continuous method.

B. Engage decking tongue and groove edges.

C. Secure decking per manufacturer's requirements regarding fastener size and locations. Minimum two fasteners into bearing member, each end.

END OF SECTION

SECTION 06-1733
WOOD I-JOISTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood I-joists for roof framing.

B. Bridging, bracing, and anchorage.

1.02 RELATED REQUIREMENTS

A. Section 06-1000 - Rough Carpentry: Installation requirements for miscellaneous framing.

1.03 DESIGN REQUIREMENTS

A. Refer to structural notes/criteria in Drawings.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's literature describing materials, dimensions, allowable spans and spacings, bearing and anchor details, bridging and bracing requirements, and installation instructions; identify independent inspection agency.

C. Shop Drawings: Indicate sizes and spacing of joists, bracing and bridging, bearing stiffeners, holes to be cut (if any), and framed openings between joists.

D. Certificate: Certification by joist manufacturer that products delivered are of the same design and construction as those evaluated by the independent inspection agency.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in manufacturer's original packaging with manufacturer's name and product identification intact and legible.

B. Protect products from damage due to weather and breakage.

C. Protect joists from warping or other distortion by stacking in upright position, braced to resist movement, with air circulation under coverings and around stacks.

D. Handle individual joists in the upright position.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood I-Joists:
   1. Boise Cascade Company: www.bc.com/#sle.
   2. Georgia-Pacific Corporation: www.buildgp.com.

3. Louisiana-Pacific Corporation: www.lpcorp.com/#sle.
4. RedBuilt LLC; Redbuilt I-Joist: www.redbuilt.com//#sle.
5. Weyerhaeuser Company: www.weyerhaeuser.com/#sle.
6. Substitutions: See Section 01-6000 - Product Requirements.

2.02 MATERIALS

A. Wood I-Joists: Solid lumber top and bottom flanges and oriented strand board (OSB) webs bonded together with structural adhesive; Joints shall meet or exceed section properties of specified products as indicated on Drawings.

B. Joist Bridging: Type, size and spacing recommended by joist manufacturer.

C. Fasteners: Stainless steel, type to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that supports and openings are ready to receive joists.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 ERECTION

A. Install joists in accordance with manufacturer's instructions.

B. Set structural members level and plumb, in correct position.

C. Make provisions for erection loads and for sufficient temporary bracing to maintain structure plumb and in true alignment until completion of erection and installation of permanent bracing.

D. Install permanent bridging and bracing.

3.04 TOLERANCES

A. Framing Members: 1/2 inch maximum, from true position.

END OF SECTION

SECTION 06-1753
SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated wood trusses for roof framing.

B. Bridging, bracing, and anchorage.

1.02 RELATED REQUIREMENTS

A. Section 06-1000 - Rough Carpentry: Installation requirements for miscellaneous framing.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. TPI 1 - National Design Standard for Metal-Plate-Connected Wood Truss Construction; 2007 and errata.

C. TPI BCSI 1 - Building Component Safety Information Booklet: The Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses; 2011.

D. TPI DSB-89 - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses; 1989.

E. BCSI 1 - Building Component Safety Information Booklet: The Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses; joint publication of the Truss Plate Institute and the Wood Trust Council of America; 2008.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on plate connectors, bearing plates, and metal bracing components.

C. Shop Drawings: Show truss configurations, sizes, spacing, size and type of plate connectors, cambers, framed openings, bearing and anchor details, and bridging and bracing.
   1. Include identification of engineering software used for design.
   2. Provide shop drawings stamped or sealed by design engineer.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform design by or under direct supervision of a Professional Engineer experienced in design of this Work and licensed in Oregon.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle and erect trusses in accordance with TPI BCSI 1.

B. Store trusses in vertical position resting on bearing ends.

PART 2 PRODUCTS

2.01 TRUSSES

A. Wood Trusses: Designed and fabricated in accordance with TPI 1 and TPI DSB-89 to achieve structural requirements indicated.

2.02 MATERIALS

A. Lumber:
   1. Grade: WCLB (GR), Douglas Fir-Larch No. 2 or better .
   2. Moisture Content: Between 7 and 9 percent.
   3. Lumber fabricated from old growth timber is not permitted.

B. Steel Connectors: ASTM A666, Type 304 stainless steel; die stamped with integral teeth; thickness as indicated.

C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.03 ACCESSORIES

A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: Softwood lumber, any species, construction grade, 19 percent maximum and 7 percent minimum moisture content.

B. Fasteners: Stainless steel, type to suit application.

2.04 FABRICATION

A. Fabricate trusses to achieve structural requirements specified.

B. Brace wood trusses in accordance with TPI DSB-89 and BCSI 1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that supports and openings are ready to receive trusses.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 ERECTION

A. Install trusses in accordance with manufacturer's instructions and TPI DSB-89 and TPI BCSI 1; maintain a copy of each TPI document on site until installation is complete.

B. Set members level and plumb, in correct position.

C. Install permanent bridging and bracing.

3.04 TOLERANCES

A. Framing Members: 1/4 inch maximum, from true position.

END OF SECTION

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SECTION 06-1800
GLUED-LAMINATED CONSTRUCTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Steel hardware and attachment brackets.

1.02 REFERENCE STANDARDS

A. AITC 117 - Standard Specifications for Structural Glued Laminated Timber of Softwood Species; 2010.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

1.03 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, framed openings .

1.04 QUALITY ASSURANCE

A. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of glue laminated structural units with three years of documented experience, and certified by AITC in accordance with AITC A190.1.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect members to AITC requirements for individually wrapped.

B. Leave individual wrapping in place until finishing occurs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glued-Laminated Structural Units:
   1. Western Wood Structures, Inc: www.westernwoodstructures.com/#sle.
   2. Substitutions: See Section 01-6000 - Product Requirements.

2.02 MATERIALS

A. Lumber: Softwood lumber conforming to RIS grading rules with 12 percent maximum moisture content before fabrication. Design for the following values, unless indicated otherwise in Drawings:
   1. Bending (Fb): 2400 psi.
   2. Tension Parallel to Grain (Ft): 1500 psi.

3. Compression Parallel to Grain (Fc): 1650 psi.
4. Compression Perpendicular to Grain Bottom (Fc1): 650 psi.
5. Compression Perpendicular to Grain Top (Fc1): 650 psi.
6. Horizontal Shear (Fv): 265 psi.
7. Modulus of Elasticity (E): 1,800,000 psi.

B. Steel Connections and Brackets: ASTM A666, Type 304 stainless steel.

2.03 FABRICATION

A. Fabricate glue laminated structural members in accordance with AITC Industrial grade.

B. Fabricate glue laminated structural members in accordance with AITC Architectural grade at exposed conditions and Industrial grade at concealed conditions. Refer to Drawings.

C. Verify dimensions and site conditions prior to fabrication.

D. Cut and fit members accurately to length to achieve tight joint fit.

E. Fabricate member with camber built in.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that supports are ready to receive units.

B. Verify sufficient end bearing area.

3.02 ERECTION

A. Lift members using protective straps to prevent visible damage.

B. Set structural members level and plumb, in correct positions or sloped where indicated.

3.03 TOLERANCES

A. Framing Members: 1/2 inch maximum from true position.

END OF SECTION

SECTION 06-2000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood casings and moldings.

1.02 RELATED REQUIREMENTS

A. Section 06-1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 06-4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

C. Section 07-4646 - Fiber Cement Siding.

D. Section 09-9113 - Exterior Painting: Painting of finish carpentry items.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

B. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

C. PS 1 - Structural Plywood; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Unless otherwise indicated provide products of quality specified by AWI Architectural Woodwork Quality Standards Illustrated for Premium grade.

B. Unless otherwise indicated provide products of quality specified by Woodwork Institute Manual of Millwork for Premium grade.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

A. Softwood Lumber: Doug-Fir KD S4s, clear vertical grade species, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
   1. Grading: In accordance with rules certified by ALSC; www.alsc.org.
   2. Location: Interior.

B. Softwood Lumber: Resawn texture cedar, K.D., grade C and better species, maximum moisture content of 6 percent; primed, fingerjointed, 20 foot lengths.
   1. Location: Exterior.

2.04 SHEET MATERIALS

A. Softwood Plywood Exposed to View: Face species as indicated, rough sawn texture, veneer core; PS 1 Grade A-B; no plugs, glue type as recommended for application.
   1. Grading: Certified by the American Plywood Association.

2.05 ADHESIVE

A. Adhesive: Type recommended by laminate manufacturer to suit application .

2.06 FASTENINGS

A. Fasteners, typical of all applications: Stainless steel; length required to penetrate wood substrate 1-1/2 inch minimum.

2.07 ACCESSORIES

A. Wood Filler: Solvent base, tinted to match surface finish color.

2.08 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 INSTALLATION

A. Set and secure materials and components in place, plumb and level.

B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.02 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09-9000.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

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SECTION 06-4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Hardware.

D. Factory finishing.

1.02 RELATED REQUIREMENTS

A. Section 06-1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 09-9900 - Painting and Coating

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

C. BHMA A156.9 - Cabinet Hardware; 2020.

D. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

E. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.

F. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

G. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).

H. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; National Hardwood Lumber Association; 2011.

I. PS 1 - Structural Plywood; 2009.

J. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2010.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

C. Product Data: Provide data for hardware accessories.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Custom quality, unless other quality is indicated for specific items.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.02 LUMBER MATERIALS

A. Softwood Lumber: NIST PS 20; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade II/Custom; average moisture content of 5-10 percent; species as indicated on drawings.

B. Hardwood Lumber: NHLA; Graded in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Grade II/Custom; average moisture content of 5-10 percent; species as indicated on drawings.

2.03 PANEL MATERIALS

A. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, composed of wood chips bonded with interior grade adhesive under heat and pressure; sanded faces; thickness as required; use for components indicated on drawings.

B. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as required.

C. Plywood for Non-Decorative Purposes: NIST PS 1, Interior rated adhesives, core of seven (7) wood plies from listed species unless otherwise indicated, thickness as indicated or as required by application.
   1. Semi-Exposed Surfaces: APA A-B Grade, rotary cut redwood face veneer.
   2. Concealed Surfaces: PS 1; APA B-B Grade, rotary cut Douglas fir face veneer.
   3. Location: At countertops and base cabinets in all sink and lavatory locations.

D. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S); use for drawer bottoms, dust panels, and other components indicated on drawings.

E. Pre-Finished High Density Particle Board (PFHDPB)

2.04 LAMINATE MATERIALS

A. Provide specific types as indicated.
   1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, color, finish as indicated.
   2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, color, finish as indicated.

2.05 COUNTERTOPS

A. Plastic Laminate Countertops: Medium density fiberboard substrate covered with HPDL, conventionally fabricated, with decorative PVC edge.
   1. Counter Plastic Edge Banding/Profile: Radius edge with thick applied band, 0.12 inch thick, 1/8 inch nominal (3 mm) radius edge with thick applied band, shaped; smooth finish; of width to match component thickness, color as selected from manufacturer's standards.

2.06 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Typical Plastic Edge Banding/Profile: Radius edge with thick applied band, 0.12 inch thick, 1/8 inch nominal (3 mm) radius edge with thick applied band shaped; smooth finish; of width to match component thickness, color as selected from manufacturer's standards.
   1. Use at all drawer and door edges.

C. Other Edge Banding/Profile: Impact resistant HPDL or PVC edge banding, square edge with thin applied band, 1/16 inch thick, square edge with thin applied band, flat shaped; smooth finish; of width to match component thickness
   1. Use at all exposed shelf edges, casework boxes. Ease edge of banding to remove any sharp edges.

D. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

E. Concealed Station Brackets:
   1. Product: "C" (Concealed Bracket), "EC" (Extended Concealed Bracket); steel, black powder coat, mounting hardware as recommended by manufacturer; manufactured by A & M Hardware, Inc.; www.AandMhardware.com; 1-888-647-0200.
      a. "C", without upper extension:
         1) 9" Support Arm, 4,520 lbs/pair load limit
         2) 12" Support Arm, 4,020 lbs/pair load limit
         3) 18" Support Arm, 2,060 lbs/pair load limit
         4) 24" Support Arm, 1,800 lbs/pair load limit
      b. "EC", with upper extension:
         1) 9" Support Arm, 7,960 lbs/pair load limit
         2) 12" Support Arm, 3,100 lbs/pair load limit
         3) 18" Support Arm, 4,500 lbs/pair load limit
         4) 24" Support Arm, 2,320 lbs/pair load limit
      c. Color: Black powder coat.
   2. Substitutions: See Section 01-6000 - Product Requirements.

F. Surface Station Brackets:
   1. Product:Standard Bracket; steel, black powder coat, mounting hardware as recommended by manufacturer; manufactured by A & M Hardware, Inc.; www.AandMhardware.com; 1-888-647-0200.

a. Color: Black powder coat.
b. Size: A & M "24 x 24".

2. Substitutions: See Section 01-6000 - Product Requirements.

2.07 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.

D. Catches: Touch type.

E. Drawer Slides:
1. Type: Full extension.
2. Static Load Capacity: Commercial grade.
3. Manufacturers:
a. Knape & Vogt Manufacturing Company; Light-Duty Drawer Slides: www.knapeandvogt.com/#sle.
b. Substitutions: See Section 01-6000 - Product Requirements.

F. Hinges: European style concealed self-closing type, steel with polished finish.
1. Manufacturers:
a. Blum, Inc: www.blum.com/#sle.
b. Substitutions: See Section 01-6000 - Product Requirements.

2.08 SITE FINISHING MATERIALS

A. Finishing: Field finished as specified in Section 09-9000.

2.09 FABRICATION

A. Cabinet Style: Flush overlay.

B. Cabinet Doors and Drawer Fronts: Flush style.

C. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

D. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

E. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs.
1. Cap exposed plastic laminate finish edges with material of same finish and pattern.

F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.10 FACTORY FINISHING

A. Finish work in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1500, Nitrocellulose Lacquer, Transparent.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

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SECTION 07-2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at exterior walls, perimeter stem walls, underside of floor slab, roof assemblies, concealed header assemblies, and to fill all voids as indicated on the Drawings.

B. Batt insulation and vapor retarder in exterior wall construction.

1.02 RELATED REQUIREMENTS

A. Section 06-1000 - Rough Carpentry: Installation requirements for board insulation over steep slope roof sheathing or roof structure.

1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.

F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

H. ASTM C1224 - Standard Specification for Reflective Insulation for Building Applications; 2015 (Reapproved 2020).

I. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

K. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.

B. Insulation at Perimeter Stem Walls: Polyisocyanurate board, Type I.

C. Insulation Over Exterior Wall Sheathing: Polyisocyanurate board, Type I.

D. Insulation in Wood Framed Walls: Batt insulation with integral vapor retarder.

E. Insulation Over Roof Deck: Polyisocyanurate board, Type II.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
   4. Board Edges: Square.
   5. Type and Water Absorption: Type XII, 0.3 percent by volume, maximum, by total immersion.
   6. Products:
      a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge: building.dupont.com/#sle.
      b. Owens Corning Corporation; FOAMULAR NGX Type IV Next Generation Extruded: www.ocbuildingspec.com/#sle.
      c. Substitutions: See Section 01-6000 - Product Requirements.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289.
   1. Classifications:
      a. Type I: Faced with aluminum foil on both major surfaces of the core foam.
         1) Class 1 - Non-reinforced core foam.
         2) Compressive Strength: 16 psi, minimum.
         3) Thermal Resistance, R-value: At 1-1/2 inch thick; 9.0, minimum, at 75 degrees F.
      b. Type II: Faced with aluminum foil on both major surfaces of the core foam; non-reinforced core foam.
         1) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
         2) Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48), minimum, at 75 degrees F.

2. Board Size: 48 inch by 96 inch.
3. Board Thickness: 1.0 inch, minimum.
4. Board Edges: Square.
5. Manufacturers:
    a. DuPont de Nemours, Inc: building.dupont.com/#sle.
    b. GAF; EnergyGuard Polyiso Insulation: www.gaf.com/#sle.
    c. Johns Manville; AP Foil-Faced: www.jm.com/#sle.
    d. Substitutions: See Section 01-6000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
3. Formaldehyde Content: Zero.
4. Thermal Resistance: R-value of 21 as indicated in Drawings.
5. Thickness: 5-1/2 inch.
6. Facing:
    a. Aluminum foil, flame spread 25 rated, one side; when not in direct contact with finish material
    b. Asphalt treated Kraft paper, one side; when in contact with finish material.
7. Manufacturers:
    a. CertainTeed Corporation: www.certainteed.com/#sle.
    b. Johns Manville; _____: www.jm.com/#sle.
    c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
    d. Substitutions: See Section 01-6000 - Product Requirements.

2.04 ACCESSORIES

A. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
1. Application: Sealing of interior circular penetrations, such as pipes or cables.
2. Width: As required for application.

B. Self-Adhered Transition Flashing: Multipurpose, self-adhered flashing with modified butyl adhesive, polyester fiber top sheet, and polypropylene interlayer.
1. Application: Primerless adhesion for use at through-wall flashings and wall transitions to roof and below-grade systems.
2. Thickness: 45 mil, 0.045 inch, nominal.
3. Size: 6 inches wide, in rolls 75 feet long.

C. Flashing Tape: Special reinforced film with high performance adhesive.
1. Application: Window and door opening flashing tape.
2. Width: As required for application.
3. Primer: Tape manufacturer's recommended product.

D. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

E. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide, at foil face vapor barrier areas; polyester elsewhere.

F. Nails or Staples: Steel wire; Stainless Steel; type and size to suit application.

G. Wire: Stainless Steel.

H. Support tape: Nylon reinforced or as approved by manufacturer.

I. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install boards horizontally on walls.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION AT CAVITY WALLS

A. Install boards horizontally on walls.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place tapered insulation above existing sloped concrete surface.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.05 BOARD INSTALLATION OVER STEEP SLOPE ROOF SHEATHING OR ROOF STRUCTURE

A. Installation of board insulation over steep slope roof structure or roof sheathing, see Section 06-1000.

3.06 BOARD INSTALLATION - MISCELLANEOUS

A. Install board insulation at wood framed header assemblies and roof blocking to fill all voids in framing.

3.07 BATT INSTALLATION

A. Install in exterior wall spaces without gaps or voids. Do not compress insulation.

B. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.08 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

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SECTION 07-2500
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.

B. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof, joints around frames of openings in exterior walls, and roof assemblies water vapor resistant and air tight.

1.02 RELATED REQUIREMENTS

A. Section 03-3000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

B. Section 06-1000 - Rough Carpentry: Water-resistive barrier under exterior cladding.

C. Section 07-2100 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

D. Section 07-4270 - Aluminum Composition Material Wall Panels: Weather barrier.

E. Section 07-5400 - Thermoplastic Membrane Roofing: Vapor retarder installed as part of roofing system.

F. Section 07-9005 - Joint Sealers: Sealant materials and installation techniques.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
   1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

D. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.04 REFERENCE STANDARDS

A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022.

D. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc.; 2013.

1.05 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Self-Adhered Water Resistant Air Barrier Membrane:
   1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
   2. Water Vapor Permeance: 29 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).
   3. Dry Film Thickness: 28 mils (0.028 inch), minimum.
   4. Criteria for Water Resistance Barriers: Pass, when tested in accordance with ICC - ES AC38.
   5. Water Penetration around Nails: Pass, when tested in accordance with AAMA 711-05 and modified ASTM D 1970.
   6. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
   7. Manufacturers:
      a. Henry Company Blueskin VP 160.
      b. Substitutions: See Section 01-6000 - Product Requirements.

2.02 ACCESSORIES

A. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.

2.03 SELF-ADHERING MEMBRANE FLASHING

A. Manufacturer and Product:
   1. W.R. Grace Construction Products "Perm-A-Barrier".
   2. Henry Company, Blueskin SA.
   3. Substitutions: See Section 01-6000 - Product Requirements.

B. Materials: Rubberized asphalt and polyethylene. 40 mils thickness.

C. Location: Around all wall openings and where noted on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

D. Self-Adhered Sheets:
1. All surfaces to receive membrane must be dry and clean of oil, dust, fronts, bulk water and other contaminiates that would be detrimental to adhesion of membrane. Approved adhesive -primer to be appliend as recommended by Membrane manufacturer. Primer required for applications below 40 degrees, not required above 40 degrees temperature.
2. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
3. Lap sheets shingle-fashion to shed water and seal laps air tight.
4. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
5. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
6. At wide joints, provide extra flexible membrane allowing joint movement.

E. Openings and Penetrations in Exterior Weather Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
4. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
5. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.
6. Refer to Drawings for additional placement requirements, and coordination placement with metal flashings.

3.04 FIELD QUALITY CONTROL

A. See Section 01-4000 - Quality Requirements, for additional requirements.

B. Coordination of ABAA Tests and Inspections:
   1. Provide testing and inspection required by ABAA QAP.
   2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
   3. Cooperate with ABAA testing agency.
   4. Allow access to air barrier work areas and staging.
   5. Do not cover air barrier work until tested, inspected, and accepted.

C. Do not cover installed weather barriers or vapor retarders until inspections have been completed.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07-3113
ASPHALT SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Asphalt shingle roofing.

B. Hand tabbing of all shingles.

1.02 RELATED REQUIREMENTS

A. Section 01-2300 - Alternates: this work is an Alternate Bid.

B. Section 07-6200 - Sheet Metal Flashing and Trim: Edge and cap flashings.

1.03 REFERENCE STANDARDS

A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

C. ASTM D3161/D3161M - Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2020.

D. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules; 2019.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

F. NRCA (RM) - The NRCA Roofing Manual; 2017.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating material characteristics.

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 WARRANTY

A. See Section 01-7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 40 year manufacturer's warranty. Warrantor to agree to repair or replace roofing that leaks or is damaged due to wind or other causes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Asphalt Shingles:
   1. GAF; Timberline Ultra HD: www.gaf.com/sle.
   2. Certainteed, Landmark Pro, www.certainteed.com
   3. Owens Corning Corp: www.owenscorning.com, Duration Designer, www.owenscorning.com
   4. Substitutions: See Section 01-6000 - Product Requirements.

2.02 ASPHALT SHINGLES

A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
   1. Fire Resistance: Class A.
   2. Wind Resistance: Class F, when tested in accordance with ASTM D3161/D3161M.
   3. Warranted Wind Speed: 130 mph.
   4. Algae Resistant.
   5. 40-Year Warranty.
   6. Self-sealing type.
   7. Style: Square.
   8. Color: To be selected from standard color chart.

2.03 SHEET MATERIALS

A. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
   1. Type: Woven polypropylene with anti-slip polyolefin coating on both sides.
   2. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
   3. Performance: Meet or exceed requirements for ASTM D226/D226M, Type II asphalt-saturated organic felt.
   4. Fasteners: As specified by manufacturer and building code qualification report or approval, if any.
   5. Manufacturers:
      a. GAF "Deck-Armor" or equivalant to shingle manufacturer.
      b. Substitutions: See Section 01-6000 - Product Requirements.
   6. Location: Typical under shingles, as roof deck protection. See below for eaves, valleys, wall junctures, etc.

B. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
   1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   2. Manufacturers:
      a. GAF "Weatherwatch" mineral serfaced leak barrier", or equavilant to shingle manufacturer.
      b. Substitutions: See Section 01-6000 - Product Requirements.
   3. Location: Typical at eaves, valleys, wall junctures, etc., and other locations as noted in Drawings.

C. Flexible Flashing: Self-adhering polymer-modified asphalt sheet complying with ASTM D1970/D1970M; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.

2.04 ACCESSORIES

A. Nails: Standard round wire shingle type, of stainless steel, 10 wire gage, 0.1019 inch shank diameter, 3/8 inch head diameter, of sufficient length to penetrate through roof sheathing or 3/4 inch into roof sheathing or decking.

B. Plastic Cement: ASTM D4586/D4586M, asphalt roof cement.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

C. Verify roof openings are correctly framed.

D. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

A. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.

B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.

C. Broom clean deck surfaces before installing underlayment or eave protection.

D. Install eave edge flashings tight with fascia boards. Weather lap joints 2 inches and seal with plastic cement. Secure flange with nails spaced 6 inches on center.

3.03 INSTALLATION - EAVE PROTECTION MEMBRANE

A. Install eave protection membrane from eave edge to minimum 2 ft up-slope beyond interior face of exterior wall.

B. Install eave protection membrane in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

3.04 INSTALLATION - UNDERLAYMENT

A. Underlayment At Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches. Stagger end laps of each consecutive layer. Nail in place. Weather lap minimum 4 inches over eave protection.

B. Items projecting through or mounted on roof: Weather lap and seal watertight with plastic cement.

3.05 INSTALLATION - VALLEY PROTECTION

A. Install flexible flashing in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

3.06 INSTALLATION - METAL FLASHING AND ACCESSORIES

A. Install flashings in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.

C. Secure in place with nails at 12 inches on center. Conceal fastenings.

D. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

3.07 INSTALLATION - SHINGLES

A. Install shingles in accordance with manufacturer's instructions manufacturer's instructions and NRCA (RM) applicable requirements.
   1. Fasten individual shingles using 2 nails per shingle, or as required by code, whichever is greater.
   2. Fasten strip shingles using 4 nails per strip, or as required by code, whichever is greater.

B. Place shingles in straight coursing pattern with 5-5/8 inch weather exposure to produce double thickness over full roof area. Provide double course of shingles at eaves.

C. Project first course of shingles 3/4 inch beyond fascia boards.

D. Extend shingles 1/2 inch beyond face of gable edge fascia boards.

E. Cap hips with individual shingles, maintaining 5 inch weather exposure. Place to avoid exposed nails.

F. After installation, place one daub of plastic cement, one inch diameter under each individual shingle tab exposed to weather, to prevent lifting.

G. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counterflashings.

H. Complete installation to provide weather tight service.

3.08 PROTECTION

A. Do not permit traffic over finished roof surface.

END OF SECTION

SECTION 07-4646
FIBER-CEMENT SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiber-cement siding.

1.02 RELATED REQUIREMENTS

A. Section 07-2500 - Weather Barriers: Weather barrier under siding.

1.03 REFERENCE STANDARDS

A. ASTM C1186 - Standard Specification for Flat Fiber Cement Sheets; 2008 (Reapproved 2012).

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
   1. Manufacturer's requirements for related materials to be installed by others.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods, including nail patterns.

PART 2 PRODUCTS

2.01 FIBER-CEMENT SIDING

A. Lap Siding: Individual horizontal boards made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Style: Standard lap style.
   2. Texture: Smooth.
   3. Length: 12 ft, nominal.
   4. Width (Height): 5-1/4 inches.
   5. Thickness: 5/16 inch, nominal.
   6. Finish: Factory applied primer.
   7. Warranty: 50 year limited; transferable.
   8. Manufacturers:
      a. James Hardie Building Products, Inc: www.jameshardie.com/#sle.
      b. Substitutions: See Section 01-6000 - Product Requirements.

2.02 ACCESSORIES

A. Trim: Same material and texture as siding.

B. Fasteners: Stainless Steel; length as required to penetrate minimum 1-1/4 inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.

B. Verify that weather barrier has been installed over substrate completely and correctly.

C. Do not begin until unacceptable conditions have been corrected.

D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.
   1. Read warranty and comply with terms necessary to maintain warranty coverage.
   2. Use trim details indicated on drawings.
   3. Touch up field cut edges before installing.
   4. Pre-drill nail holes if necessary to prevent breakage.

B. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.

C. Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses.

D. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

3.03 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07-6100
SHEET METAL ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. 2 inch high, mechanically-seamed sheet metal roofing, associated flashings, (2) self adhered weather barrier layers, insulation, and underlayment for a complete manufacturers approved system.

B. Counterflashings.

C. Insulation.

D. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 01010 - Alternates: this work is included in the Base Bid.

B. Section 07-6200 - Sheet Metal Flashing and Trim: Placement of flashing, gutters, downspouts, copings, reglets and accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

D. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2014.

E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

G. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

H. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2020a.

I. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments; 2012, with Editorial Revision (2015).

J. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Product Data: Provide data on metal types, finishes, and characteristics.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise noted.

B. Installer Qualifications: Company specializing in performing sheet metal roof installations with minimum 5 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

1.07 WARRANTY

A. See Section 01-7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 35 year manufacturer warranty for coating performance. Warranty shall include degradation of metal finish.

C. Metal substrate will not rupture, fail structurally, or perforate.

D. Installer's and General Contractor's Warranty: Warrant panels, flashings, sealants, fasteners and accessories against defective materials and/or workmanship, covering repairs required to maintain roof panels watertight and weatherproof with normal usage for two years following Project Substantial Completion date.

E. Weathertight Performance Warranty: Manufacturer's standard warranty in which manufacturer agrees to repair or replace metal roof panel assemblies that fail to remain weathertight within 20 years.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); 22 gage, 0.04 inch minimum base metal thickness; plain texture; shop pre-coated with polyvinylidene fluoride (PVDF) coating, color as selected by Architect.

B. Stainless Steel Sheet: ASTM A666, Type 304, soft temper, 25 gage, 0.0219 inch thick; smooth No. 4 finish.

2.02 MANUFACTURER

A. Custom-Bilt Metals. 800-826-7813, info@custombiltmetals.com
   1. Panel Designation: "Titan CB-2000".

B. AEP Span. 877-742-9131, customercare@aepspan.com
   1. Panel Designation: "Span-Lok hp".

C. Taylor Metal Products. 800-574-1388, www.Taylormetal.com
   1. Panel Designation: "MS-200", typical.

D. Substitutions: See Section 01-6000 - Product Requirements.

2.03 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: ASTM C1289, Type II, Class 1- Faced with aluminum foil on both major surfaces of the core foam; non-reinforced core foam.
   1. Grade and Compressive Strength: Grade 2, 20 psi, minimum.
   2. Tapered Board: Slope as indicated; minimum thickness 1/4 inch; fabricate of fewest layers possible.
   3. R value: R-30, 5 1/2 inch total thickness.
   4. Product:
      a. Approved by roofing manufacturer.
      b. Atlas Roofing Corporation; ACFoam-II Polyiso Roof Insulation: www.atlasroofing.com/#sle.
      c. GAF; EnergyGuard Polyiso Insulation: www.gaf.com/#sle.
      d. Johns Manville[<>]: www.jm.com/#sle.
      e. Substitutions: See Section 01-6000 - Product Requirements.

2.04 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet, same gage as roofing sheet.

C. Fabricate starter strips, interlockable with sheet.

D. Form pieces in longest practical lengths.

E. Hem exposed edges on underside 1/2 inch; miter and seam corners.

F. Form material with standing seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

G. Seam height: 2 inches.

2.05 SEAMS:

A. Panel seams shall interlock entire length of seam.

B. Design standing seam to lock up and resist joint disengagement during design wind uplift conditions as calculated according to local building codes.

C. Provide pre-installed sealant within confines of panel’s female leg to aid in resistance of leaks and provide panel-to-panel seal while allowing expansion and contraction movement.

D. Seams shall be continuously locked or crimped together by mechanical means during installation. Seaming tools shall be sourced from manufacturer’s recommended vendor.

2.06 FINISHES

A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as scheduled.

B. Primer Coat: On coated sheets, finish concealed side of sheet with primer compatible with finish system as recommended by finish system manufacturer.

2.07 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers.

B. Slip Sheet Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
   1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
   2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   3. Flammability: Minimum of Class A, when tested in accordance with ASTM E108.
   4. Ultraviolet Resistance and Weatherability: Approved in writing by manufacturer for exposure to weather for minimum of 12 months.
   5. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
   6. Fasteners: As specified by manufacturer and building code qualification report or approval, if any.
   7. Products - as approved by metal roofing manufacturer only:
      a. Certainteed "Diamond Deck".
      b. GAF "Tigerpaw".

C. SA Underlayment: Self-adhering butyl-rubber sheet complying with ASTM D1970/D1970M; strippable release film.
   1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   2. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
   3. Approved Manufacturers and Products:
      a. W.R. Grace Construction Products "Ice and Water Shield".
      b. GAF-Elk "StormGuard".
      c. Owens Corning "Weatherlock Flex".
      d. Certainteed "Winter Guard".
      e. Substitutions: See Section 01-6000 - Product Requirements.

D. Concealed Sealants: Non-curing butyl sealant.

E. Exposed Sealants: ASTM C920 elastomeric sealant, with minimum movement capability as recommended by manufacturer for sealed substrates; color to match adjacent material.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains.

B. Verify deck is dry and free of snow or ice. Verify joints in wood deck are solidly supported and fastened.

C. Verify correct placement of wood nailers and insulation positioning between nailers.

D. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets are in place, and nailing strips located.

E. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

C. Place eave edge and gable edge metal flashings tight with fascia boards. Weather lap joints 2 inches and seal with plastic cement. Secure flange with nails spaced 6 inches OC.

3.03 INSTALLATION - ROOFING

A. Apply SA underlayment over entire roof area, prior to insulation, directly on roof deck.
   1. Apply in single layer laid perpendicular to slope; weather lap edges 6 inches.

B. Apply insulation, integrated 2 x 4 nailer in top 1-1/2 inch layer of insulation for roofing clip attachment, per Drawings. Locate nailer spacing and fastener schedule per metal roofing manufacturer requirements.

C. Attachment of Insulation:
   1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements. Do not penetrate through roof deck where roof decking is exposed inside the building.

D. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.

E. Apply SA underlayment over entire roof area, directly on insulation.
   1. Apply in single layer laid perpendicular to slope; weather lap edges 6 inches.

F. Install slip sheet underlayment.
   1. Apply in single layer laid perpendicular to slope; weather lap edges 6 inches.

G. Cleat and seam all joints.

H. Install in complete accordance with roof panel manufacturer's instructions for assembly and installation.

I. Cutting and Fitting:
   1. Cut panels neat, square, and true with shearing action cutters. Torch or power saw cutting is prohibited.
   2. Openings 6 inches and larger: Shop fabricate and reinforce to maintain original load capacity.
   3. Openings less than 6 inches: Field cutting is acceptable.

J. Install panels in accordance with manufacturer’s instructions and recommendations. Anchor securely in place using clips and fasteners spaced in accordance with manufacturer’s recommendations for design wind load criteria.

K. Form seams with manufacturer-approved motorized seaming tool; completely engage panel, clip, and factory-applied sealant in seam.

L. Comply with methods and recommendations of SMACNA Architectural Sheet Metal Manual for flashing configurations required.

3.04 INSTALLATION - STANDING SEAM ROOFING

A. Lay sheets with long dimension perpendicular to eaves. Apply pans beginning at eaves.

B. Lock cleats into seams and flatten.

C. At eaves and gable ends, terminate roofing by hooking over edge strip.

D. Fold lower ends of seams at eaves over at 45 degree angle.

3.05 FIELD QUALITY CONTROL

A. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

3.06 PROTECTION

A. Do not permit traffic over unprotected roof surface.

END OF SECTION

SECTION 07-6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and sheet metal roofing.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 06-1000 - Rough Carpentry: Wood nailers for sheet metal work.

B. Section 07-6100 - Sheet Metal Roofing.

C. Section 07-9005 - Joint Sealers.

1.03 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

F. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.

G. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

H. CDA A4050 - Copper in Architecture - Handbook; current edition.

I. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.02 ACCESSORIES

A. Fasteners: Stainless steel , with soft neoprene washers.

B. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.

C. Sealant to be Exposed in Completed Work: ASTM C920 elastomeric sealant, with minimum movement capability as recommended by manufacturer for sealed substrates; clear.

D. Sealant: Type 1 specified in Section 07-9005.

E. Plastic Cement: ASTM D4586/D4586M, Type I.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

G. Fabricate flashings to allow toe to extend 2 inches over roofing edge. Return and brake edges.

2.04 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM) Rectangular profile.

B. Gutters: SMACNA (ASMM) Rectangular profile; 5 inches wide x 4 inches deep.

C. Downspouts: Rectangular profile; 2 inches x 3 inches.

D. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Brackets.

E. Downspout Boots: Plastic.

F. Seal metal joints.

PART 3 EXECUTION

3.01 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

3.02 INSTALLATION

A. Comply with drawing details.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

F. Secure gutters and downspouts in place with concealed fasteners.

G. Slope gutters 1/8 inch per foot minimum.

H. Connect downspouts to downspout boots, and grout connection watertight.

3.03 FIELD QUALITY CONTROL

A. See Section 01-4000 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

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SECTION 07-9005
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

1.02 RELATED REQUIREMENTS

A. Section 07-2500 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.

1.03 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2014.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

D. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

E. ASTM C 1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Joint Sealants.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.05 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

1.06 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

PART 2 PRODUCTS

2.01 SEALANTS

A. Type 1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25 minimum; Uses M, G, and A; single component.

1. Color: color as selected.
2. Applications: Use for:
    a. Control, expansion, and soft joints in masonry.
    b. Joints between concrete and other materials.
    c. Joints at wood siding and trim as indicated.
    d. Other exterior joints for which no other sealant is indicated.
3. Polyurethane Products:
    a. Sika Corporation; MasterSeal NP-1: www.usa-sika.com.
    b. Substitutions: See Section 01-6000 - Product Requirements.
4. Test Data:
    a. Movement capability, % - +100 to -50.
    b. Tensile strength - 250 psi.
    c. Ultimate elongation at break, % - 1000.
    d. Hardness, Shore A - passes 25 - 30.

B. Type 2 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
1. Color: Match adjacent finished surfaces.
2. Applications: Use for:
    a. Interior wall and ceiling control joints.
    b. Joints between door and window frames and wall surfaces.
    c. Other interior joints for which no other type of sealant is indicated.
3. Products:
    a. Sherwin-Williams Company; 850A Acrylic Latex Caulk: www.sherwin-williams.com.
    b. Substitutions: See Section 01-6000 - Product Requirements.

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D1056 sponge or expanded rubber; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
   1. Width/depth ratio of 2:1.
   2. Neck dimension no greater than 1/3 of the joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION

A. Protect sealants until cured.

END OF SECTION

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SECTION 08-1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Stainless-steel hollow metal doors and frames.

D. Hollow metal borrowed lites glazing frames.

1.02 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Republic Doors: www.republicdoor.com.
   3. Steelcraft, an Allegion brand: www.allegion.com/#sle.
   4. Steelcraft: www.steelcraft.com.
   5. Substitutions: See Section 01-6000 - Product Requirements.

B. Stainless-Steel Hollow Metal Doors and Frames:
   1. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Steelcraft, an Allegion brand: www.allegion.com/#sle.
   3. Substitutions: See Section 01-6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Stainless Steel for Typical Exterior Locations: Type 304 alloy complying with ASTM A666.
   4. Finish: Factory primed, for field finishing.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Type 1 , Stainless-Steel Exterior Doors:
   1. Based on NAAMM HMMA Custom Guidelines: Comply with guidelines of NAAMM HMMA 866 for stainless-steel hollow metal doors.
      a. Physical Endurance - Level A (1,000,000 cycles), in accordance with ANSI/SDI A250.4 for Swing Test.
      b. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
   2. Applications: Comply with designated application in accordance with NAAMM HMMA 866 guidelines.
      a. Highly corrosive.
   3. Door Face Sheets: Stainless-steel, Type 316 alloy in compliance with ASTM A666.
   4. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
   5. Door Thermal Resistance: R-Value of 10.8, minimum.
   6. Door Thickness: 1-3/4 inches.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. General:
   1. Comply with the requirements of grade specified for corresponding door, except:
      a. ANSI A250.8 - SDI-100, Level 1 Door Frames: 16 gage, 0.053 inch, minimum thickness.
      b. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 - SDI-100, Level 1, 16 gage, 0.053 inch
   2. Finish: Same as for door.

D. Exterior Stainless Steel Door Frames:
   1. Provide knock-down type in compliance with NAAMM HMMA 866, with Type 304 alloy in compliance with ASTM A666.
   2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
   3. Weatherstripping: Separate, see Section 08-7100.

E. Interior Door Frames, Non-Fire Rated: Face welded type.
   1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
   1. Size: As indicated on drawings.
   2. Frame Material: 18 gauge, 0.0478 inch, stainless steel.
   3. Metal Finish: Gray polyester powder coating.
   4. Glazing: 1/4 inch thick, tempered glass, in compliance with requirements of authorities having jurisdiction.

B. Glazing: As specified in Section 08-8000, factory installed.

C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

2.07 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Coordinate frame anchor placement with wall construction.

C. Install door hardware as specified in Section 08-7100.

D. Touch up damaged factory finishes.

3.03 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08-1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; non-rated.

1.02 RELATED REQUIREMENTS

A. Section 08-1113 - Hollow Metal Doors and Frames.

B. Section 08-7100 - Door Hardware.

C. Section 08-8000 - Glazing.

D. Section 09-9000 - Painting and Coating.

1.03 REFERENCE STANDARDS

A. ICC (IBC) - International Building Code; 2021.

B. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

C. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Samples: Submit two samples of door veneer, 12 by 12 inch in size illustrating wood grain, stain color, and sheen.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:

1. Graham Wood Doors: www.grahamdoors.com.
2. Eggers Industries; ____: www.eggersindustries.com/#sle.
3. Haley Brothers; ____: www.haleybros.com/#sle.
4. Marshfield Door Systems, Inc: www.marshfielddoors.com.
5. VT Industries, Inc: www.vtindustries.com.
6. Oregon Door: www.oregondoor.com.
7. Lynden Door: www.lyndendoor.com.
8. Substitutions: See Section 01-6000 - Product Requirements.

2.02 DOORS

A. Doors: Refer to drawings for locations and additional requirements.
   1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at each location.
   2. Wood veneer facing for field transparent finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Natural birch, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with slip match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

2.05 ACCESSORIES

A. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.

2.06 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other throughbolted hardware.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

2.07 FACTORY FINISHING - WOOD VENEER DOORS

A. Factory finish doors in accordance with specified quality standard:
   1. Transparent Finish: Transparent conversion varnish, Premium quality, high gloss sheen.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes and tolerances are acceptable.

B. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.03 TOLERANCES

A. Maximum Diagonal Distortion (Warp): 1/8 inch measured with straight edge or taut string, corner to corner, over an imaginary 36 by 84 inches surface area.

B. Maximum Vertical Distortion (Bow): 1/8 inch measured with straight edge or taut string, top to bottom, over an imaginary 36 by 84 inches surface area.

C. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inches surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE

A. Refer to Door Schedule in Drawings.

END OF SECTION

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SECTION 08-5313
VINYL WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vinyl-framed, factory-glazed windows.

B. Factory fabricated tubular extruded plastic windows with fixed and operating sash.

C. Factory glazed including infill panels.

D. Operating hardware.

E. Insect screens.

1.02 RELATED REQUIREMENTS

A. Section 07-9005 - Joint Sealers: Perimeter sealant and back-up materials.

B. Section 08-8000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.

B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

C. FS L-S-125 - Screening, Insect, Nonmetallic; Federal Specifications and Standards; Revision B, 1972.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, anchors, fasteners, glass, and internal drainage.

C. Shop Drawings: Indicate opening dimensions, framed opening tolerances, affected related work, and installation requirements.

D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.
   4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Vinyl Windows:
   1. JeldWen Premium Vinyl Windows, V-4500 Series.
   2. Milgard Style Line, Tuscany Series.
   3. Substitutions: See Section 01-6000 - Product Requirements.

2.02 DESCRIPTION

A. Vinyl Windows: Factory fabricated frame and sash members of extruded, hollow, ultra-violet-resistant, polyvinyl chloride (PVC) with integral color; with factory-installed glazing, hardware, related flashings, anchorage and attachment devices.
   1. Configuration: As indicated on drawings.
      a. Product Type: AP - Awning projected window and FW - Fixed window in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
   2. Color: Color as selected.
   3. Size to fit openings with minimum clearance around perimeter of assembly providing necessary space for perimeter seals.
   4. Framing Members: Fusion welded corners and joints, with internal reinforcement where required for structural rigidity; concealed fasteners.
   5. System Internal Drainage: Drain to exterior side by means of weep drainage network any water entering joints, condensation within glazing channel, or other migrating moisture within system.
   6. Glazing Stops, Trim, Flashings, and Accessory Pieces: Formed of rigid PVC, fitting tightly into frame assembly.

B. Performance Requirements: Provide products that comply with the following:
   1. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
      a. Performance Class (PC): R.
   2. Performance Validation: Windows shall comply with AAMA/WDMA/CSA 101/I.S.2/A440 performance requirements as indicated by having AAMA, WDMA, or CSA certified label, or an independent test report for indicated products itemizing compliance and acceptable by authorities having jurisdiction.
   3. Positive Design Pressure: ____ psf.
   4. Negative Design Pressure: ____ psf.

2.03 PERFORMANCE REQUIREMENTS

A. Design Pressure: In accordance with applicable codes.

B. Condensation Resistance Factor: CRF of 50, minimum, the lower value of the glass and frame window components and determined in accordance with AAMA 1503.

C. Overall Thermal Transmittance (U-value): 0.35, maximum, including glazing, measured on window sizes required for this project.

2.04 COMPONENTS

A. Glazing: Insulated double pane, annealed glass, clear, low-E coated, argon filled, with glass thicknesses as recommended by manufacturer for specified wind conditions.

B. Windows: Extruded, hollow, tubular, ultra-violet resistant polyvinyl chloride (PVC) with integral color; factory fabricated; with vision glass, related flashings, anchorage and attachment devices.
   1. Performance Requirements: AAMA/WDMA/CSA 101/I.S.2/A440 R15.
   2. Configuration: Fixed, non-operable and outward opening, top hinged sash.
   3. Color: Color as selected.

C. Frames: Standard profile; flush glass stops of screw fastened type.

D. Insect Screen Frame: Rolled aluminum frame of rectangular sections; fit with adjustable hardware; nominal size similar to operable glazed unit.

E. Insect Screens: Woven aluminum mesh; 14/18 mesh size.
   1. Color: Black.

2.05 HARDWARE

A. Sash lock: Lever handle and keeper with cam lock, provide at least one for each operating sash.

B. Casement/Awning Sash: Steel rotary arm sash operating mechanism with fold-down handle and two bar adjustable hinges and keepers fitted to projecting sash arms with limit stops.

C. Finish For Exposed Hardware: Stainless Steel.

2.06 FABRICATION

A. Fabricate framing, mullions and sash members with fusion welded corners and joints, in a rigid jig. Supplement frame sections with internal reinforcement where required for structural rigidity.

B. Form snap-in glass stops, closure molds, weather stops, and flashings of extruded PVC for tight fit into window frame section.

C. Arrange fasteners to be concealed from view.

D. Permit internal drainage weep holes and channels to migrate moisture to exterior. Provide internal drainage of glazing spaces to exterior through weep holes.

E. Factory glaze window units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings and adjoining air and vapor seal materials are ready to receive this work.

3.02 INSTALLATION

A. Install window unit assemblies in accordance with manufacturers instructions and applicable building codes.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities as necessary.

C. Align window plumb and level, free of warp or twist, and maintain dimensional tolerances and alignment with adjacent work.

3.03 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.04 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

C. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer and appropriate for application indicated.

END OF SECTION

SECTION 08-7100
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood and hollow metal doors.

B. Electrically operated and controlled hardware.

C. Lock cylinders for doors that hardware is specified in other sections.

D. Thresholds.

E. Weatherstripping, seals and door gaskets.

1.02 RELATED REQUIREMENTS

A. Section 08-1113 - Hollow Metal Doors and Frames.

B. Section 08-1416 - Flush Wood Doors.

1.03 REFERENCE STANDARDS

A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.

B. BHMA A156.1 - American National Standard for Butts and Hinges; 2013.

C. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; 2011.

D. BHMA A156.3 - American National Standard for Exit Devices; 2014.

E. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.

F. BHMA A156.6 - American National Standard for Architectural Door Trim; 2010.

G. BHMA A156.7 - American National Standard for Template Hinge Dimensions; 2014.

H. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; 2010.

I. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000; 2012.

J. BHMA A156.15 - American National Standard for Release Devices - Closer Holder, Electromagnetic and Electromechanical; 2011.

K. BHMA A156.17 - American National Standard for Self Closing Hinges & Pivots; 2014.

L. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.

M. BHMA A156.21 - American National Standard for Thresholds; 2014.

N. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012.

O. BHMA A156.31 - American National Standard for Electric Strikes and Frame Mounted Actuators; 2013.

P. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

Q. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

R. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

S. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

U. NFPA 101 - Life Safety Code; 2015.

V. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware will be installed upon.

1.05 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.

C. Shop Drawings:
   1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts, electrical characteristics and connection requirements .
   2. Submit manufacturer's parts lists and templates.

D. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements.

E. Keying Schedule: Submit for approval of Owner.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Allegion Brands, Ives: www.allegion.com/us.

B. Assa Abloy Brands, Corbin Russwin: www.assaabloydss.com.

2.02 DOOR HARDWARE - GENERAL

A. Provide hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

B. Provide items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:
   1. Applicable provisions of federal, state, and local codes.
   2. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   3. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   4. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

D. Function: Lock and latch function numbers and descriptions of manufactures series as listed in this specification section.

E. Electrically Operated and/or Controlled Hardware: Provide all power supplies, power transfer hinges, relays, and interfaces required for proper operation; provide wiring between hardware and control components and to building power connection.

F. Finishes: Provide door hardware of the same finish unless otherwise indicated.
   1. Primary Interior Finish: Satin chrome plated over nickel on brass or bronze, 626 (approx US26D).
      a. Location: Interior doors.
   2. Primary Exterior Finish: Stainless steel, satin, 630.
      a. Location: Exterior doors.
   3. Finish Definitions: BHMA A156.18.
   4. Exceptions:
      a. Where base metal is specified to be different, provide finish that is an appearance equivalent according to BHMA A156.18.

2.03 LOCKS AND LATCHES

A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
   1. If no hardware set is indicated for a swinging door provide an office lockset.
   2. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
   3. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.

B. Lock Cylinders: Manufacturer’s standard tumbler type, six-pin standard core.
   1. Provide cams and/or tailpieces as required for locking devices required.

C. Keying: Keyed in like-groups.
   1. Key to existing keying system.

2. When providing keying information, comply with DHI Handbook "Keying systems and nomenclature".

D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

E. Privacy Latchset - Mortise Style;
1. Basis of Design: L9496 Px17A by Schlage.
2. Privacy lokck with ADA thumturn and "vacant/occupied" indicator.

2.04 HINGES

A. Hinges - Basis of Design: FBB179 or FBB199, Stanley.

B. Self Closing Hinges: Comply with BHMA A156.17.

C. Hinges: Provide hinges on every swinging door.
1. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
2. Provide ball-bearing hinges at all doors having closers.
3. Provide hinges in the quantities indicated.
4. Provide non-removable pins on exterior outswinging doors.
5. Where electrified hardware is mounted in door leaf, provide power transfer hinges.

D. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7; standard weight, unless otherwise indicated.

E. Quantity of Hinges Per Door:
1. Doors up to 60 inches High: Two hinges.
2. Doors From 60 inches High up to 90 inches High: Three hinges.
3. Doors 90 inches High up to 120 inches High: Four hinges.
4. Doors 42 inches Wide up to 90 inches High: Four Hinges.

F. Manufacturers - Hinges:
1. Assa Abloy Brands; McKinney: www.assaabloydss.com.
2. Ives Architectural Hardware.
3. Bommer Industries, Inc: www.bommer.com.
4. C. R. Laurence Company, Inc: www.crl-arch.com/sle.
5. Hager Companies: www.hagerco.com.
6. Stanley Black & Decker: www.stanleyblackanddecker.com.

2.05 PUSH/PULLS

A. Push/Pulls - Basis of Design: Ives.

B. Push/Pulls: Comply with BHMA A156.6.
1. Provide push and pull on doors not specified to have lockset, latchset, exit device, or auxiliary lock.
2. On solid doors, provide matching push plate and pull plate on opposite faces.

C. Manufacturers - Push/Pulls:
1. Assa Abloy McKinney or Ives.
2. C. R. Laurence Company, Inc: www.crl-arch.com/sle.
3. Substitutions: See Section 01-6000 - Product Requirements.

2.06 LOCKS AND LATCHES

A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
   1. Hardware Sets indicate locking functions required for each door.
   2. If no hardware set is indicated for a swinging door provide an office lockset.
   3. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
   4. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.

B. Lock Cylinders: Manufacturer's standard tumbler type, six-pin standard core.
   1. Provide cams and/or tailpieces as required for locking devices required.

C. Keying: Grand master keyed.

D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.07 CYLINDRICAL LOCKSETS

A. Cylindrical Locksets - Basis of Design: Schlage ND Series.

B. Locking Functions: As defined in BHMA A156.2, and as follows.
   1. Passage: No locking, always free entry and exit.
   2. Privacy: F76, emergency tool unlocks.
   3. Office: F81, key not required to lock, remains locked upon exit.
   4. Classroom: F84, key required to lock.
   5. Intruder Classroom: F110, keyed both sides.
   6. Communicating: F80 or F113.
   7. Hotel: F93.
   8. Store Room Function: F86, key required to lock, may not be left unlocked.

C. Manufacturers - Cylindrical Locksets:
   1. Schlage, an Allegion brand: www.allegion.com/us.
   2. Substitutions: See Section 01-6000 - Product Requirements.

2.08 MORTISE LOCKSETS

A. Mortise Locksets - Basis of Design: Schlage L Series.

B. Locking Functions: As defined in BHMA A156.13, and as follows:
   1. Passage: F01.
   2. Privacy: F19, or F02 with retraction of deadbolt by use of inside lever/knob.
      a. Occupied indicator for single user toilet rooms, shower rooms.
   3. Office: F04, key not required to lock, remains locked upon exit.

2.09 FLUSHBOLTS AND COORDINATORS

A. Flushbolts: Lever extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
   1. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
   2. Floor Bolts: Provide dustproof strike except at metal thresholds.

B. Coordinators: Provide on doors having closers and self-latching or automatic flushbolts to ensure that leaves close in proper order.

C. Manufacturers - Flushbolts:
   1. Ives, an Allegion brand: www.allegion.com/us.
   2. Substitutions: See Section 01-6000 - Product Requirements.

2.10 ELECTRIC STRIKES

A. Electric Strikes: Complying with BHMA A156.31 and UL (DIR) listed as a Burglary-Resistant Electric Door Strike; style to suit locks.

B. Manufacturers - Electric Strikes:
   1. Assa Abloy Brands, HES; 5200: www.assaabloydss.com.
   2. Substitutions: See Section 01-6000 - Product Requirements.

2.11 EXIT DEVICES

A. Exit Devices - Basis of Design: Von Duprin 98/99 Series Exit Devices.

B. Locking Functions: Functions as defined in BHMA A156.3, and as follows:
   1. Entry/Exit, Always-Unlocked: Outside lever unlocked, no outside key access, no latch holdback.
   2. Entry/Exit, Free Swing: Key outside retracts latch, latch holdback (dogging) for free swing during occupied hours, not fire-rated; outside trim must be specified as lever or pull.
   3. Entry/Exit, Always-Latched: Key outside locks and unlocks lever, no latch holdback (dogging).
   4. Entry/Exit, Always-Locked: Key outside retracts latchbolt but does not unlock lever, no latch holdback.
   5. Exit Only, Secure: No outside trim, no key entry, no latch holdback, deadlocking latchbolt.

C. Manufacturers - Exit Devices:
   1. Von Duprin, an Allegion brand: www.allegion.com/us.
   2. Substitutions: See Section 01-6000 - Product Requirements.

2.12 CLOSERS

A. Closers - Basis of Design: LCN 4010 Series, or 281 Sargent.

B. Closers: Complying with BHMA A156.4.
   1. Provide surface-mounted, door-mounted closers unless otherwise indicated.
   2. Provide a door closer on every exterior door.
   3. Provide a door closer on every fire- and smoke-rated door. Spring hinges are not an acceptable self-closing device unless specifically so indicated.
   4. On pairs of swinging doors, if an overlapping astragal is present, provide coordinator to ensure the leaves close in proper order.

C. Manufacturers - Surface Mounted Closers:
   1. LCN, an Allegion brand: www.allegion.com/us.
   2. Substitutions: See Section 01-6000 - Product Requirements.

2.13 STOPS AND HOLDERS

A. Stops: Complying with BHMA A156.8; provide a stop for every swinging door, unless otherwise indicated.
   1. Provide wall stops, unless otherwise indicated.
   2. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.
   3. Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop unless specifically so stated.

B. Kick Down Holder: Ives FS 452.

C. Wall Stops: Ives WS406/407CCV, concave wall bumper.

D. Door Guard: Ives 481 Change Door Guard.

E. Manufacturers - Wall and Floor Stops/Holders:
   1. Assa Abloy Brands, McKinney: www.assaabloydss.com.
   2. Ives.
      a. 407-1/2 Wall Stops.
      b. FS 452 Holdopen.
   3. Substitutions: See Section 01-6000 - Product Requirements.

2.14 GASKETING, THRESHOLDS AND DOOR PROTECTION

A. Gasketing and Thresholds - Basis of Design: Pemko.

B. Gaskets: Complying with BHMA A156.22.
   1. On each door in smoke partition, provide smoke gaskets; top, sides, and meeting stile of pairs. If fire/smoke partitions are not indicated on drawings, provide smoke gaskets on each door identified as a "smoke door" and 20-minute rated fire doors.
      a. Pemko S88D.
   2. On each exterior door, provide weatherstripping gaskets, unless otherwise indicated; top, sides, and meeting stiles of pairs.
      a. Where exterior door is also required to have fire or smoke rating, provide gaskets functioning as both smoke and weather seals.
      b. Pemko 303 AV.
   3. On each exterior door, provide door bottom sweep, unless otherwise indicated; 216AV Pemko.
   4. On each exterior door, provide door top; 346AV Pemko.
   5. On doors indicated as "sound-rated", "acoustical", or with an STC rating, provide sound-rated gaskets and automatic door bottom; make gaskets completely continuous, do not cut or notch gaskets for installation.
      a. Door Bottom Seal: 4301 ARL, Pemko.
      b. Threshold/carpet Seperator: 174A Pemko.
      c. Sound Seal: S88D, Pemko.

C. Thresholds: Complying with BHMA A156.21.
   1. At each exterior door, provide a threshold unless otherwise indicated, 6 inch wide typical, unless detailed otherwise.
   2. Field cut threshold to frame for tight fit.
   3. Pemko 1716 A.

D. Fasteners At Exterior Locations: Non-corroding.

2.15 PROTECTION PLATES AND ARCHITECTURAL TRIM

A. Protection Plates:
   1. Kickplate: Provide on push side of every door with closer, except aluminum storefront and glass entry doors.

B. Drip Guard: Provide projecting drip guard over all exterior doors unless they are under a projecting roof or canopy.
   1. Assa Abloy Pemko Door Top 346.

C. Manufacturers - Protection Plates and Architectural Trim:
   1. Assa Abloy Brands, McKinney: www.assaabloydss.com.
   2. Ives.
   3. Substitutions: See Section 01-6000 - Product Requirements.

2.16 FLOOD SHIELDS

A. Flood Shield - Basis of Design: National Guard Products, Flood Shield, FS22.
   1. Location: Exterior face of exterior doors.
   2. Comply with FEMA guidelines.
   3. Shield: 1/4 inch Marine grade aluminum shield with handle cutouts. Closed cell neoprene rubber gaskets installed on bottom and sides of shield.
   4. Channels: Two (2) anodized aluminum mounting channels. Fasten to outside of door frames.
   5. Fasteners: #10 x 1-1/2 inch stainless steel sheet metal screws.
   6. Finish: Color as selected.
   7. Height: 22 inches.
   8. Manufacturers:National Guard Products; FS22 Flood Shield; www.ngp.com.Substitutions: See Section 01-6000 - Product Requirements.
      a. National Guard Products; FS22 Flood Shield; www.ngp.com.
      b. Substitutions: See Section 01-6000 - Product Requirements.

2.17 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS

A. Provide products that comply with the following:
   1. Applicable provisions of Federal, State, and local codes.

2.18 KEYING

A. Door Locks: Grand master keyed.

B. Supply keys in the following quantities:
   1. 2 master keys.
   2. 5 grand master keys.
   3. 3 change keys for each lock.

2.19 KEY CABINET

A. Cabinet Construction: Sheet steel construction, piano hinged door with cylinder type lock master keyed to building system.

B. Cabinet Size: Size for project keys plus 50 percent growth.

C. Horizontal metal strips for key hook labelling with clear plastic strip cover over labels.

D. Finish: Baked enamel, color as selected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of the correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Mounting heights for hardware from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Sets Schedule or on drawings.
1. For steel doors: Comply with DHI (LOCS) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames".
2. For Wood Doors: Comply with DHI WDHS.3 "Recommended Locations for Architectural Hardware for Flush Wood Doors".
3. Locksets: 38 inch.
4. Push/Pulls: 42 inch.
5. Dead Locks: 42 inch.

D. Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 ADJUSTING

A. Adjust work under provisions of Section 01-7000 - Execution and Closeout Requirements.

3.04 CLEANING

A. Clean adjacent surfaces soiled by hardware installation. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.05 PROTECTION

A. Protect finished Work under provisions of Section 01-7000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

3.06 HARDWARE SCHEDULE - ATTACHED AT END OF THIS SECTION.

HARDWARE SETS

4.01 HARDWARE SETS - GENERAL

A. These Hardware Sets indicate requirements for single doors of that type, with conditional requirements for pairs and other situations.

B. Pairs of Swinging Doors: Provide one of each specified item on each leaf unless specifically stated otherwise. Treat pairs as two active leaves unless otherwise indicated.

C. HW-CYL: Doors whose hardware is specified in other sections but which must be keyed to building system:
   1. Lock Cylinder, Mortise, keyed to building system.

4.02 SWING DOORS -- NOT REQUIRING KEY LOCKING

A. HW-1C: Push/Pull, Non-Fire-Rated, Counter Gate:
   1. Spring Hinge.
   2. Hinge.
   3. Silencers at Stop.
   4. Wallstop.

B. HW-2: Latchset, Non-Fire-Rated.
   1. Hinges.
   2. Latchset, Passage.
   3. Wallstop.

C. HW-5: Privacy Lockset, Non-Fire-Rated:
   1. Hinges.
   2. Mortise Lockset, Privacy.
   3. Robe Hook, Ives 582 Double Robe Hook.

4.03 SWING DOORS -- LOCKABLE, MAY BE LEFT UNLOCKED, KEY NOT REQUIRED TO LOCK

A. HW-10: Office, Non-Fire-Rated:
   1. Hinges.
   2. Lockset, Office.
   3. Wallstop.

B. HW-11: Entrance, Non-Fire-Rated:
   1. Hinges.
   2. Lockset.
   3. Lock Guard.
   4. Closer.
   5. Holdopen.
   6. Kickplate.
   7. Weatherstripping.
   8. Threshold.
   9. Door Top.
   10. Door Bottom.

4.04 SWING DOORS -- KEY REQUIRED TO LOCK, MAY BE LEFT UNLOCKED

A. HW-20: Classroom Lock, Non-Fire-Rated:
   1. Lockset, Classroom.
   2. Hinges.
   3. Wall stop.

B. HW-23: Privacy Lockset, Non-Fire-Rated, Exterior Door w/ Deadbolt:
   1. Hinges.
   2. Mortise Lockset, Privacy.
   3. Deadbolt.
   4. Lock Guard.
   5. Closer.
   6. Kickplate.
   7. Holdopen.
   8. Weatherstripping.
   9. Threshold.
   10. Door Top.
   11. Door Bottom.
   12. Robe Hook: Ives 582 Double Robe Hook.

4.05 SWING DOORS -- ELECTRICAL ACCESS CONTROL

A. HW-50: Entry Control, Fail-Secure, Outswing, Exterior, Non-Fire-Rated:
   1. Hinges.
   2. Motorized Panic Device with vertical rods.
   3. Closer.
   4. Kickplate.
   5. Holdopen.
   6. Weatherstripping.
   7. Threshold.
   8. Door Top.
   9. Door Bottom.
   10. Card Reader.
   11. Door Position Switch.
   12. Request to Exit.
   13. Power Transfer.

       NOTE: Door to provide hardware for Staff/authorized personnel to gain access with card reader when locked. Staff may "dog-down" panic devices if desired.

B. HW-51: Entry Control, Electric Strike, Fail-Secure, Outswing, Non-Fire-Rated:
   1. Hinges.
   2. Lockset, Always-Locked, Access Control Lockset.
   3. Privacy Latch.
   4. Electric Strike.
   5. Lock Guard.
   6. Closer.
   7. Kickplate.
   8. Holdopen.
   9. Weatherstripping.
   10. Threshold.
   11. Door Top.
   12. Door Bottom.

13. Card Reader.
14. Door Position Switch.
15. Request to Exit.
16. Power Transfer.
17. Robe Hook: Ives 582 Double Robe Hook.

NOTE: Door to provide hardware for Staff/authorized personnel to gain access with card reader when locked.

C. HW-52: Classroom Lock, Electric Strike, Fail-Secure, Outswing, Non-Fire-Rated:
1. Spring Hinge.
2. Hinges.
3. Lockset, Classroom, Always-Locked, Access Control Lockset.
4. Card Reader.
5. Door Position Switch.
6. Electric Strike.
7. Wall Stop.
8. Robe Hook: Ives 582 Double Robe Hook.

NOTE: Door to provide hardware for Staff/authorized personnel to gain access with card reader when locked.

END OF SECTION

SECTION 08-8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07-9005 - Joint Sealers: Sealant and back-up material.

B. Section 08-1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

C. Section 08-1416 - Flush Wood Doors: Glazed lites in doors.

D. Section 08-5313 - Vinyl Windows: Glazing furnished by window manufacturer.

1.03 REFERENCE STANDARDS

A. ASTM C1036 - Standard Specification for Flat Glass; 2011.

B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

C. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

D. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

E. GANA (GM) - GANA Glazing Manual; 2009.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual for glazing installation methods.

1.05 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.

1.06 WARRANTY

A. See Section 01-7800 - Closeout Submittals, for additional warranty requirements.

B. Sealed Insulating Glass Units: Provide a five (5) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 INSULATING GLASS UNITS

A. Type IG-1 - Sealed Insulating Glass Units: Vision glass, double glazed.
   1. Application: All exterior glazing unless otherwise indicated.
   2. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
      b. Coating: Low-E (passive type), on #2 surface.
      c. U-value: 0.35 max.
      d. Solar Heat Gain Coefficient (SHGC): .40 max.
   3. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
   4. Total Thickness: 1 inch.
      a. Argon filled.
      b. 1/2 inch air space.

2.02 EXTERIOR GLAZING ASSEMBLIES

A. Performance Criteria: Select type and thickness of glass to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Use the procedure specified in ASTM E1300 to determine glass type and thickness.
   2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
   3. Glass thicknesses listed are minimum.

2.03 GLASS MATERIALS

A. Float Glass Manufacturers:
   1. PPG Industries, Inc: www.ppgideascapes.com.
   2. American-Saint Gobain Corp.
   3. Libbey-Owens-Ford Glass Co.
   4. Pittsburg Plate Glass Co.
   5. Viracon.
   6. Cardinal Glass Industries.
   7. Technical Glass Products.
   8. Substitutions: Refer to Section 01-6000 - Product Requirements.

B. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and Kind FT.
   3. Tinted Types: ASTM C1036, Class 2 - Tinted, color and performance characteristics as indicated.
   4. Thicknesses: As indicated; for exterior glazing comply with requirements indicated for wind load design regardless of thickness indicated.

2.04 SEALED INSULATING GLASS UNITS

A. Sealed Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Edge Spacers: Aluminum, bent and soldered corners.
   3. Edge Seal: Glass to elastomer.

4. Purge interpane space with dry hermetic air.

2.05 GLAZING COMPOUNDS

A. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

B. Silicone Sealant: Single component; chemical 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.

2.06 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness; ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.

E. Install sealants in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR WET METHOD (SEALANT AND SEALANT)

A. Place setting blocks at 1/4 points and install glazing pane or unit.

B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch intervals, 1/4 inch below sight line.

C. Fill gaps between glazing and stops with glazing sealant to depth of bite on glazing, but not more than 3/8 inch below sight line to ensure full contact with glazing and continue the air and vapor seal.

D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.04 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.05 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 09-2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gypsum wallboard.

B. Joint treatment and accessories.

C. Prime paint on walls and ceilings to receive textured finish.

D. Textured finish system.

1.02 RELATED REQUIREMENTS

A. Section 06-1000 - Rough Carpentry: Building framing and sheathing.

B. Section 06-1000 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 07-2100 - Thermal Insulation: Acoustic insulation.

D. Section 07-9005 - Joint Sealers: Acoustic sealant.

1.03 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2009).

C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

E. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

F. GA-216 - Application and Finishing of Gypsum Board; 2013.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum: www.americangypsum.com.
   2. CertainTeed Corporation: www.certainteed.com/#sle.

3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.
   3. Mold Resistant Paper Faced Products:
      a. CertainTeed Corporation; ProRoc Brand Moisture & Mold Resistant Gypsum Board.

C. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
   1. Application: Vertical surfaces behind thinset tile, except in wet areas, and all areas behind sinks, lavatory sinks, mop sinks, etc.
   2. Type: Regular and Type X, in locations indicated.
   3. Type X Thickness: 5/8 inch.
   4. Regular Board Thickness: 5/8 inch.
   5. Edges: Tapered.

D. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Ceilings, unless otherwise indicated.
   2. Thickness: 5/8 inch.
   3. Edges: Tapered.

2.03 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: As specified in Section 07-2100.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

E. Textured Finish Materials: Latex-based compound; plain.

F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

G. Adhesive for Attachment to Wood ASTM C557 and Wood ASTM C557:

H. Acoustical Sound Board: Fibrous 1/2 inch thick board, installed behind gypsum board in sound rated walls as indicated in Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.

3.06 TEXTURE FINISH

A. Prime paint prior on all walls and ceilings designated to receive spray textured finish.

B. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

C. Texture Required: Light orange peel texture.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09-5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 01-6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 28-4600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

C. Section 21-1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

D. Section 15880 - Ai-rOut: Air diffusion devices in ceiling.

E. Section 16500 - In-teri: Light fixtures in ceiling system.

F. Section 16820 - Paging System: Speakers in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

E. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at www.chps.net/.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc; ____: www.armstrongceilings.com/#sle.
   2. CertainTeed Corporation; ____: www.certainteed.com/#sle.
   3. USG Corporation; ____: www.usg.com/ceilings/#sle.

B. Suspension Systems:
   1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. Acoustical Panels, Type ACT-1: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
   2. Size: 24 by 48 inch.
   3. Panel Edge: Square.
   4. Suspension System: Exposed grid.

B. Acoustical Panels: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. VOC Content: As specified in Section 01-6116.
   2. Size: 12 by 24 inches.
   3. Thickness: 5/8 inches.
   4. Light Reflectance: 87 percent, determined in accordance with ASTM E1264.
   5. NRC Range: 80 to .80, determined in accordance with ASTM E1264.
   6. Edge: Square.
   7. Surface Pattern: Non-directional fissured.
   8. Armstong Model: "Fine Fissured", square lay-in, #1729.

2.03 SUSPENSION SYSTEM

A. Manufacturers:
   1. Same as for acoustical units.

B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

C. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Finish: White painted.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Seismic Restraint
   1. Armstrong Seismic Rx Suspension System, ICC Report ESR-1308
   2. BERC-2 clips required on two adjacent walls, with grid attached to wall perimeter molding on opposite walls.
   3. BERC-2 clips attached to main grid beam and cross tees.
   4. Install in strict accordance with manufacture requirements to meet seismic requirements.

PART 3 EXECUTION

3.01 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

B. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

C. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

F. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

G. Do not eccentrically load system or induce rotation of runners.

H. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

I. Suspended ceiling system shall be braced for lateral loads. Contractor shall brace as follows or as required to meet ASTM C636 and as required to comply with Seismic Design Catagory D, per ASCE Standards.
   1. Contractor shall submit design calculations substantiating lateral restraint or shall install (4) no. 12 gauge wires to main runner within 2 inches of cross runner intersections and splayed out 90 degrees, at a maximum angle of 45 degrees. Lateral support wires to be spaced at 12'-0" maximum each way, 4'-0" maximum from wall. Attachment of the restraint wires to structure above shall be adequate for load imposed. Provide compression strut at each group of restraint wires.

3.02 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09-6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient base.

C. Resilient stair coverings and accessories.

D. Installation accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM F2034 - Standard Specification for Sheet Linoleum Floor Covering; 2008 (Reapproved 2013).

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit specified product, unless submitting a subsitution - then submit product information for Architect to select color(s). Multiple colors may need to be provided for final selection.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01-6000 - Product Requirements, for additional provisions.

1.05 FIELD CONDITIONS

A. Provide adequate lighting for installation.

B. **Maintain temperature in storage area between 55 degrees F and 90 degrees F.**

C. **Store materials for not less than 48 hours prior to installation in area of installation at a temperature of** 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 SHEET FLOORING

2.02 TILE FLOORING

A. Vinyl Tile - Type LVT-1 and LVT-2: Printed film type, with transparent or translucent wear layer.
   1. Manufacturers:
      a. Mohawk Group; www.mohawkgroup.com - Basis of Design
      b. Milliken; www.milliken.com
      c. Patcraft; www.patcraft.com
      d. Substitutions: See Section 01-6000 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1700, of Class III
   3. Dimensional Stability: .02"/ linear foot max
   4. Static Load Limit: 1000 psi
   5. Resistance to Chemicals: passes ASTM F925
   6. Critical Radiant Flux (CRF): Class 1
   7. Square Tile Size: 12 by 24 inch.
   8. Wear Layer Thickness: .5mm.
   9. Total Thickness: 2.5mm
   10. Color: As indicated on drawings.
   11. Instalation pattern: verify with Architect.
   12. Installation method: Perimeter glue minimum

B. Vinyl Tile, Rigid Click - Type LVTc-3: Printed film type, with transparent or translucent wear layer;
   1. Manufacturers:
      a. Mohawk Group; www.mohawkgroup.com - Basis of Design
      b. Milliken; www.milliken.com
      c. Patcraft; www.patcraft.com
      d. Substitutions: See Section 01-6000 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1700, Class III.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648.
   4. Plank Tile Size: per type
   5. Wear Layer Thickness: .5 mm.
      a. Total Thickness: 6 mm.
   6. Tile Edge: Interlocking shape.
   7. Installation method: Perimeter glue
   8. Instalation pattern: verify with Architect.
   9. Color: As indicated on drawings.

2.03 RESILIENT BASE

A. Resilient Base - Type RB: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Manufacturers:
      a. Flexco - Basis of Design
      b. Mohawk Group
      c. Johnsonite, a Tarkett Company; _____: www.johnsonite.com/#sle.
      d. Substitutions: See Section 01-6000 - Product Requirements.
   2. Height: 4 inch nominal.

3. Thickness: 0.125 inch.
4. Finish: Satin.
5. Length: Roll.
6. Color: Color as selected from manufacturer's standards.

2.04 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.

C. Moldings, Transition and Edge Strips: Same material as flooring.

PART 3 EXECUTION

3.01 EXAMINATION

A. **Verify that surfaces are flat to tolerances acceptable to flooring Manufacturer**, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified by Manufacture, are dust-free, and are ready to receive resilient base.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Before beginning work, verify layout pattern with Architect.

C. Install in accordance with manufacturer's written instructions.

D. Spread only enough adhesive to permit installation of materials before initial set.

E. Fit joints and butt seams tightly.

F. Set flooring in place, press with heavy roller to attain full adhesion.

G. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

H. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 12' between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.05 INSTALLATION - STAIR COVERINGS

A. Adhere over entire surface. Fit accurately and securely.

3.06 CLEANING

A. Remove visable adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

B. Protect throughout construction.

END OF SECTION

SECTION 09-6813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

A. Section 03-3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:
   1. Patcraft; www.patcraft.com
   2. Milliken & Company: www.milliken.com/#sle.
   3. Mohawk Group: www.mohawkgroup.com/#sle.
   4. Substitutions: See Section 01-6000 - Product Requirements.

2.02 MATERIALS

A. Walk of Tile Carpeting, Type WOT-1: Multi-level Loop, manufactured in one color dye lot.
   1. Tile Size: 24" by 24" inch, nominal.
   2. Thickness: 6/32" inch min.
   3. Color: See drawings.
   4. Solution Dyed Nylon
   5. Gauge: 1/12 inch.
   6. Primary Backing Material: Polypropylene.
   7. Total Weight: 32 oz/sq yd.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: where required. Color from manufacturer selection.

C. Adhesives:

D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH) and flatness per manufacture.
   1. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Trim carpet tile neatly at walls and around interruptions.

G. Complete installation of edge strips, concealing exposed edges.

END OF SECTION

SECTION 09-9000
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Mechanical and Electrical:
      a. In finished areas, paint all insulated and exposed pipes, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
      c. On the roof and outdoors, paint all equipment that is exposed to weather or to view, including that which is factory-finished.

D. Do Not Paint or Finish the Following Items:
   1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Floors, unless specifically so indicated.
   6. Glass.
   7. Acoustical materials, unless specifically so indicated.
   8. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

1.05 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on all finishing products, including VOC content.

C. Samples: Submit two paper chip samples, 8x8 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Benjamin Moore & Co: www.benjaminmoore.com/#sle.
2. Sherwin-Williams.

C. Transparent Finishes:
1. Behr Process Corporation: www.behr.com/#sle.
2. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
3.
4. Same as above.

D. Stains:
1. Same as above.

E. Primer Sealers: Same manufacturer as top coats.
1. Same as above.

F. Substitutions: See Section 01-6000 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.

1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Supply each coating material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Volatile Organic Compound (VOC) Content:
1. Provide coatings that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

D. Colors: As indicated on drawings.
1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint WE-OP-3L - Wood, Opaque, Latex, 3 Coat - unfinished wood trim, soffits:
1. One coat of latex primer sealer.
2. Semi-gloss: Two coats of latex enamel; Moorcraft Super Spec Latex House & Trim No. 170, applied at dry film thickness of not less than 1.1 mils per coat.

B. Paint WE-OP-2L - Wood, Opaque, Latex, 2 Coat - Preprimed Siding & Trim:
1. One coat of latex primer sealer - touch up as needed on bare surfaces, end cuts, etc.
2. Semi-gloss: Two coat of latex enamel; Moorcraft Super Spec Latex House & Trim No. 170, applied at dry film thickness of not less than 1.1 mils per coat.

C. Paint WE-TR-VS - Wood, SeTransparent Stain:
1. One coat of stain; Moorwood Alkyd Semi-Transparent Deck & Siding Stain.

D. Paint ME-OP-3A - Ferrous Metals, Unprimed, Alkyd, 3 Coat:
1. One coat of alkyd primer.
2. Semi-gloss: Two coats of alkyd enamel; __Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.

E. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Semi-gloss: Two coats of alkyd enamel; Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.

2.04 PAINT SYSTEMS - INTERIOR

A. Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:
1. One coat of latex primer sealer.

2. Semi-gloss: Two coats of latex enamel; Benjamin Moore Paints; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276: Applied at a dry film thickness of not less than 1.2 mils per coat..

B. Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:
1. One coat of stain; Benjamin Moore Paints; Benwood Wood Finishes Penetrating Stain (234).
2. One coat sealer ; ____.
3. Satin: MPI gloss level 4; use this sheen for items subject to frequent touching by occupants, including door frames and railings.
4. Satin: One coat of varnish; ____.

C. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer.

D. Paint MI-OP-2L - Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with latex primer.
2. Gloss: Two coats of latex enamel; Benjamin Moore Paints: IMC DTM Acrylic Semi-Gloss (M29). Applied at a dry film thickness of not less than 2.0 mils per coat.

E. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:
1. One coat of alkyd primer sealer.
2. Eggshell: Two coats of latex enamel; Moorcraft Super Spec Latex Eggshell Enamel No. 274: Applied at a dry film thickness of not less than 1.3 mils per coat.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
3. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

F. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

G. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

H. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

I. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

J. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

K. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

L. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.

M. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's instructions.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Sand wood surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

END OF SECTION

SECTION 10-2601
WALL AND CORNER GUARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

B. Wall Protection.

1.02 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate physical dimensions.

C. Samples: Submit two sections of bumper rail, 24 inch long, illustrating component design, configuration, color and finish.

D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wall and Corner Guards: See Section 09-0502 Finish Materials.
   1. Construction Specialties, Inc: www.c-sgroup.com/#sle.
   2. Inpro: www.inprocorp.com.
   3. Substitutions: See Section 01-6000 - Product Requirements.

2.02 COMPONENTS

A. Engineered PETG: Rigid sheet should be high-impact Acrovyn 4000 with standard Suede texture, nominal .060" (1.52mm) thickness. Chemical and stain resistance should be per ASTM D543 standards as established by the manufacturer.
   1. Color as selected from manufacturer's standard colors.

B. Trim: Aluminum or colored anodized finish from manufacturer's standard colors.

C. Corner Guards - Surface Mounted:
   1. Material: High impact vinyl with full height extruded aluminum retainer.
   2. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
   3. Width of Wings: 2 inches.
   4. Corner: Square.
   5. Color: As selected from manufacturer's standard colors.
   6. Length: One piece.
   7. Preformed end caps.
   8. Provide End Wall Guards where shown on Plan.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to wall framing members only.

B. Position corner guard 6 inches above finished floor to 48 inches high.

END OF SECTION

SECTION 10-2800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Accessories for toilet rooms, showers, and utility rooms.

D. Diaper changing stations.

E. Utility room accessories.

F. Grab bars.

1.02 RELATED REQUIREMENTS

A. Section 06-1000 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates.

B. Section 22-4000 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. AJW Architectural Products: www.ajw.com/#sle.
   2. American Specialties, Inc: www.americanspecialties.com/#sle.
   3. Bradley Corporation: www.bradleycorp.com/#sle.
   4. Bobrick: www.bobrick.com.
   5. Substitutions: Section 01-6000 - Product Requirements.

2.02 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.03 COMMERCIAL TOILET ACCESSORIES

A. Combo Recessed Sanitary Napkin Disposal, Toilet Seat Cover Dispenser and Toilet Paper Dispenser: Double roll, stainless steel.

B. Paper Towel Dispenser: Electric, roll paper type.
   1. Cover: Stainless steel.
   2. Paper Discharge: Touchless automatic.
   3. Capacity: 6 inch diameter roll.
   4. Mounting: Surface mounted.
   5. Power: Battery operated.
   6. Refill Indicator: Illuminated refill indicator.

C. Waste Receptacle: Wall-mounted, stainless steel, seamless lower door for access to container, with tumbler lock, reinforced panel full height of door, continuously welded bottom pan and seamless exposed flanges.

D. Soap Dispenser: Soap lather dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator.

E. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Size: As indicated on drawings.
   3. Frame: 0.05 inchangle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
   4. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.

F. Grab Bars: Stainless steel, smooth surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Length and Configuration: As indicated on drawings.

G. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.

H. Robe Hook - B-682.

2.04 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Shower Curtain Rod: Stainless steel tube, 1 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for installation with exposed fasteners.
   1. Products:
      a. Bobrick B-207.
      b. Substitutions: Section 01-6000 - Product Requirements.

B. Shower Curtain:
   1. Material: Opaque vinyl, 0.008 inch thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
   2. Size: 36 by 72 inches, hemmed edges. Verify size with shower width.
   3. Grommets: Stainless steel; pierced through top hem on 6 inch centers.
   4. Color: White.
   5. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.
   6. Products:
      a. Bobrick 204.
      b. Substitutions: Section 01-6000 - Product Requirements.

C. Robe Hook: Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.
   1. Products:
      a. B-682 Multiple Hook.
      b. Substitutions: Section 01-6000 - Product Requirements.

2.05 DIAPER CHANGING STATIONS

A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
   1. Material: Polyethylene.
   2. Mounting: Surface.
   3. Color: Gray.
   4. Minimum Rated Load: 250 pounds.

2.06 UTILITY/LAUNDRY ROOM ACCESSORIES

A. Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, hat-shaped channel.
   1. Holders: Three spring-loaded rubber cam holders.
   2. Length: 24 inches.
   3. Products:
      a. Bobrick B-223.
      b. Substitutions: 01-6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 06-1000 for installation of blocking in walls.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 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: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on drawings.

D. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings

3.04 SCHEDULE

A. Custodial Rooms, each to have:
   1. (1) Mop and broom holder.

B. SINGLE USER TOILET ROOMS, each room to have:
   1. (1) 36 inch grab bar.
   2. (1) 42 inch grab bar.
   3. (1) 18 inch grab bar.
   4. (1) Soap Dispenser.
   5. (1) Paper Towel Dispenser.
   6. (1) Toilet Paper Dispenser.
   7. (1) Seat Cover Dispenser.
   8. (1) Mirror.
   9. (1) Hat and Coat Hook.
   10. (1) Diaper Changing Station when indicated on Drawings.

C. TOILET ROOM with SHOWER, each room to have:
   1. All items listed above for TOILET ROOM, plus,
   2. Shower Curtain and Hooks.
   3. Multi Robe Hook, in lieu of single robe hook.

END OF SECTION

SECTION 10-4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06-1000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

B. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Ansul, Inc: www.ansul.com or equivalent.
   2. Substitutions: See Section 01-6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. FFFP - Foam Type Fire Extinguishers: Stainless steel tank, with pressure gauge.
   1. Class: A:B type.
   2. Finish: Baked enamel, red color.
   3. Temperature range: 40 degrees F to 120 degrees F.

2.03 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 12-2413
ROLLER WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roller shades with manual operation.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Ceiling suspension system members and attachment to building structure.
   2. Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
   3. Shade mounting assembly and attachment.
   4. Size and location of access to shade operator, and adjustable components.
   5. Minimum drawing scale: 1/4 inch = 1 foot.

D. Samples:
   1. Complete, full-size operating unit not less than 16 inches wide for each type or roller shade indicated.
   2. For the following products:
      a. Shade Material: Not less than 12-inch-square section of fabric, from dye lot used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of material.

E. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.

F. Product Certificates: For each type of roller shade, signed by product manufacturer.

G. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
   1. Methods for maintaining roller shades and finishes.
   2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
   3. Operating hardware.

1.03 QUALITY ASSURANCE

A. Source limitations: Obtain roller shades through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Flame-Resistance Ratings: Passes NFPA 701.

C. Product Standard: Provide roller shades complying with WCMA A 100.1.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, lead-free designation, and location of installation using same designation indicated on Drawings and in a window treatment schedule.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.01 2.1 ROLLER SHADES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated in Section 09-0502 Finish Materials (Draper, Inc.) or a comparable product by one of the following manufacturers:
   1. MechoShade System, Inc.
   2. Hunter Douglas, Inc.; Hunter Douglas Window Fashions Division.
   3. Lutron Shading Solutions by VIMCO.
   4. Nysan Shading Systems Ltd.
   5. Substitutions: See Section01-6000-Product Requirements.

B. Shade Band Material: Provide products listed in Section 09-0502 Finish Materials.
   1. Bottom Hem: Straight.

C. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with removable spline fitting integral channel in tube for shade material.

D. Direction of Roll: Regular, from back of roller, and reverse, from front of roller, as indicated on Drawings for double-roller shades. Provide double height shade pocket at corner windows scheduled to receive window shades. Where double height pocket abuts single height pocket, provide closure cap to seal exposed portion of double height shade pocket.

E. Mounting Brackets: Galvanized or zinc-plated steel.

F. Pocket-Style Headbox: U-shaped, formed steel sheet or extruded aluminum; long edges returned or rolled; with bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.

G. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide exposed-to-view, external or concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

H. Audiovisual Light-Blocking shades: Designed for eliminating all visible light gaps when shades are fully closed; fabricated from blackout shade band material with pocket and bottom bar extended and formed for light-tight joints among shade components and between shade components and adjacent construction.
   1. Side Channels, Sill Channel or Angle, and Perimeter Seals: Manufacturer's standard design, including sill light seal attached to bottom bar, for eliminating light gaps when shades are closed.
   2. Shade Band Retention System: Manufacturer's standard design for guiding shade band material through range of travel and holding shade band flat with edges of material within side channels.

I. Mounting: As indicated on Drawings, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

J. Shade Operation: Manual; with continuous-loop bead-chain, clutch, and cord tensioner and bracket lift operator.
   1. Position of Clutch Operator: [Left] [Right] side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Drawings or in a window treatment schedule.
   2. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
   3. Lift-Assist Mechanism: Manufacturer's standard spring assist for balancing roller shade weight and lifting heavy roller shades.
   4. Loop Length: Length required to make operation convenient from floor level.
   5. Beach Chain: Stainless Steel.
   6. Cord Tensioner Mounting: As directed.
   7. Operating Function: Stop and hold shade at any position in ascending or descending travel.

2.02 ROLLER SHADE FABRICATION

A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

B. Concealed Component: Noncorrodible or corrosion-resistant-coated materials.
   1. Lifting Mechanism: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.

D. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

E. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, applications, baking, and minimum dry film thickness.

F. Colors of Metal and Plastic Components Exposed to View: As selected by Architect from manufacturer's full range, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.03 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunctions throughout entire operational range.

3.04 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 22-0500
PLUMBING MATERIALS AND METHODS

PART 1 GENERAL

1.01 DESCRIPTION

A. The provisions of the General Requirements, Supplementary Requirements, and Division 1 apply to the plumbing work specified in this Division.

B. The requirements of this Section apply to the plumbing systems specified in these Specifications and in other Division 22 sections.

C. Provide all items, articles, materials, equipment, operations and/or methods listed, mentioned, shown and/or scheduled on the Drawings and/or in these Specifications, including all labor, supervision, services, permits, fees, and incidentals necessary and required to provide a complete and operable facility with complete systems as shown, specified, and required by applicable codes.

D. The work shall include, but not be limited to, the following systems:
1. Water, sanitary sewer, and storm sewer service complete per serving utility company requirements.
2. Service and distribution piping including valves, supports, insulation, etc.
3. Complete plumbing systems, including fixtures, trim, equipment, etc.
4. Rough-in and final connection of plumbing equipment and fixtures furnished under other Divisions of this Specification.
5. Piping to and connection of equipment or fixtures furnished outside of these Specifications and Contract but described on the Drawings.
6. Special systems as specified herein.

E. Advise subcontractor, suppliers, and vendors involved in the work specified in this Section of the applicable requirements.

1.02 QUALITY ASSURANCE

A. All work and materials shall conform to all applicable local and state codes and all federal, state and other applicable laws and regulations. All clarifications and modifications which have been cleared with appropriate authorities are listed under the applicable sections. All electrical products shall bear the label of a recognized testing laboratory such as UL or CSA.

B. Whenever the requirements of the Specifications or Drawings exceed those of the applicable code or standard, the requirements of the Specifications and Drawings shall govern.

C. Codes and Standards: Comply with the provisions of the following referenced codes, standards and specifications:
1. Federal Specifications (FS)
2. American National Standards Institute (ANSI)
3. National Electrical Manufacturer's Association (NEMA)
4. National Fire Protection Association (NFPA)
5. Underwriters Laboratories, Inc. (UL)
6. Factory Mutual (FM)
7. International Building Code (IBC) with State and Local Amendments
8. International Mechanical Code (IMC) with State and Local Amendments
9. Uniform Plumbing Code (UPC) with State and Local Amendments
10. American Society for Testing and Materials (ASTM)
11. Americans with Disabilities Act (ADA)
12. International Fire Code (IFC) with State and Local Amendments
13. Energy Policy Act (EPAct)
14. Manufacturers Standardization Society (MSS)
15. National Sanitation Foundation (NSF)
16. American Gas Association (AGA)

D. Each piece of equipment furnished shall meet all detailed requirements of the Drawings and Specifications and shall be suitable for the installation shown. Equipment not meeting all requirements will not be acceptable, even though specified by name. Where two or more units of the same class of equipment are furnished, use product of the same manufacturer; component parts of the entire system need not be products of same manufacturer. Furnish all materials and equipment, new and free from defect and of size, make, type and quality herein specified or approved by the Architect. All materials shall be installed in a neat and professional manner.

E. All apparatus shall be built and installed to deliver its full rated capacity at the efficiency for which it was designed.

F. The Drawings and Specifications are complementary. What is called for by one shall be as though called for by both.

G. Drawings: Do not scale drawings for roughing-in measurements, nor use as shop drawings. Make field measurements and prepare shop drawings. See Article 3.01 for more requirements. Coordinate work with shop drawings of other specification divisions.

H. Field Wiring: It is the intent of these specifications that all systems shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections provided. Provide all necessary field wiring and devices from the point of connection indicated on the electrical drawings. All equipment shall be installed in compliance with the Electrical Code and the equipment's UL listing. Bring to the attention of the Architect in writing, all conflicts, incompatibilities, and/or discrepancies prior to bid or as soon as discovered.

1.03 WORK OF OTHER CONTRACTS

A. Work under this contract shall be conducted in a manner to allow for the future installations of such equipment or items listed in other sections of this Specification.

1.04 WORK OF OTHER DIVISIONS

A. Work under this Division shall be conducted in a manner to cooperate with the installation of such equipment or items as specified in other Divisions.

B. HVAC piping systems, fuel piping systems, fire suppression piping systems, and control devices and control wiring relating to the heating and air conditioning systems are specified under other Divisions of these Specifications except for provisions or items specifically noted on the Drawings or specified herein.

C. Consult all Drawings and Specifications in this project and become familiar with all equipment to be installed. Coordinate all aspects of the construction with the other trades on the job to ensure that all work and materials required to provide a complete and operational facility are included in the bid.

D. All sections of Division 22 are interrelated and shall be considered in their entirety when interpreting any material, method, or direction listed in any section of Division 22. Individual sections are not written for specific subcontractors or suppliers but for the general contractor.

1.05 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES (SUBMITTALS)

A. Submit in accordance with Division 1 full technical and descriptive shop drawing data on proposed materials and equipment as detailed in each section.

B. The Contractor shall verify that all equipment submitted can be delivered and installed within the time constraints of the construction period.

C. Include the manufacturer, type, style, catalog number, complete specification, certified dimensions, and description of physical appearance for each item and option submitted. Reproduction of catalog data sheets shall be clean and legible to show all details, including gauge of metal used.

D. Include only information on exact equipment to be installed, not general catalogs of the manufacturer. Where sheets show proposed equipment as well as other equipment, identify proposed equipment with rubber stamp arrow or similar concise method.

E. Submit with each copy a transmittal letter verifying that all included equipment submittals have been carefully considered for quality, dimensions, function, and have been coordinated with the Drawings and Specifications. Guarantee that proposed materials will meet or exceed the quality and function of those specified.

F. Include field wiring diagrams and connection diagrams for all control and/or low voltage systems, including floor plans.

G. Submittal Review: The submittal review process is a means to provide quality control. The action noted to be taken (or where conflicts with the contract documents are not noted) shall not be interpreted by the Contractor as automatic "change orders." Approval of the data for substitution and shop drawings shall not eliminate the Contractor's responsibility for compliance with Drawings or Specifications, nor shall it eliminate the responsibility for freedom from errors of any sort in the data discovered prior to or after the review process. Deviations, discrepancies, and conflicts between the submittals and the Contract Documents shall be called to the Architect's attention in writing at the time of transmittal of the data.

H. Submittals shall be in the form of PDF documents. Arrange submittals numerically with specification sections identified in tabs. All required sections shall be submitted at one time.

1.06 PRODUCT SUBSTITUTION

A. Materials other than those specified may be approved for this project providing a written request is submitted to the Architect prior to bid in accordance with Instructions to Bidders. Requests shall include complete specifications, dimensions, manufacturer and catalog number for each item for which approval is desired. If, in the opinion of the Architect, the material is not complete or if it is not an acceptable substitute, he may reject it. The Architect's evaluation will be based solely on the material submitted.

1.07 CHANGE ORDERS

A. All supplemental cost proposals by the Contractor shall be accompanied by a complete itemized breakdown of labor and materials without exception. At the Architect's request, the Contractor's estimating sheets for the supplemental cost proposals shall be made available to the Architect. Labor must be separated and allocated for each item of work.

1.08 RECORD DOCUMENTS

A. Project Record (As-Installed) Drawings:
   1. Maintain a set of record drawings on the job site as directed in Division 1.
   2. Keep Drawings clean, undamaged, and up to date.
   3. Record and accurately indicate the following:
      a. Depths, sizes, and locations of all buried and concealed piping and all cleanouts, whether concealed or exposed, dimensioned from permanent building features.
      b. Locations of all valves with assigned tag numbers.
      c. Changes, additions, and revisions due to change orders, obstructions, etc. Eradicate extraneous information.
      d. Locations of tracer wire terminal points.
      e. Model numbers of installed equipment.
   4. Make Drawings available when requested by Architect for review.
   5. Submit as part of the required Project Closeout documents. Final submittal will be in the form of reproducible drawings.
   6. Quality of entire set of project record drawings to match the quality of the contract documents; quality to be judged by Architect. Computer-aided design drafting (CADD) shall be used to complete project record drawings. Use standards set in contract documents. Note field modifications, all addenda and change order items on project record drawings. If deficiencies are found in either the quality or the accuracy of the drawings, they will be returned unapproved. Additional review of subsequent submissions shall be at the Contractor's expense.

B. Operating and Maintenance Manuals: Submit Operating and Maintenance Instructions, including manufacturer's service data, wiring diagrams, and parts lists and vendors for all serviceable items of equipment, valve charts, balancing data, final control diagrams showing final set points, duct and piping pressure test reports, equipment startup records, and any additional equipment added by change order. Provide any performance curves, data, and model numbers from submittals. Comply with provisions of Division one where applicable to the mechanical work. Submittal shall be in the form of a PDF file per specification section. Arrange submittals numerically with equipment type or classification identified in tabs. Manufactures O&M manuals shall be provided as a single PDF file that can be hyper-linked by owner for reference. O&M manuals that are a series of PDF files will not be accepted.

1.09 WARRANTY

A. Furnish, prior to application for final payment, three copies of written and signed guarantee effective a period of one year from date of completion and acceptance of entire project; agree to correct, repair and/or replace defective materials and/or equipment or the results of defective workmanship without additional expense to the Owner. Where no response satisfactory to the Owner has occurred within three working days from the written report of a warranty covered defect, the Contractor shall agree to pay for the cost of repair of the reported defect by a Contractor of the Owner's choice.

B. Where the manufacturer's guarantee exceeds one year, the longer guarantee shall govern and include the Contractor's labor.

C. Warranty period shall begin once all phases of construction are complete.

PART 2 PRODUCTS

2.01 GENERAL

A. General: Provide all new materials and equipment, identical to apparatus or equipment in successful operation for a minimum of two years. Provide materials of comparable quality omitted here but necessary to complete the work. Maximum allowable variation from stated capacities, minus 5% to plus 10% as approved in each case.

B. Compatibility: Provide products which are compatible with other portions of the work and provide products with the proper or correct power and fuel-burning characteristics, and similar adaptations for the project.

C. Efficiency: Service (Domestic) Water Heating Equipment shall comply with ASHRAE Standard 90.1-2016 and the State Energy code. Where equipment efficiencies are indicated, the use of alternate or substitute manufacturer’s equipment with lower efficiencies is not permitted.

D. Storage and Handling:
1. Delivery: Deliver to project site with manufacturer's labels intact and legible.
2. Handling: Avoid damage.
3. Storage: Inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.

2.02 ACCESS PANELS

A. Manufacturers: Inryco/Milcor, Bilco, Elmdor, Karp, Potter-Roemer or accepted substitute. Inryco/Milcor Style DW, K, or M panels as required by construction.

B. Construction: Flush style, fire rated in fire rated partitions and ceilings. Provide flush key cylinder locks on all access panels less than 8' above the floor in public spaces. Turn keys over to owners at project completion. Screwdriver latches on all others. Stainless steel construction when installed in locker room shower ceilings or restroom walls.

2.03 EXPANSION JOINTS AND LOOPS

A. Flexible Expansion/Seismic Loop: Factory fabricated assembly consisting of two 90 degree elbows, two lengths of flexible hose, and a 180 degree return bend to allow free movement in 3 axis. Return bend shall include attachment point for support and a drain/vent fitting. Hose shall be corrugated metal style with metal overbraid. Connections to match piping system except connection 2" and larger shall be flanged style. Copper or bronze construction for potable water systems. Metraflex "Metraloop."

2.04 METERS AND GAUGES

A. General: Install meters and gauges where shown on the plans or specified elsewhere in these specifications.

B. Pressure-Temperature Test Plugs:
   1. ¼" or ½" NPT fitting of solid brass capable of receiving either an 1/8" OD pressure or temperature probe and rated for zero leakage from vacuum to 1000 psig. Neoprene valve core for temperatures to 200 deg. F., Nordel to 350 deg. F.
   2. Provide for each test plug a pressure gauge adapter with 1/16" or 1/8" OD pressure probe.
   3. Furnish a test kit containing one 2-1/2" dial pressure test gauge of suitable range, one gauge adapter with 1/16" or 1/8" OD probe and two 5" stem pocket test thermometers – one 0 to 220 degrees F and one 50 to 550 degrees F. Turn the kit over to the Architect.
   4. Cisco "P/T Plugs," Peterson "Pete's Plug" or approved substitute.

C. Thermometers: Liquid-in-glass, adjustable stem, separable sockets, plus 40 to 240 degrees F range (unless indicated otherwise). Weiss numbers are listed. Equivalent Taylor, Trerice, Weksler or approved substitute.
   1. Wide case (9") in equipment rooms and all major equipment items. Weiss "9VS" Series.
   2. Narrow case (7") in all other locations. Weiss "7VS" Series.

D. Pressure Gauges: Install on discharge of all pumps and where shown on Drawings 4-1/2" dial, 0-100 psig graduation pressure gauges with Ashcroft No. 1106 pulsation dampers and stop cocks. Weiss UGE-1 or equivalent Ashcroft, Marsh, Trerice, Weksler.

2.05 VALVES

A. General: Provide factory fabricated valves of the type, body material, temperature and pressure class, and service indicated. Bronze gate, globe and check valves shall comply with MSS-SP-80. Ball valves shall comply with MSS-SP-110. Iron gate and globe valves shall comply with MSS-SP-70. Iron check valves shall comply with MSS-SP-71. Butterfly valves shall comply with MSS-SP-67. Valve size same as connecting pipe size.

B. Acceptable Manufacturers: Milwaukee, Crane, Grinnell, Nibco, Hammond, Stockham, Legend, Watts, and Walworth. Grooved end valves Victaulic, Gruvlock, or accepted substitute. NIBCO numbers are given except as noted. Where possible, provide valves from a single manufacturer.

C. Valve styles: Domestic hot and cold water.
   1. Valves 2" and Smaller:
      a. Ball: Two-piece, Lead free certified, bronze body, full port, 600 psi WOG, Fig. T/S-585-70.
      b. Check: Lead free certified, Bronze body, swing check, 200 psi WOG, T/S-413B (bronze disc) or T/S-413Y (Teflon disc).
   2. Valves 2" through 12":
      a. Ball: Three-piece, Lead free certified, bronze body, full port, 600 psi WOG, T/S-595Y.
      b. Butterfly: Ductile iron body, aluminum bronze disc, 200 psi WOG, Lugged body – LD-2000, Wafer body – WD-2000, Grooved body – GD-4765.

D. Butterfly Valve Operators: Locking lever for shut-off service; "Memory Stop" for lever handle with 10 position throttling plate for throttling service; gear operator with babbitt sprocket rim for chain-operated valves and gear operators on all 8" or larger valves.

E. Butterfly Valve Style: Lug-type with cap screws for all valves utilized for equipment isolation for servicing. Lug and grooved style valves shall be capable for use as isolation valves and recommended by manufacturer for dead-end service at full system pressure.

F. Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper manner to receive insulation.

G. Selection of Valve Ends (Pipe Connections): Select and install valves with ends matching the types of pipe/tube connections.

2.06 HANGERS AND SUPPORTS

A. General: Provide factory-fabricated horizontal piping hangers, clamps, hanger rod, inserts, supports, etc., of the indicated MSS type and size. The Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry Practice SP-58 and SP-69 are referenced in this section.

B. Manufacturers: B-Line, Carpenter & Paterson, Grinnell, Michigan, Superstrut, Tolco, Erico, or accepted substitute. Grinnell figure numbers in parentheses where applicable (or other manufacturers as noted).

C. Corrosion Protection: Provide materials which are zinc plated or factory painted to prevent corrosion. Prevent electrolysis in the support of copper tubing by the use of copper hangers (copper coated is not sufficient), strut cushion, or at least 2 layers of UPC 10 mil tape.

D. Seismic Requirements: Provide seismic restraints in accordance with OSSC Section 1613. Design restraint systems in accordance with “Seismic Restraint Manual: Guidelines for Mechanical Systems," Second Edition, 1998, SMACNA, or “A Practical Guide to Seismic Restraint” ASHRAE RP-812, 1999.

E. Horizontal Piping Hangers and Supports:
1. Adjustable Clevis Hanger: MSS Type 1 (Fig. 260).
2. Adjustable Band Hanger: MSS Type 7 (Fig. 97), fabricated from steel.
3. Adjustable Swivel-Band Hanger: MSS Type 10 (Fig. 70).
4. Clamp: MSS Type 4 (Fig. 212, 216).
5. Double-Bolt Clamp: MSS Type 3 (Fig. 295A, 295H), including pipe spacers.
6. Adjustable Saddle-Support: MSS Type 36 (Fig. 258) and MSS Type 37 (Fig. 259), including saddle, pipe and reducer. Fabricate base-support from steel pipe and include cast-iron flange or welded-steel plate.
7. Channel Support System: Galvanized, 12 gauge channel and bracket support systems, single or double channel as indicated on the Drawings or as required by piping and equipment weights. Grinnell "Power Strut" channel. Acceptable Manufacturers: Super Strut, Globestrut, Bee, Kindorf or Unistrut.

F. Vertical Pipe Clamps:
1. Two-Bolt Riser Clamp: MSS Type 8 (Fig. 261).
2. Four-Bolt Riser Clamp: MSS Type 42 include pipe spacers at inner bolt-holes.

G. Hanger Attachment:
1. Hanger Rod: Rolled threads, zinc plated. Right hand threaded.
2. Turnbuckles: MSS Type 13 (Fig. 230).
3. Weldless Eye-Nut: MSS Type 17 (Fig. 290).
4. Malleable Eye-Socket: MSS Type 16 (Fig. 110R).
5. Clevises: MSS Type 14 (Fig. 299).

H. Building Attachments:
1. Concrete Inserts: MSS Type 18 (Fig. 282), steel or Grinnell Power-Strut PS349 continuous channel. Acceptable Manufacturers: Michigan Hanger, Globestrut, Unistrut, Super Strut.
2. Clamps: MSS Type 19 (Fig. 285, 281), Type 20, 21 (Fig. 225, 226, 131), Type 23 (Fig. 86, 87, 88), Type 25 (Fig. 227), Type 27 through 30 where applicable.

2.07 IDENTIFICATION MARKERS

A. Pipe Markers:
   1. Adhesive pipe markers of width, letter size and background color conforming to ANSI A13.1.
   2. Acceptable Manufacturers: Brady B946 with arrow banding tape or similar Seaton, Zeston, MSI.

B. Nameplates:
   1. Engraved nameplates, 1/16" thick, laminated 2-ply plastic, bottom ply white, outer ply black, letters formed by exposing bottom ply.
   2. Size: 2" by 4" nameplates with 1/4" high letters.

C. Valve Tags:
   1. 2" diameter, 18-gauge polished brass tags with 3/16" chain hole and 1/4" high stamped, black-filled service designation.
   2. Acceptable Manufacturers: Seaton, Brady, MSI.

2.08 PENETRATION FIRE STOPPING

A. Through-penetration fire stopping system tested and listed by Underwriters Laboratories. 3M, Metacaulk, SpecSeal, or approved.

B. Select system for proper application based on wall construction, type of penetrating item, wall rating, etc.

PART 3 EXECUTION

3.01 LAYOUT AND COORDINATION

A. Site Examination: Before starting work, carefully examine site and all contract Drawings. Become thoroughly familiar with conditions governing work on this project. Verify all indicated elevations, building measurements, roughing-in dimensions and equipment locations before proceeding with any of the work.

B. Utility Locations: The location of existing utilities, wires, conduits, pipes, ducts, or other service facilities are shown in a general way only on the Drawings and are taken from existing records. Ascertain whether any additional facilities other than those shown on the plans may be present and determine the exact location and elevations of all utilities prior to commencing installation.

C. Sleeves, Inserts, Cast-in-Place Work: Provide sleeves, inserts, anchoring devices, cast-in-place work, etc. which must be set in concrete sequenced at the proper time for the project schedule.

D. Coordination:
   1. The Drawings are based on equipment of a certain manufacturer and may be identified as such. Where alternate manufacturers or approved substitutes are incorporated into the work, any required design changes are the responsibility of the Contractor. Such changes may include changes in utility or system connection sizes, location, or orientation, service clearances, structural support or acoustic considerations.
   2. Prepare accurate AutoCAD shop drawings showing the actual physical dimensions required for the installation for piping and plumbing devices. Submit drawings prior to purchase/fabrication/installation of any of the elements involved in the coordination. Provide drawing files to other trades for coordination.
   3. Cooperate with other trades in furnishing material and information for sleeves, bucks, chases, mountings, backing, foundations and wiring required for installation of mechanical items.
   4. Coordinate all work with other trades and determine in advance where interfacing of the mechanical work and other work are required to be connected together. Provide all materials and equipment to make those connections. Submit shop drawings showing required connections where special conditions exist.

E. Discrepancies: Report immediately any error, conflict or discrepancy in Plans, Specifications and/or existing conditions. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of piping be necessary, provide for approval the simplest layout possible for that particular portion of the work.

3.02 UTILITY COORDINATION

A. Utility Coordination: Coordinate all aspects of the incoming plumbing utility services indicated with the City Engineer, serving utility, and the off-street improvements Contractor. Requirements of the utility company which exceed the provisions made on the Drawings or covered by these Specifications shall take precedence. Provisions made on the Drawings or Specifications in excess of the utility company's requirements shall take precedence. No additional compensation will be allowed the Contractor for connection fees or additional work or equipment not covered in the Drawings or Specifications which are a result of policies of the serving utilities.

3.03 MECHANICAL EQUIPMENT WIRING

A. Provide all mechanical equipment motors, automatic temperature, limit, float and similar control devices required, with wiring complete from power source indicated on Electrical Drawings.

B. Provide properly rated motor overload and undervoltage protection and all manual or automatic motor operating devices for all mechanical equipment.

C. Equipment and systems shown on the Drawings and/or specified, are based upon requirements of specific manufacturers which are intended as somewhat typical of several makes which may be approved. Provide all field wiring and/or devices necessary for a complete and operable system including controls for the actual selected equipment/system.

D. Provide all starters for mechanical motors. Review Electrical Specifications and Drawings to determine which mechanical motor starters will be provided under the Electrical Specification Sections and provide all others.

3.04 GENERAL INSTALLATION

A. Locating and Positioning Equipment: Observe all Codes, Regulations and good common practice in locating and installing mechanical equipment and material so that completed installation presents the least possible hazard. Maintain adequate clearances for repair and service to all equipment and comply with Code requirements.

B. Arrangement: Arrange piping parallel with primary lines of the building construction, and with a minimum of 7' overhead clearance in all areas where possible. Unless indicated otherwise, conceal all piping. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance. Give right-of-way to piping which must slope for drainage. Set all equipment level or as recommended by manufacturer. Under no conditions shall beams, girders, footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.

C. Drip Pans: Provide drip pans under all domestic hot water heaters and all above ceiling in-line pumps and cooling coils or as noted on drawings. Locate pan immediately below piping and equipment, and extend a minimum of 6" on each side and lengthwise 18" beyond equipment being protected. Fabricate pans 2" deep, of reinforced 20 gauge galvanized sheet metal with watertight seams and rolled or hemmed edges. Provide 3/4" drainage piping, properly discharged to over floor drain or as shown on the Drawings. Comply with Mechanical Code for overflow protection and pipe sizing.

D. Access Panels: Provide access panels with proper backing reinforcement for all equipment, dielectric unions, valves and items requiring service and installed above ceilings, behind walls, or in furring, complete with correct frame for type of building construction involved. Exact size, number and location of access panels are not necessarily shown on Drawings. Use no panel smaller than 12" by 12" for simple manual access or smaller than 16" x 20" where personnel must pass through.

E. Adjusting: Adjust and calibrate all automatic mechanical equipment, mixing valves, flush valves, float devices, etc. Adjust flow rates at each piece of equipment or fixture.

F. Building Vapor Barrier: Wherever the building insulation vapor barrier is penetrated by piping, hangers, conduits, etc., provide clear self-adhesive tape recommended by the insulation manufacturer around the penetrations.

3.05 VALVE INSTALLATION

A. General: Comply with the following requirements:
   1. Install valves where required for proper operation of piping and isolation of equipment, including valves in branch lines where necessary to isolate sections of piping, and where shown on the drawings. Install valves at low points in piping systems that must be drained for service or freeze protection.
   2. Locate valves in accessible spaces (or behind access panels) and so that separate support can be provided when necessary.
   3. Install valves with stems pointed up, in the vertical position where possible, but in no case with stems pointed downward from a horizontal plane.

B. Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper manner to receive insulation.

C. Valve Access: Provide access panels to all valves installed behind walls, in furring or otherwise inaccessible.

3.06 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Proceed with the installation of hangers, supports and anchors only after the required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) the proper placement of inserts, anchors and other building structural attachments.
   1. Install hangers, supports, clamps, and attachments to support piping and equipment properly from the building structure. Use no wire or perforated metal to support piping, and no supports from other piping or equipment. For exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.
   2. Prevent electrolysis in the support of copper tubing by the use of at least 2 layers of UPC listed 10 mil tape at all bearing surfaces or strut clamp cushion. Copper plated hangers alone are not sufficient.
   3. Support fire sprinkler piping independently of other piping and in accordance with NFPA Pamphlet 13.
   4. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at panel points only.

B. Provisions for Movement:
   1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units. Install specified seismic restraints to restrict excessive movement.
   2. Install hangers and supports so that equipment and piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
   3. Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded. Comply with the following installation requirements:
      a. Clamps: Attach clamps, including spacers (if any), to piping outside the insulated piping support. Do not exceed pipe stresses allowed by ANSI B31.
      b. Insulated Pipe Supports: Insulated pipe supports shall be supplied and installed on all insulated pipe and tubing.
      c. Load Rating: All insulated pipe supports shall be load rated by the manufacturer based upon testing and analysis in conformance with ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.
      d. Support Type: Manufacturer's recommendations, hanger style and load shall determine support type.

e. Insulated Piping Supports: Where insulated piping with continuous vapor barrier or where exposed to view in finished areas is specified, install hard maple wood insulation shields (Elcen Fig. 216) or steel pipe covering protection shields (MSS type 39) at each hanger.

C. Pipe Support:
1. Vertical Spacing: Support at base, at equivalent of every floor height (maximum 10' as required by Code) and just below roof line.
2. Screwed or Welded Steel or Copper Piping: Maximum hanger spacing shall be as follows:

	Steel	Copper
1-1/4" and smaller	7' span	6' span
1-1/2" pipe	9' span	6' span
2" pipe	10' span	10' span
2-1/2" & larger	12' span	10' span

3. Cast Iron Soil Pipe:
   a. Hubless and Compression Joint: At every other joint except when developed length exceeds 4', then at each joint.
   b. Additional Support: Provide at each horizontal branch and/or at concentrated loads to maintain alignment and prevent sagging.
4. Install additional hangers or supports at concentrated loads such as pumps, valves, etc. to maintain alignment and prevent sagging.
5. Support Rod: Hanger support rods sized as follows:

Pipe and Tube Size		Rod Size	
Inches	mm	Inches	mm
1/2” to 4”	12.7 to 101.6	3/8”	9.5
5” to 8”	127.0 to 203.2	1/2”	12.7
10” to 12”	254.0 to 304.8	5/8”	15.9

6. Provide manufactures approved channel continuously below all horizontal PEX or other plastic pipe where hung from structure.

D. Adjust hangers and supports to bring piping to proper levels and elevations.

E. Provide all necessary structural attachments such as anchors, beam clamps, hanger flanges and brackets in accordance with MSS SP-69. Attachments to beams wherever possible. Supports suspended from other piping, equipment, metal decking, etc., are not acceptable.

F. Horizontal banks of piping may be supported on common steel channel member spaced not more than the shortest allowable span required on the individual pipe. Maintain piping at its relative lateral position using clamps or clips. Allow lines subject to thermal expansion to roll axially or slide. Size channel struts for piping weights.

G. Installation of drilled-in concrete anchors shall comply with the manufacturer’s instructions for working load, depth of embedment, and spacing between anchors and from the edge of the slab. Use only wedge style anchors.

H. Seismic Restraints: Install restraints where recommended in SMACNA "Seismic Restraint Manual." Show analysis of supporting structure, anchorages, and restraints in accordance with OSSC Chapter 16 and reference ASCE standard. Seismic restraint system components shall be approved by the California Office of Statewide Health Planning and Development (OSHPD). Acceptable Manufacturers: Amber/Booth, Mason Industries, Tolco, or approved. Contractor shall submit calculations and shop drawings, sealed and signed by a Professional Engineer, showing seismic restraint design for all equipment, piping and ductwork required to be braced. **Seismic importance factor for new building is 1.5. For remodeled areas seismic importance factor is 1.0.**

3.07 PLUMBING SYSTEM IDENTIFICATION

A. Piping System: Indicate each pipe system by its generic name (abbreviated) as shown/scheduled/specified; except vent and drainage piping. Comply with ANSI A13.1 for marker locations, letter sizes, and colors. Include arrows to show direction of flow and "Electric Traced" signs to identify heat cable wrapped piping. Locate pipe labels in accessible areas as follows:
   1. Near each valve, meter, gauge, or control device.
   2. Near equipment such as pumps, heat exchangers, water heaters, etc.
   3. At piping branch connections.
   4. At penetrations (each side) of walls, ceilings, and floors.
   5. At access panels and doors.
   6. At 25 foot maximum intervals. Provide a minimum of 1 label above each room where lift out ceiling is installed. Reduce intervals in congested areas such as mechanical rooms.

B. Valve Identification: Tag all valves with brass disc and chain. Prepare valve charts indicating valve number, size, location, concealed or exposed, function, valve manufacture and model number, and normal position. Provide floor plan as part of record Drawings. Use no duplicate numbers in Plumbing and Heating systems. Mount glazed frames containing one set of valve charts in the building mechanical room.
   1. Include floor plan of each floor level with valve tag numbers indicated at approximate valve locations. Provide separate maps for plumbing valves and HVAC valves. Maps are to be 11"x17".
   2. Label all ceilings directly below or access panels directly in front of plumbing or HVAC valves using engraved, printed labels or hanging tags stating the valve ID as shown on the Valve Map and the Valve Tag Directory.

C. Equipment: Provide engraved plastic-laminate signs at locations of major equipment such as heat exchangers, pumps, etc. Identify equipment in field same as on drawings. Permanently mount in an appropriate and effective location.

D. Operation Tags: Where needed for proper and adequate information on operation and maintenance of mechanical systems, provide tags of plasticized card stock, either pre-printed or hand printed to convey the message; example: "DO NOT CLOSE THIS VALVE EXCEPT WHEN THE PUMP IS OFF."

3.08 EQUIPMENT CONNECTIONS

A. Provide complete plumbing connections for all items of equipment requiring such connections, including incidental piping, fittings, trim and labor necessary for a finished working installation.

B. Verify the rough-in and finish requirements for all equipment provided under other Divisions of the work and requiring plumbing connections with equipment supplier and installer prior to rough-in. Minimum branch pipe size for fixtures shall be 1/2".

3.09 PROTECTION

A. Protect all work and materials against loss or damage. Close all pipe openings with caps or plugs. At final completion, thoroughly clean and deliver all work and equipment in an unblemished new condition. Keep all motors and bearings in watertight and dustproof covers during entire course of installation.

B. Protect floors, walls, framing and sheathing where pipe cutting and threading operations are conducted with plastic sheeting under plywood sheets. Extend plastic sheeting beyond the plywood. Clean-up metal cuttings, oil, etc., daily or as necessary to prevent debris from being tracked beyond the protected area. Damages, as determined by the Architect, due to the pipe cutting/threading operation shall be repaired by the responsible trade.

3.10 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of mechanical work. Do all necessary cutting and patching of existing building and yard surfaces required for completion of the mechanical work. Patch to match finish and color of adjacent surfaces. Coordinate work in remodel and new areas to avoid cutting of new finished surfaces.

3.11 PIPE PENETRATION FIRE STOPPING

A. Install as recommended by manufacturer and in accordance with the product's UL listing. Below are the minimum installation requirements.
   1. Install specified penetrating item(s) with required annular spacing in proper size wall or floor opening. Support penetrating item(s) adequately on both sides of construction.
   2. Clean all opening and penetrating item surfaces in penetration area to remove loose debris, dirt, oil, wax, grease, old caulking, etc.
   3. If needed or required for gypsum or concrete block walls, install specified galvanized steel wire mesh or sleeve recessed and centered inside wall around penetrating item(s) so that it is snug against perimeter of opening.
   4. When required, install specified type and depth of backing material in annular space, recessed to required fill depth of fire stopping caulking.
   5. Gun, trowel, and/or pump fire stopping sealant to specified depth in annular space around penetrating item(s). Trowel sealant surfaces flush with wall or floor surfaces to a smooth, defect-free finish. Where required, apply specified size caulking bead around penetrating item(s) at zero annular contact areas and tool smooth.

B. Drawings show some, not all, of the penetration. Review architectural drawings for all fire walls.

C. Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.

3.12 ACOUSTIC SEALING/CAULKING

A. See details on drawings. Seal all pipe penetrations of classrooms or auditorium.

B. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.
   1. Architectural Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

C. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Products:
      a. Pecora Corporation; AC-20 FTR
      b. Tremco Incorporated; Tremflex 834.
      c. USG Corporation; SHEETROCK Acoustical Sealant.

D. Joint Backing: Round, closed cell, non-gassing foam rod compatible with sealant; ASTM C 1330 Type B, cylindrical, bi-cellular material; oversized 30 to 50 percent larger than joint width.
   1. Products:
      a. Sof Rod manufactured by Nomaco Inc.
      b. Sonolastic Soft Backer-Rod manufactured by BASF.

E. Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.

3.13 MECHANICAL PAINTING

A. Minimum Requirements: All mechanical equipment, piping, insulation, etc., exposed in finished areas, storage rooms and other locations except mechanical equipment rooms will be painted per 09 9000.

3.14 PLUMBING WORK CLOSEOUT

A. General: Refer to the Division 1 sections for general closeout requirements. Calibrate all equipment requiring same. Complete each system as shown or specified herein and place in operation except where only roughing-in or partial systems are called for. Each system shall be tested and left in proper operation free of leaks, obstructions, or contamination.

B. Record Drawings: Submit record set of drawings required in Division 1 as previously specified in this Section.

C. Closeout Equipment/Systems Operations: Sequence operations properly so that work of project will not be damaged or endangered. Coordinate with seasonal requirements. Operate each item of equipment and each system in a test run of appropriate duration with the Architect present, and with the Owner's operating personnel present, to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance. Clean and lubricate each system, and replace dirty filters, excessively worn parts and similar expendable items of the work.

D. Operating Instructions: Conduct a walk-through instruction seminar for the Owner's personnel who are to be involved in the continued operation and maintenance of plumbing equipment and systems. Provide written instructions outlining and explaining the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar features of the systems.

END OF SECTION

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SECTION 22-0700
PLUMBING INSULATION

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the insulation of plumbing systems specified elsewhere in these specifications.

B. The requirements of Section 22 0500, Common Plumbing Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Minimum Insulation Thickness and Thermal Performance: Comply with Oregon Energy Efficiency Specialty Code.

B. Composite (Insulation, Jacket or Facing and Adhesives) Fire and Smoke Hazard Ratings: Not to exceed a flame spread of 25 or smoke development of 50 and containing less than 0.1% by weight deca-PDE fire retardant.

C. Component Ratings of Accessories (Adhesives, Mastics, Cements, Tapes, Finishing Cloth for Fittings): Same as "B" requirements above and permanently treated. No water soluble treatments.

1.03 SUBMITTALS

A. Submit catalog data and performance characteristics for each product specified.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General: In addition to the requirements specified in Section 22 0500, the following apply:
   1. Deliver insulation, coverings, cements, adhesives and coatings to the site in factory-fabricated containers with the manufacturer's stamp or label affixed showing fire hazard ratings of the products. Store insulation in original wrappings and protect from weather and construction traffic.
   2. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged insulation. Remove such insulation from project site.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Insulation Manufacturers: Johns Manville, Owens-Corning, Knauf, Certain Teed, Armstrong, Pabco, Imcoa or Nomaco. Johns Manville products are listed unless indicated otherwise.

B. Adhesive Manufacturers: Foster, 3M, Insul-Coustic, Borden, Kingco or Armstrong.

2.02 PIPING INSULATION

A. Interior and Exterior Piping Systems 32 to 180 Deg. F: Glass fiber preformed pipe insulation with a minimum K-value of 0.23 at 75 deg. F, a minimum density of 3.5 pounds per cubic foot within all-service vapor barrier jacket, vinyl or pre-sized finish and pressure sensitive seal containing less than 0.1% by weight deca-PDE fire retardant.

B. Pipe Temperatures Minus 30 to 180 Deg. F: Flexible, preformed, pre-slit, self-sealing elastomeric pipe insulation up to 2-1/8" ID, thermal conductivity of 0.27 BTU/hr. sq. ft./in. at 75 deg. F and vapor transmission rating of 0.2 perms/inch. On cold surfaces, apply in thickness necessary to prevent condensation on the surface at 85 deg. F and 70% RH. Armstrong "Armaflex 2000" or, in concealed locations, Imcoa or Nomaco also approved.

2.03 EQUIPMENT INSULATION

A. Equipment Temperatures Below 70 Deg. F: Flexible, closed cell, elastomeric sheet insulation of 5.5 #/cubic feet density and 0.27 thermal conductivity at 75 deg. F. Armstrong "Armaflex."

B. Equipment Temperatures From 70 to 450 Deg. F: Glass fiber 3 pound density insulation with a 0.23 thermal conductivity at 75 deg. F. Johns Manville "814 Spin-Glas" with "FSK" jacket containing less than 0.1% by weight deca-PDE fire retardant or finished as recommended by manufacturer.

2.04 INSULATION ACCESSORIES

A. Insulation Compounds and Materials: Provide rivets, staples, bands, tapes, adhesives, cements, coatings, sealers, welded studs, etc., as recommended by the manufacturer for the insulation and conditions specified. No staples allowed on cold water piping systems.

B. Interior Tanks and Equipment Insulation Covering: Finished metal jacket or as recommended by the manufacturer for insulation material specified.

C. PVC Protective Jacketing and Valve and Pipe Fitting Covers: Johns Manville Zeston 2000, Proto LoSmoke, or Ceel-Co Ceel-Tite 100 Series with precut fitting fiberglass insulation or approved.

D. Jacket Lap Sealing Adhesives: Foster Drion 85-75 contact cement or approved substitute.

E. Saddles and Shields: Unless otherwise indicated and except as specified in piping system specification sections, install the following types:
   1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

PART 3 EXECUTION

3.01 PIPING INSULATION

A. General: Do not insulate underground piping except at joints and fittings on preinsulated piping unless indicated otherwise. At contractor's option and in accordance with Part 2 of this section, elastomeric insulation may be installed on domestic water piping in thicknesses equivalent to the glass fiber insulation. Installation shall comply with the manufacturer's recommendation with joints and seams completely sealed.

B. Domestic Water Piping:
   1. Insulate with glass fiber pipe covering, 1" thick for cold water piping and for 1" and smaller hot water piping; 1-1/2" for 1-1/4" and larger hot water piping.
   2. Insulate hot water return piping same as cold water piping.
   3. Insulate all water piping exposed to outside weather and freezing temperatures with 1" thickness of glass fiber pipe covering with weather-proof metal jacket. Apply insulation after heat cable is installed.

C. Pipe Fittings:
   1. Insulate and finish all fittings including valve bodies, bonnets, unions, flanges and expansion joints with precut fiberglass insulation and preformed PVC covers sealed to adjacent insulation jacket for continuous vapor barrier covering over all fittings.
   2. Provide removable/reusable insulation covers on 4" and larger valves, unions, flanges, pump casings, strainers and similar fittings or equipment requiring periodic service.

D. Protective Covering: Install continuous protective PVC or metal covering on all piping and fittings in mechanical rooms, accessible tunnels, attic spaces, accessible ceilings, etc., where insulation may be subject to damage. Install with rivets or cement seams and joints.

E. Insulated Piping: Comply with the following.
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.9.
   2. Install MSS SP-58, Type 39 or Type 40 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
   3. Shield Dimensions for Pipe: Not less than the following.
      a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
      b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
      c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
      d. NPS 8 and NPS 14 (DN200 and DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
      e. NPS 16 and NPS 24 (DN400 and DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
   4. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
   5. Insert Material: Length at least as long as protective shield.
   6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

F. Piping Insulation Lap Seams and Butt Joints: Install insulation jacket in accordance with manufacturer's recommendation and without staples on cold water lines. Where jacket joint and lap seams have not adhered, remove affected section of insulation and reinstall or apply lap sealing adhesive in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 22-1000
PLUMBING PIPING AND PUMPS

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide pipe, pipe fittings, piping specialties, pumps and related items required for complete piping system.

B. Related Work: The requirements of Section 22 0500, Common Plumbing Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. General: ASTM, and ANSI Standards are indicated. In addition, special standards are referenced where neither ASTM nor ANSI Standards are applicable.

B. Labeling: All piping shall be continuously and legibly labeled on each length as required by codes and standards and including as a minimum, country of origin, manufacturer's identification marking, wall thickness designation, and applicable standards and approvals. Fittings shall be labeled as required by the referenced standard. Tubular fixture traps shall be stamped with manufacturer's mark and material thickness.

C. Potable Water Valves: Potable water piping materials not limited to faucets, mixing valves, or pressure reducing valves. Valves shall meet NSF Standard 61, Section 9, for drinking water faucets and shall be brass construction. Brass components which contact water within the faucet shall be from brass which contains no more than 3 percent lead by dry weight.

D. Concealed Plastic Piping: No concealed plastic piping inside the building unless approved by Code or Governing Authorities.

E. Definitions: Where piping fluid is not indicated in the following paragraphs, provide similar piping materials for similar fluids (i.e., "make-up water" = "domestic water"; "wet stand pipe" = "fire sprinkler pipe"; "drainage piping" = "sanitary/storm sewer piping").

F. Plumbing System Disinfection shall be performed by an experienced, qualified, chemical treatment agency.

1.03 STORAGE AND HANDLING

A. Provide factory-applied end caps on each length of pipe and tube. Maintain end caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

1.04 SUBMITTALS

A. Submit catalog data for each product specified.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Copper Pipe and Tube:
   1. Application:
      a. Above grade, indoor domestic water.
      b. Above grade, indoor Priming lines.
   2. Pipe: ASTM B88. Produced by American manufacturer only. Foreign produced piping is not allowed.
      a. Above Ground Domestic Water: Type L hard temper copper with soldered joints.

b. Underground Domestic Water and Priming Lines: Type L soft annealed with no joints or type K hard tempered copper with silver soldered joints.
3. Fittings: Wrought copper solder-joint fittings, ANSI / ASME B16.22.
4. Preinsulated Piping: Type K solder joint copper piping with 1" thick urethane insulation protected by 20 gauge PVC outer jacket. Rovanco "Insul/80," equivalent Rikwil or approved substitute.
5. Domestic Water, 2-1/2" and Larger: Rolled groove gasketed mechanical fittings with UPC approval. Tyco-Grinnell CTS or Victaulic CTS, NIBCO Press System or approved.

B. Plastic Pipe – Drain, Waste, Vent (DWV):

1. Application: Where allowed by Code only.
   a. Sanitary waste
   b. Plumbing vent
2. Pipe:
   a. Acrylonitrile-butadiene-styrene (ABS) (ASTM D3965) plastic drain, waste and vent piping (ASTM F628) and fittings (ASTM D2661) (DWV). (Only when used on slopes of 2% or greater and for below grade piping).
   b. Poly(vinyl chloride) (ASTM D1784) (PVC) solid core plastic drain, waste and vent pipe (ASTM D2665 and D1785) and fittings (ASTM D2665) (DWV).
3. Fittings: Provide fittings of the type indicated, matching piping manufacture. Where not otherwise indicated, provide socket style, solvent weld fittings produced and recommended for the service indicated by the piping manufacturer.

C. Plastic Pipe:

1. Application:
   a. Domestic water, systems operating at less than 80 psi and 140 degrees F.
2. Pipe:
   a. Cross-linked polyethylene (PEX-a) tubing for Water Service: ASTM F877; SDR 9. NSF-pw and NSF 61.
3. Fittings: Cold expansion (ASTM F1960) style fittings of the type indicated, matching piping manufacturer. Where not otherwise indicated, provide fittings produced and recommended by the piping manufacturer for the service indicated.

D. Plastic Pipe:

1. Application: Where approved by Code.
   a. Domestic water
   d. Cooling coil condensate drain
2. Pipe:
   a. Polyvinyl Chloride and Chlorinated Polyvinyl Chloride Plastic Pipe for Water Service: SDR-PR pipe, ASTM D2241; Schedules 40, 80 and 120, ASTM D1785.
3. Fittings: Provide fittings of the type indicated, matching piping manufacturer. Where not otherwise indicated, provide socket style, solvent weld fittings produced and recommended by the piping manufacturer for the service indicated.

2.02 MISCELLANEOUS PIPING MATERIALS

A. Insulating (Dielectric) Fittings: Do not use, see Section 3.3, D.

B. Soldering and Brazing Materials: Provide soldering materials as determined by the installer to comply with installation requirements.
1. Tin-Antimony Solder: ASTM B32, Grade 95TA.
2. Lead-Free Solder: ASTM B32, Grade HB. Harris "Bridgit" approved.
3. Silver Solder: ASTM B32, Grade 96.5TS.
4. Flux: Water soluble paste flux.
5. Brazing filler rod: BCuP rod to suit conditions.

C. Sleeve Seal: Rubber-link pipe wall and casing closure. Thunderline Link-Seal. For fire rated wall, floor or ceiling penetrations, 3-M "CP-25" caulk, "No. 303" putty and/or "PSS 7904" sealing system.

D. Strainers: "Y-pattern," iron or bronze body rated for pressures indicated with blow-off connection and 20 mesh stainless steel screen.

2.03 PIPING SPECIALTIES

A. Cleanouts:
1. Manufacturer: Jay R. Smith, Zurn, Wade, Watts, Josam, Mifab, or approved substitute.
2. Types:
   a. Tile Floor Cleanouts: Smith 4053-U with square heavy-duty nickel bronze top, bronze plug, and vandalproof screws. Adjustable top where cast into floor slab.
   b. Carpeted Floor Cleanout: Smith 4023-U-X with round heavy-duty nickel bronze top, bronze plug, carpet clamping device, and vandalproof screws. Adjustable top where cast into floor slab.
   c. Concrete Floor Cleanout: Smith 4023 with round heavy-duty nickel bronze top. Stainless steel shallow cover and vandalproof screws. Adjustable top where cast into floor slab.
   d. Wall Cleanouts: Smith 4472-U, bronze ferrule with raised head bronze plug, stainless steel shallow cover and vandalproof screws.
   e. Outside Area Walks and Drives: Smith 4254-U-G with galvanized cast iron body, top secured with vandalproof screws, and **ABS plug**. Install in 18” x 18” x 6” deep concrete pad flush with grade.
   f. Second Floor Clean-outs: Mifab C1100-RFC clean out with surface membrane clamp.

B. Drains:
1. Zurn, Jay R. Smith, Josam, Watts, Wade and Mifab are approved. Numbers scheduled on drawings represent minimum acceptable standard for locations involved. Where CECO is listed previously listed manufactures are approved.
2. Cast iron construction with acid resistant coating, anchor flange, and other options as indicated by model number.
3. Install 4 pound sheet lead flashing, extending not less than 10" from and clamped to all drains not completely cast-in-place in a homogeneous material.

C. Flashing: Minimum 4# sheet lead; to extend horizontally 10” from edge of vent penetrations or rain drain body and vertically 12” minimum up from roof turned over and down into hub of vent or finished with bronze cap providing counterflashing for screwed pipe.

D. Shock Arrester: Precharged bellows or sealed piston type manufactured to meet PDI WH-201 and ASSE 1010 Standards. Size in accordance with PDI procedures. Jay R. Smith, PPP, Sioux Chief, Wade, Zurn, Watts, Josam, or approved substitute.

E. Priming Valves:
1. Electrically operated priming station with header sized for number of outlets required. Provide with 120v power supply, timer, and solenoid valve tested per UL. Provide with IAPMO approved atmospheric vacuum breaker. Provide in recessed wall box with access door per Section 22 0500. P.P.P. Inc., PT Series or approved.
2. Flow operated valves Jay R. Smith 2699 only. Locate in closets, under counters or in walls behind access panels as specified in Section 22 0500.
3. McIntosh Primes: Manufactured for connection to flush valve to be with gasket chrome supply line and wall escutcheon.
4. Use copper or PEX specified previously for all underground priming lines.

F. Traps: Except chrome plated fixture traps. Recessed drainage pattern for threaded pipe and same grade as pipe for cast iron and plastic pipe; with cleanout plugs in trap body in all above grade locations.

G. Pressure Reducing Valve: Single seat type with renewable stainless steel seat and valve. Size and capacity as shown on Drawings. Bronze bodies with screwed connections on valves 2-1/2” and smaller and flanged steel bodies on valves 3” and larger. Install each PRV with strainer on inlet or internal strainer. Leslie, Watts, Cash-Acme, Zurn-Wilkins, or approved substitute.

H. Backflow Preventer: Where indicated on the Drawings, install a reduced pressure backflow preventer complete with shutoff valves, two separate check valves, differential relief valve, and test cocks. USC Foundation for Cross Connection Control, State Health Officials, and serving utility approved. Bronze bodies on units 2" and smaller, and cast iron bodies with bronze trim on units 2-1/2" and larger.

I. Backflow Preventer: Where indicated on the Drawings, install a double check backflow preventer complete with shutoff valves, two separate check valves, and test cocks. USC Foundation for Cross Connection Control, State Health Officials, and serving utility approved. Bronze bodies on units 2" and smaller, and cast iron bodies with bronze trim on units 2-1/2" and larger.

J. Domestic Water Balancing Valve: Lead free brass or bronze body or 300 Series stainless steel body with stainless steel trim. Victaulic TA Series 76X or approved substitute.

2.04 PUMPS

A. Domestic Hot Water Circulator: Stainless steel body and lead free design in-line circulator with sleeve bearing. Provide with 3 speed switch to allow balancing to actual needs. Grundfos UP Series or equal Bell & Gossett, Peerless, or Armstrong. Provide with 7-day programmable electronic time clock and aquastat to start and stop the pump.

B. Elevator Sump Pump: Submersible, 50 gpm at 25 ft. head, minimum 1/2 horsepower sump pump with integral float switch. Myers, Paco, Hydronix, Zoeller, Viking, Liberty, or approved.

2.05 BACKFILL MATERIALS

A. Subbase Materials: A graded mixture of gravel, sand, crushed stone or crushed slag.

B. Finely-Graded Subbase Material: Well graded sand, gravel, crushed stone or crushed slag, with 100% passing a 3/8" sieve.

C. Backfill Material: Soil material suitable for compacting to the required densities, and complying with AASHTO designation M145, Group A-1, A-2-4, A-2-5, or A-3.

D. Stabilization Fabric: Nonwoven stabilization and drainage fabric. Mirafi 140S or 140M.

PART 3 EXECUTION

3.01 UTILITY SERVICE

A. Plumbing Utility Connections: Complete installation. Contact local serving utilities to determine conditions involved and make or arrange to have connection made at proper time and pay all costs involved.

B. Sanitary and Storm Sewers: Connect sanitary and storm sewers as shown on the Drawings and as required by the serving utility. Verify depth, size and location prior to installation of the new sewer systems.

C. Water Service: Connect to water system.

3.02 PIPE INSTALLATION

A. General: Install pipe, tube and fittings in accordance with recognized industry practices and plumbing code standards. Install each run accurately aligned with a minimum of joints and couplings, but with adequate and accessible unions and flanges for disassembly, maintenance and/or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings.

B. Piping Runs: Route piping close to and parallel with walls, overhead construction, columns and other structural and permanent-enclosure elements of the building. Install piping plumb and level except where pitched for drainage. If not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building or equipment and avoid diagonal runs. Wherever possible in finished and occupied spaces, conceal piping from view. Do not encase horizontal runs in solid (concrete or CMU) partitions.

C. Ensure all copper piping is protected from contact with non-copper and plated supports. Provide strut cushion below clamp or 2 layers of UPC listed 10 mil tape.

3.03 PIPING JOINTS

A. General: Provide joints of the type indicated in each piping system, and where piping and joint as manufactured form a system, utilize only that manufacturer's material.

B. Cast Iron "No-Hub": All joints in accordance with the Cast Iron Soil Pipe Institute (CISPI) Designation No. 310-97 "Installation Procedures for Hubless Cast Iron Soil Pipe and Fittings For Sanitary and Storm Drain, Waste and Vent Piping Applications." Horizontal runs of 5" and greater shall be braced as indicated in Figure 4 for "rodding" restraints. Application of couplings as follows:
1. Standard Duty Couplings: All vent piping and all drainage and waste piping above grade.
2. Heavy Duty Couplings: All underground waste installations and any storm drain installations 2 stories or more in height.

C. Solder Copper Tube and Fitting Joints: In accordance ANSI B 828 with recognized industry practice. Cut tube ends squarely. Copper tubing shall be cut with a wheeled tubing cutter or approved copper tubing cutting tool. The tubing shall be cut square to permit proper joining with the fittings. Remove scale, slag, dirt and debris from inside and outside of tubing and fittings before assembly. The tubing end shall be wiped clean and dry. The burrs on the tubing shall be reamed with a deburring or reaming tool. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in a manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens. "T-Drill" field formed tees may be utilized where the main is at least two pipe sizes larger than the branch.

D. Insulating (Dielectric) Fittings: Where the "joining of ferrous and non-ferrous piping", use brass valve or brass nipple with length/nominal diameter ratio of 8 or greater rather than dielectric fitting.

E. Changes in Direction: Use fittings for all changes in direction. Run lines parallel with building surfaces.

F. Line Grades:
1. Drainage Lines: Run at maximum possible grade and in no case less than 1/4" per foot within building.
2. Vents: Pitch for drainage 1/4" per 10'.
3. Water: Pitch to low points and install hose bib drains. 3' minimum depth of ground cover for all lines outside building unless otherwise noted.

G. Unions and Flanges: At all equipment to permit dismantling and elsewhere as consistent with good installation practice.

H. Expansion: Provide loops, swing joints, anchors, runouts and spring pieces to prevent damage to piping or equipment.

I. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards:
1. Heat Joining of Thermoplastic Pipe: ASTM D-2657.
2. Making Solvent-Cemented Joints: ASTM D-2865 and ASTM F-402.

J. Braze Copper Tube and Fitting Joints: Where indicated. Pass a slow stream of dry nitrogen gas through the tubing at all times while brazing to eliminate formation of copper oxide.

K. Grooved Pipe Joints: Comply with fitting manufacturer's instructions for making grooves in pipe ends. Remove burrs and ream pipe ends. Assemble joints in accordance with manufacturer's instructions. Visually inspect the assembled joint to ensure proper gasket seating.

3.04 CLEANOUTS

A. Where required by code, at each change of sewer direction 45 degrees or greater and more than 10' long, at end of each branch or main and spaced not greater than 100' apart, as required by code and/or as shown on Drawings.

3.05 MISCELLANEOUS PIPING EQUIPMENT

A. Floor, Wall and Ceiling Plates: Chrome plated pressed steel or brass screw locked split plates on all pipe penetrations in finished spaces.

B. Strainers: Install in a manner to permit access for cleaning and screen removal and with blow-off valve.

C. Sleeves: At all penetrations of concrete or masonry construction. PVC, 24 gauge galvanized steel or Schedule 40 galvanized steel pipe. Use steel pipe sleeves through beams, footings, girders or columns and for all penetrations of walls or floors below grade. Where floor finish is ceramic tile, terrazzo, or similar material extend standard steel pipe sleeves 1-1/2" above finished floor. Fabricate sleeves 1" diameter larger than pipe or insulation. PVC and sheet metal sleeves at non-structural penetrations only.

D. Sleeve Caulking: Caulk below grade pipe with rubber link seal. Grout above grade pipe with cement mortar or approved waterproof mastic. All caulking or grouting shall extend full depth of sleeve. Utilize rubber sealing links in lieu of caulking. Install UL sealing caulk, putty and/or system at all penetrations of fire rated walls, floors and ceiling.

E. Shock Arrestors: Install at end of mains, in a battery of three or more flush valve-operated fixtures water header, ahead of quick closing and solenoid operated valves. Size per PDI recommendations where size is not indicated. Provide access panels.

F. Trap Priming: Traps serving floor drains, floor sinks, catch basins, and similar fixtures shall be primed in accordance with Code requirements.

G. See Section 23 0500 for Pump Starters.

3.06 EXCAVATING

A. General: Do not excavate for mechanical work until the work is ready to proceed without delay, to minimize the total time lapse from excavation to completion of backfilling. Comply with all applicable Federal and state safety regulations and local erosion control requirements.

B. Width: Excavate for piping with 6" to 9" clearance on both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves and other work. Excavate for other work to provide minimum practical but adequate working clearances.

C. Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand-excavate the bottom cut to accurate elevations. Support the following work on undisturbed soil at the bottom of the excavations:
1. Piping of 5" and less pipe/tube size.
2. Cast-in-place concrete.

3.07 BASE PREPARATION

A. Subbase Installation: Where indicated, install subbase material to receive mechanical work, and compact by tamping to form a firm base for the work. For 4" and larger piping, horizontal cylindrical tanks and similar work, shape the subbase to fit the bottom 90 degrees of the cylinder, for uniform continuous support. Provide finely-graded subbase material for wrapped, coated and plastic pipe and tank. Shape subbases and bottoms of excavation with recesses to receive pipe bells, flanged connections, valves and similar enlargements in the piping systems and set bottom of trench at proper pitch and correct elevations with subbase material.

B. Previous Excavations: Where piping crosses over an area more than 5' wide which has been previously excavated to a greater depth than required for the piping installation, provide suitable subsidence-proof support for the piping. Comply with the details shown, or where not otherwise shown, provide the following support system:
   1. Excavate to undisturbed soil, in a width equal to the pipe diameter plus 2'. Install 8" courses of subbase material, each compacted to 95% of maximum density, as required to fill excavation and support piping.

3.08 BACKFILLING

A. Do not backfill until installed mechanical work has been tested and accepted wherever testing is indicated. Install drainage fill where indicated, and tamp to a uniform firm density. Backfill with finely-graded subbase material to 6" above wrapped, coated and plastic piping and tanks, and to center line of other tanks (where recommended by tank manufacturer, use "pea gravel" backfill). Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to the required densities. Do not backfill with frozen materials.

3.09 CLEANING

A. General: Clean all dirt and construction dust and debris from all mechanical piping systems and leave in a new condition. Touch up paint where necessary.

B Disinfection of Domestic Water Piping System:
   1. Prior to starting work, verify system is complete and clean.
   2. Open all drains and fixtures valves in the building starting with the valve nearest the water service line and permit the water to run clear for 10 minutes to eliminate grease, cuttings, flux, and foreign matter.
   3. Inject disinfectant at beginning of water system to be disinfected. Introduce free chlorine in liquid form, throughout system to obtain concentration required by local Public Health Department regulations or 50 to 80 mg/L residual.
   4. Bleed water from all potable water outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
   5. Maintain disinfectant in system for 24 hours.
   6. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
   7. Flush disinfectant from system until residual is equal to that of incoming water or 1.0 mg/L.
   8. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C601. If any sample fails the analysis, repeat the procedure.
   9. Include a copy of the bacteriological analysis in the Operating and Maintenance manuals.
   10. If allowed by local jurisdiction, testing is acceptable in lieu of treatment.

C. Sanitary and Storm Drainage System:
   1. Remove construction debris from cleanouts, drains, strainers, baskets, traps, etc., and leave same accessible and operable. Place plugs in the end of uncompleted piping at the end of the day or whenever work stops.
   2. Before final acceptance of completed sewer system, flush and clean the entire system with water. Trap and remove solid material obtained from flushing and cleaning from the new system. Do not allow debris to enter the existing sewer system.

3.10 TEST

A. General:
   1. Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation signed by qualified inspector. Make all tests before applying insulation, backfilling, or otherwise concealing piping or connecting fixtures or equipment. Where part of the system must be tested to avoid concealment before the entire system is complete, test that portion separately, same as for entire system.
   2. Provide all necessary temporary equipment for testing, including pump and gauges. Remove control devices before testing and do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for the indicated pressure and time.

3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

B. Repair:
   1. Repair piping system sections which fail the required piping test by disassembly and re-installation, using new materials to the extent required to overcome leakage. Do not use chemical stop-leak compounds, solder, mastics, or other temporary repair methods.
   2. Drain test water from piping systems after testing and repair work has been completed.

C. Sewer: Furnish all facilities and personnel for conducting the test. Test in accordance with the requirements of the State Plumbing Inspector and local authorities.

D. Plumbing Waste and Vent Piping: Hydrostatic test by filling to highest point, but not less than 10' water column on major horizontal portion.

E. Water Piping: Hydrostatic pressure of 100 psig without loss for four hours.

F. Tanks and Equipment: Hydrostatic pressure to 1.5 times operating pressure but do not exceed maximum rated pressure.

3.11 SUPERVISION AND START-UP

A. Adjust flush valves, pressure reducing valves, water heater thermostats, and similar equipment.

B. Master mixing valve start-up procedure: Provide a factory authorized representative to review the installation of the mixing valve and verify that the adjustment has been completed by an authorized agent of the manufacture. Provide documentation in the O&M documents showing adjustment has been completed per manufacture instructions. Record supply and return temperatures. Work shall be completed prior to substantial completion.

END OF SECTION

SECTION 22-3000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the plumbing equipment.

B. Provide plumbing equipment specified and shown on the Drawings.

C. Related Work: The requirements of Section 22 0500, Common Plumbing Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Code: Comply with requirements of the Oregon State Plumbing Specialty Code.

B. All equipment and component parts shall conform to governing codes. Gas-fired equipment shall be design certified by AGA.

C. Labeling: All equipment shall have permanent labels affixed by the manufacturer listing model number, capacity, efficiency, approvals, and similar characteristics of the product.

PART 2 PRODUCTS

2.01 PIPING

A. Piping, fittings, pumps, and related items are specified in Section 22 1000.

2.02 WATER HEATERS

A. Light Commercial Electric Storage Water Heater:
   1. UL approved and complying with the State Energy Code. Unit shall be tested to Department of Energy 10 CRE Part 430 and compliant with OEESC 504.2. Provide adjustable automatic thermostatically controlled electric insertion elements constructed to withstand 400 degrees F without failure. Heavy glass-lined steel tank with magnesium anode, heat traps, not less than 2" of non-organic insulation or non-CFC foam insulation and factory enameled jacket. Install with ASME Code pressure-temperature relief valve and brass hose bib drain. Capacity as shown on Drawings.
   2. Manufacturers: Bock, Bradford White, A.O. Smith, or approved substitute.

2.03 WATER HEATER SYSTEM DEVICES

A. Water Heater and Tank Seismic Restraints: For water heaters and tanks, Spacemaker, Holdrite “Quickstrap,” or approved.

B. Domestic Hot Water Expansion Tank: Plastic lined drawn steel tank for potable water with epoxy exterior finish, air charging valve and system piping connection. Butyl rubber diaphragm with steel retaining ring. Base mounting ring on sizes over 5 gallons. ASME construction on sizes over 10 gallons. Provide with relief valve where working pressure rating is less than 150 psi.

PART 3 EXECUTION

3.01 UTILITY SERVICE

A. Plumbing Utility Connections: Complete installation. Verify rough in dimensions of equipment prior to installing piping.

3.02 EQUIPMENT INSTALLATION AND CONNECTION

A. All equipment shall be installed plumb and level unless otherwise recommended by the manufacturer.

B. Arrange piping connections to equipment to allow removal and replacement of the equipment without disassembly of connecting piping. Provide valves, unions, flanges, etc. at connection points.

C. Arrange equipment for adequate service access as recommended by the manufacturer and as required by code.

D. Anchor equipment to resist displacement due to seismic events as detailed on the drawings, recommended by the manufacturer, and as required by code and as specified in other sections of these specifications. Provide seismic straps as specified above for tank type water heaters.

E. Install drain pans under all water heaters as specified in Section 22 0500.

3.03 EQUIPMENT CLEANING

A. Remove construction and shipping protection and thoroughly clean all plumbing equipment just prior to building acceptance.

3.04 SUPERVISION AND START-UP

A. Do not place equipment onto operation until required work of other trades is complete, e.g. venting systems, combustion air ducts, etc.

B. Follow manufacturer's instructions for start-up and adjustment of equipment.

END OF SECTION

SECTION 22-4000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the plumbing fixtures and trim.

B. Provide fixtures as shown on the Drawings and specified herein. Provide all required fixture trim and accessories for a complete, finished installation.

C. Related Work: The requirements of Section 22 0500, Common Plumbing Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Code: Comply with requirements of the Oregon State Plumbing Specialty Code.

B. Fixture color: White unless indicated otherwise.

C. Potable Water Valves: Potable water valves not limited to faucets, mixing valves, or pressure reducing valves. Valves shall meet NSF Standard 61, Section 9, for drinking water faucets and shall be brass construction. Brass components which contact water within the faucet shall be from brass which contains no more than 3 percent lead by dry weight.

PART 2 PRODUCTS

2.01 PIPING

A. Piping, fittings, and related items as specified in related Sections 22 1000.

2.02 INTERIOR PLUMBING MATERIALS

A. Lavatory Tempering Valve: The lavatory tempering valve shall be certified per ASSE 1070 at 0.25 GPM and CSA standards and shall have a lead free certified brass or copper alloy body with corrosion resistant internal components. It shall include integral checks with screens to prevent backflow and to filter debris from entering the valve. Temperature adjustment shall be made using an Allen wrench and a locknut or locking cap on the bonnet to prevent unauthorized or accidental temperature adjustment. Valve shall be tested to provide at least 1.5 GPM at no more than 5 PSI pressure drop. Temperature range shall be at least 85-115° F. Valve shall be Acorn model ST70, Powers LFLM495, or approved equal. Tempering valve shall be installed in the wall with access panel.

B. Shock Arrester: Pre-charged bellows or sealed piston type manufactured to meet PDI WH-201 and ASSE 1010 Standards. Size in accordance with PDI procedures. Jay R. Smith, PPP, Sioux Chief, Wade, Zurn, Watts, Josam, or approved substitute.

C. Provide compliant fixture piping protector kit on all exposed accessible fixture traps and water supplies. ADA compliant and UPC listed. White anti-microbial molded vinyl or PVC construction. IPS Truebro Lav Guard 2 Series, McGuire ProWrap, or approved equal.

2.03 PLUMBING FIXTURES AND TRIM

A. Stops: Furnish stop valves for all fixtures. Loose key style, in wall, angle or straight through pattern to fit installation. Stops to be lead free certified all brass with full turn brass stem and replaceable washer, no plastic. Compression nuts to be high copper content brass. Finish to be copper nickel chrome plate. Product to carry manufacturer's name. Risers to be chrome plated copper. Provide chrome plated shallow escutcheons. McGuire, Chicago, Brasskraft, Keeney, Zurn, or approved substitute.

B. Fixture Traps: Exposed fixture tailpieces, traps, and wastes shall be chrome plated 17 gauge seamless brass tube with cast brass nuts and deep or box style escutcheons as required to conceal rough piping. Products to be stamped with manufacturer's name and material gauge. McGuire, Keeney, Zurn, or approved.

C. Water Closet, Battery powered Flush Valve, Vitreous China: Elongated water closet bowl shall be designed for 1.28 gallon siphon jet flushing action.
   1. Install each listed water closet with the following:
      a. Flush Valve: Quiet acting, exposed chrome plated brass with battery powered motion sensor and operating solenoid, screwdriver check/control stop with vandal resistant cap, cast wall flange, synthetic rubber diaphragm, and vacuum breaker, as recommended by closet manufacturer. Sloan G2 8111, or equal Moen.
      b. Seat: Solid white heavy weight molded plastic seat, with molded in bumpers; open front less cover for elongated bowl with check and self-sustaining hinge. Hinge and hardware to be 300 Series stainless steel. Church 295-SSC, Beneke 523-SS/CH-B, or Bemis 1955 SS/C, Zurn Z5956SS-EL-STS.

   2. Floor Mount "WC-1": Top Spud, ADA height. American Standard 3043.001.020 or equal Kohler.

D. Lavatory, Vitreous China:
   1. Faucet: Electronic Battery powered, 0.5 GPM aerator, chrome plated brass body, deck mounted, faucet with built-in sensor complete with solenoid valve, and grid strainer outlet Sloan Optima EAF-150, or equal, Bradley or Moen. **Install with tempering valve in wall with access door.**
   2. Counter Mounted, Self-rimming, 19" Diameter Round "LV-1": American Standard 0491.019, Kohler K-2202, or Eljer 051-0174.
   3. Wall Hung, 20" x 18", Size"LV-2": Provide with concealed arm hangers and wall backing plate (Jay R. Smith, Josam, Wade, Watts, or Zurn). American Standard 0355.012 or Kohler K-2005.

E. Single Stall Shower, " SH-1 ":
   1. Valve and Trim: Install with concealed piping and fixed 1.5 GPM head. Valve shall be ASSE 1016 / ASME A112.1016 / CSA-B125.16 listed for Type T/P at flows as low as 1.25 GPM. Temperature compensating and pressure equalizing mixing valve with combination strainer/check stops and adjustable temperature limit stop. Cast Brass or Bronze body with ADA listed operation. Powers HydroGuard T/P Series e700, Acorn SV16-LVR, Speakman CPV-TP Series, or approved equal.

F. Single Stall Shower, " SH-2 ":
   1. Valve and Trim: Install with concealed piping and fixed 1.5 GPM head. Provide with diverter valve and handheld shower head with flex hose, vacuum breaker, and wall slide bar for ADA. Valve shall be ASSE 1016 / ASME A112.1016 / CSA-B125.16 listed for Type T/P at flows as low as 1.25 GPM. Temperature compensating and pressure equalizing mixing valve with combination strainer/check stops and adjustable temperature limit stop. Cast Brass or Bronze body with ADA listed operation. Powers HydroGuard T/P Series e700, Acorn SV16-LVR, Speakman CPV-TP Series, or approved equal.

G. Service Sump (Mop Basin) "SS-1":
   1. Faucet exposed, brass body, rough plated, long spout, top brace, hose end spout with bucket hook, vacuum breaker and integral stops in shanks. Chicago 897-RCF or equal T & S, mounted 24" above rim. Install with 18 gauge type 302, No. 4 finish stainless steel splash on the two walls.

2. Molded stone 24" x 24" x 10" deep with vinyl bumper guard and 3" brass body strainer outlet. Fiat, Mustee, Swan or approved substitute.

H. Stainless Steel Sinks: Type 302 or 304 (unless noted otherwise), 18 gauge, self-rimming stainless steel sink, fully undercoated, drawn bowl with satin finish. Elkay numbers are listed; Just is approved. Install with stainless steel crumb cup strainer outlet or grid strainer (as noted), flange tail piece, and 1-1/2" trap. For faucets, Chicago numbers are listed, American Standard or Delta Commercial approved. Sinks shall be punched for faucet specified. Coordinate number of holes required. Cock hole covers are not allowed. Provide with tail piece as required for dishwasher or AC condensate drain per drawings.

Location	Tag	Basin (Elkay)	Faucet (Chicago)	ADA	Strainer, Disposal, etc.
Staff Break Room	S-1	Single Compartment DRKAD2217 with 6 1/2" depth.	786 Series, 8" projection gooseneck with 1.5 GPM vandal resistant aerator, ADA 369 handles.	Yes	See note # 1. Provide with In-Sink Aerator strainer.

Note #1: Provide 16 GA S.S. re-enforcement plate below sink and faucet securing nuts. See detail on Drawings. 6/P6.01

I. Hose Bibs:
1. Outside "HB-1": Non-freeze type with vacuum breaker, bronze wall casing and wall clamp. Zurn Z-1310-6, Wade W-8620, Woodford 67 series, Smith 5609-PB, or Watts HY420.
2. Inside "HB-2": Stainless steel wall box with loose ke sheel handle, wall flange, hold open door with key, vacuum breaker, stops, dual temperature Acorn 8109 or approved.

PART 3 EXECUTION

3.01 PIPING

A. Install in accordance with Section 22 1000.

3.02 FIXTURE INSTALLATION AND CONNECTION

A. All exposed fixture hardware and piping shall be plated with polished chrome unless otherwise directed in these specifications. Where chair carriers or special carrier design are not indicated, provide 3/16" thick by 6" wide steel to waste or vent piping and to available building construction.

B. All fixtures in contact with finished walls and floors shall be caulked with waterproof, white, non-hardening sealant which will not crack, shrink or change color with age.

C. All fixtures and component parts shall conform to governing codes.

D. All fixtures shall be securely mounted level and plumb or as recommended by the manufacturer. Mount fixtures intended to be accessible to the handicapped at the dimensions required by code.

3.03 STARTUP

A. Adjust flush valves, pressure reducing valves, mixing valves, water heater thermostats, and similar equipment.

B. Remove construction protection, tags and labels and thoroughly clean all plumbing equipment and trim. Scour all fixtures just prior to building acceptance.

END OF SECTION

SECTION 23-0500
HVAC MATERIALS AND METHODS

PART 1 GENERAL

1.01 DESCRIPTION

A. The provisions of the General Requirements, Supplementary Requirements, and Division 1 apply to the HVAC work specified in this Division.

B. The requirements of this Section apply to the HVAC systems specified in these Specifications and in other Division 23 sections.

C. Provide all items, articles, materials, equipment, operations and/or methods listed, mentioned, shown and/or scheduled on the Drawings and/or in these Specifications, including all labor, supervision, services, permits, fees, and incidentals necessary and required to provide a complete and operable facility with complete systems as shown, specified, and required by applicable codes.

D. The work shall include, but not be limited to, the following systems:
1. Fuel supply system.
2. Central heating and cooling equipment.
3. Complete piping systems including insulation, valves, supports, etc.
4. Air handling equipment including packaged equipment and exhaust fans.
5. Air distribution systems including ductwork, terminal units, dampers, insulation, and air inlets and outlets.
6. HVAC control system.
7. Assist Commissioning Agent as required by Commissioning specification.

E. Advise subcontractor, suppliers, and vendors involved in the work specified in this Section of the applicable requirements.

1.02 QUALITY ASSURANCE

A. All work and materials shall conform to all applicable local and state codes and all federal, state and other applicable laws and regulations. All clarifications and modifications which have been cleared with appropriate authorities are listed under the applicable sections. All electrical products shall bear the label of a recognized testing laboratory such as UL or CSA.

B. Whenever the requirements of the Specifications or Drawings exceed those of the applicable code or standard, the requirements of the Specifications and Drawings shall govern.

C. Codes and Standards: Comply with the provisions of the following referenced codes, standards and specifications:
1. Federal Specifications (FS)
2. American National Standards Institute (ANSI)
3. National Electrical Manufacturer's Association (NEMA)
4. National Fire Protection Association (NFPA)
5. Underwriters Laboratories, Inc. (UL)
6. Factory Mutual (FM)
7. International Building Code (IBC) with State and Local Amendments
8. International Mechanical Code (IMC) with State and Local Amendments
9. Uniform Plumbing Code (UPC) with State and Local Amendments
10. American Society for Testing and Materials (ASTM)
11. Americans with Disabilities Act (ADA)
12. International Fire Code (IFC) with State and Local Amendments
13. Energy Policy Act (EPAct)
14. Manufacturers Standardization Society (MSS)
15. American Gas Association (AGA)

D. Each piece of equipment furnished shall meet all detailed requirements of the Drawings and Specifications and shall be suitable for the installation shown. Equipment not meeting all requirements will not be acceptable, even though specified by name. Where two or more units of the same class of equipment are furnished, use product of the same manufacturer; component parts of the entire system need not be products of same manufacturer. Furnish all materials and equipment, new and free from defect and of size, make, type and quality herein specified or approved by the Architect. All materials shall be installed in a neat and professional manner.

E. All apparatus shall be built and installed to deliver its full rated capacity at the efficiency for which it was designed.

F. The Drawings and Specifications are complementary. What is called for by one shall be as though called for by both.

G. Drawings: Do not scale drawings for roughing-in measurements, nor use as shop drawings. Make field measurements and prepare shop drawings. Coordinate work with shop drawings of other specification divisions. See Article 3.1 for more information and requirements.

H. Field Wiring: It is the intent of these specifications that all systems shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections provided. Provide all necessary field wiring and devices from the point of connection indicated on the electrical drawings. All equipment shall be installed in compliance with the Electrical Code and the equipment's UL listing. Bring to the attention of the Architect in writing, all conflicts, incompatibilities, and/or discrepancies prior to bid or as soon as discovered.

1.03 WORK OF OTHER CONTRACTS

A. Work under this contract shall be conducted in a manner to allow for the future installations of such equipment or items listed in other sections of this Specification.

1.04 WORK OF OTHER DIVISIONS

A. Work under this Division shall be conducted in a manner to cooperate with the installation of such equipment or items as specified in other Divisions.

B. Plumbing piping systems and fixtures and fire suppression piping systems are specified under other Divisions of these Specifications except for provisions or items specifically noted on the Drawings or specified herein.

C. Consult all Drawings and Specifications in this project and become familiar with all equipment to be installed. Coordinate all aspects of the construction with the other trades on the job to ensure that all work and materials required to provide a complete and operational facility are included in the bid.

D. All sections of Division 23 are interrelated and shall be considered in their entirety when interpreting any material, method, or direction listed in any section of Division 23. Individual sections are not written for specific Subcontractors or suppliers but for the General Contractor.

1.05 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES (SUBMITTALS)

A. Submit in accordance with Division 1 full technical and descriptive shop drawing data on proposed materials and equipment as detailed in each section.

B. The Contractor shall verify that all equipment submitted can be delivered and installed within the time constraints of the construction period.

C. Include the manufacturer, type, style, catalog number, complete specification, certified dimensions, and description of physical appearance for each item and option submitted. Reproduction of catalog data sheets shall be clean and legible to show all details, including gauge of metal used.

D. Include only information on exact equipment to be installed, not general catalogs of the manufacturer. Where sheets show proposed equipment as well as other equipment, identify proposed equipment with rubber stamp arrow or similar concise method.

E. Submit with each copy a transmittal letter verifying that all included equipment submittals have been carefully considered for quality, dimensions, function, and have been coordinated with the Drawings and Specifications. Guarantee that proposed materials will meet or exceed the quality and function of those specified.

F. Include field wiring diagrams and connection diagrams for all control and/or low voltage systems, including floor plans.

G. Submittal Review: The submittal review process is a means to provide quality control. The action noted to be taken (or where conflicts with the contract documents are not noted) shall not be interpreted by the Contractor as automatic "change orders." Approval of the data for substitution and shop drawings shall not eliminate the Contractor's responsibility for compliance with Drawings or Specifications, nor shall it eliminate the responsibility for freedom from errors of any sort in the data discovered prior to or after the review process. Deviations, discrepancies, and conflicts between the submittals and the Contract Documents shall be called to the Architect's attention in writing at the time of transmittal of the data.

H. Submittals shall be in the form of PDF documents. Arrange submittals numerically with specification sections identified in tabs. All required sections shall be submitted at one time. **Partial submittals will be rejected without review.**

I. For adhesives and sealants used on the interior of the building (inside the waterproofing system), include printed statement of volatile organic compound (VOC) content.

1.06 PRODUCT SUBSTITUTION

A. Materials other than those specified may be approved for this project providing a written request is submitted to the Architect prior to bid in accordance with Instructions to Bidders. Requests shall include complete specifications, dimensions, manufacturer and catalog number for each item for which approval is desired. If, in the opinion of the Architect, the material is not complete or if it is not an acceptable substitute, he may reject it. The Architect's evaluation will be based solely on the material submitted.

1.07 CHANGE ORDERS

A. All supplemental cost proposals by the Contractor shall be accompanied by a complete itemized breakdown of labor and materials without exception. At the Architect's request, the Contractor's estimating sheets for the supplemental cost proposals shall be made available to the Architect. Labor must be separated and allocated for each item of work.

1.08 RECORD DOCUMENTS

A. Project Record (As-Installed) Drawings:
   1. Maintain a set of record drawings on the job site as directed in Division 1.
   2. Keep Drawings clean, undamaged, and up to date.
   3. Record and accurately indicate the following:
      a. Depths, sizes, and locations of all buried and concealed piping dimensioned from permanent building features.
      b. Locations of all valves with assigned tag numbers.
      c. Locations of all fire dampers and other airflow control devices.
      d. Changes, additions, and revisions due to change orders, obstructions, etc. Eradicate extraneous information.
      e. Model numbers of installed equipment.
   4. Make Drawings available when requested by Architect for review.
   5. Submit as part of the required Project Closeout documents. Final submittal will be in the form of reproducible drawings.

6. Quality of entire set of project record drawings to match the quality of the contract documents; quality to be judged by Architect. Computer-aided design drafting (CADD) shall be used to complete project record drawings. Use standards set in contract documents. Note field modifications, all addenda, and change order items on project record drawings. If deficiencies are found in either the quality or the accuracy of the drawings, they will be returned unapproved. Additional review of subsequent submissions shall be at the Contractor's expense.

B. Operating and Maintenance Manuals: Submit Operating and Maintenance Instructions, including manufacturer's service data, wiring diagrams, and parts lists and vendors for all serviceable items of equipment, valve charts, balancing data, final control diagrams showing final set points, duct and piping pressure test reports, equipment startup records, and any additional equipment added by change order. Provide any performance curves, data, and model numbers from submittals. Comply with provisions of Division one where applicable to the mechanical work. Submittal shall be in the form of a PDF file per specification section. Arrange submittals numerically with equipment type or classification identified in tabs. Manufactures O&M manuals shall be provided as a single PDF file that can be hyper-linked by Owner for reference. O&M manuals that are a series of PDF files will not be accepted.

1.09 WARRANTY

A. Furnish, prior to application for final payment, three copies of written and signed guarantee effective a period of one year from date of completion and acceptance of entire project; agree to correct, repair and/or replace defective materials and/or equipment or the results of defective workmanship without additional expense to the Owner. Where no response satisfactory to the Owner has occurred within three working days from the written report of a warranty covered defect, the contractor shall agree to pay for the cost of repair of the reported defect by a contractor of the Owner's choice.

B. Where the manufacturer's guarantee exceeds one year, the longer guarantee shall govern and include the Contractor's labor.

PART 2 PRODUCTS

2.01 GENERAL

A. General: Provide all new materials and equipment, identical to apparatus or equipment in successful operation for a minimum of two years. Provide materials of comparable quality omitted here but necessary to complete the work. Maximum allowable variation from stated capacities, minus 5% to plus 10% as approved in each case.

B. Compatibility: Provide products which are compatible with other portions of the work and provide products with the proper or correct power and fuel-burning characteristics, and similar adaptations for the project.

C. Efficiency: Heating and cooling equipment shall comply with ASHRAE Standard 90.1-2010 and the State Energy Code. Where equipment efficiencies are indicated, the use of alternate or substitute manufacturer's equipment with lower efficiencies is not permitted.

D. Storage and Handling:
1. Delivery: Deliver to project site with manufacturer's labels intact and legible.
2. Handling: Avoid damage.
3. Storage: Inside protected from weather, dirt and construction dust. Where necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.

2.02 STARTERS AND SWITCHES

A. Manufacturers: Cerus Industrial Model numbers are listed. General Electric, ABB, Allen Bradley, Schneider Electric, Eaton, are approved if equal. Provide starters by same manufacturer throughout project.

B. General: Provide each motor with starter or switch as approved and recommended by manufacturer of motor or equipment of which motor is a part. All starters shall include integral disconnect.

C. System Description
   1. Single Phase Starter: Starters for 115VAC single phase motors less than 1 HP shall be capable of both manual and automatic operation. Refer to Section D for single phase starter requirements.
   2. Magnetic Starters: Starters for 3-phase motors shall be magnetic starters. Refer to Section E for magnetic starter requirements.

D. Enclosed Full Voltage Non-Reversing (FVNR) Single Phase Starter
   1. Single Phase Motor Starter Control: The single phase motor starter shall consist of a manually operated quick-make toggle mechanism lockable in the "Off" position which shall also function as the motor disconnect. Additionally, the starter shall provide thermal overload protection, run status pilot light and fault pilot light. The starter must include the capability to operate in both manual and automatic control modes. In automatic mode, the starter shall have the capability to integrate with a building automation system by providing terminals for run input, run status output and fault output. All control terminals shall be integrated in the starter. At a minimum, each single phase starter shall include an interposing run relay and current sensing status output relay. Single phase motor starter shall be in a surface mount enclosure.
   2. Approved manufacturer: Cerus Industrial, model BAS-1P or approved equal.

E. Enclosed Full Voltage Non-Reversing (FVNR) Non-Combination Starter
   1. Magnetic Motor Starters shall be enclosed in a general purpose electrical enclosure with the appropriate environmental rating.
   2. Starters shall consist of a horsepower rated magnetic contactor with a minimum of 1NO and 1NC auxiliary contacts and solid state electronic overload relay. Overload relay shall protect all three phases with a wide range current setting and trip class to allow field adjustment for specific motor FLA. Overload relay shall provide phase failure, phase loss, locked rotor and stall protection.
   3. Provide a manual reset pushbutton on the starter cover to restore normal operation after a trip or fault condition.
   4. Each starter shall include an installed 50VA control power transformer (CPT) with protected secondary. The CPT must accept the available line voltage and the control voltage shall not exceed 120V.
   5. Installed accessories shall include Hand-Off-Auto operation switch with 22mm style operator interfaces. Include LED pilot light indicators for Hand, Off, Auto, Run and Overload conditions. All pilot devices shall be water tight and dust tight.
   6. When remotely controlled by an automation system, the starter shall include remote run terminals which accept both a voltage input signal and a contact closure. The voltage run input shall accept both AC and DC signals including 24VAC, 120VAC, 24VDC and 48VDC to allow direct connection of the transistorized automation signal to the starter.
   7. In applications where the motor is interlocked with a damper or valve, the actuator control must reside within the starter enclosure. The starter must provide a voltage output to operate the actuator to open the damper or valve without closing the motor circuit. The starter will only close the motor circuit and start the motor after it has received a contact closure from a limit or end switch confirming the damper or valve position.
   8. Manufacturer shall provide and install tags with engraved white lettering to designate equipment served.

F. Enclosed Full Voltage Non-Reversing (FVNR) Combination Starter / Disconnect
   1. Magnetic Motor Starters shall be enclosed in a general purpose electrical enclosure with the appropriate environmental rating.
   2. Starters shall consist of a horsepower rated magnetic contactor with a minimum of 1NO and 1NC auxiliary contacts and solid state electronic overload relay. Overload relay shall protect all three phases with a wide range current setting and trip class to allow field adjustment for specific motor FLA. Overload relay shall provide phase failure, phase loss, locked rotor and stall protection.
   3. Provide a manual reset pushbutton on the starter cover to restore normal operation after a trip or fault condition.
   4. Each starter shall include an installed 50VA control power transformer (CPT) with protected secondary. The CPT must accept the available line voltage and the control voltage shall not exceed 120V.

5. Installed accessories shall include Hand-Off-Auto operation switch with 22mm style operator interfaces. Include LED pilot light indicators for Hand, Off, Auto, Run and Overload conditions. All pilot devices shall be water tight and dust tight.
6. When remotely controlled by an automation system, the starter shall include remote run terminals which accept both a voltage input signal and a contact closure. The voltage run input shall accept both AC and DC signals including 24VAC, 120VAC, 24VDC and 48VDC to allow direct connection of the transistorized automation signal to the starter.
7. In applications where the motor is interlocked with a damper or valve, the actuator control must reside within the starter enclosure. The starter must provide a voltage output to operate the actuator to open the damper or valve without closing the motor circuit. The starter will only close the motor circuit and start the motor after it has received a contact closure from a limit or end switch confirming the damper or valve position.
8. Provide and install tags with engraved white lettering to designate equipment served.
9. Enclosed combination starters shall include all of the magnetic starter requirements in addition to a disconnecting method. Acceptable disconnects include: motor circuit protectors or UL 489 circuit breakers. All disconnects shall include a lock-out mechanism when in the off position.
10. The Motor Circuit protector shall be a UL listed 508 current limiting manual motor starter with magnetic trip elements only. The breaker shall carry a UL 508F rating (up to 100A frame size) which provides for coordinated short circuit rating for use with the motor contactor and provides a minimum interrupting rating of 30,000 AIC for the combination starter.
11. Disconnect shall be UL 98 suitable for service entrance protection.
12. UL 489 breaker shall include thermal and magnetic trip mechanisms.
13. Provide over/under voltage and phase monitoring capability. Monitor shall be field adjustable for both over and under voltage levels and a delay time before returning to normal operation after a trip.

G. Quality Assurance
1. Manufacturer shall provide a five year warranty on the complete starter assembly.
2. The starter assembly shall be UL listed under UL 508A.

2.03 SOLID-STATE, VARIABLE-SPEED MOTOR CONTROLLERS

A. General: Controllers listed and labeled as a complete unit and arranged to provide variable speed of a standard NEMA Design B 3-phase induction motor by adjusting output voltage and frequency of controller. Designed and rated by the manufacturer for the type of load (e.g., fans, blowers, and pumps) used and also approved by the manufacturer for the type of connection used between the motor and load (direct connection or power transmission connection).

B. Input Line Reactors: 5% for reduction of harmonics.

C. Output Line Reactors: Specially designed and constructed for IGBT controllers and designed to protect motor from voltage spikes over 150% of the bus voltage. Required where controller to motor cable length exceeds 50 feet. Provide dV/dT filters for 460 volt motors with cable lengths in excess of 300'.

D. In lieu of providing line reactors, the drive manufacturers may submit a power system analysis demonstrating compliance with IEEE 519.

E. Ratings:
1. Output Ratings: 3-phase, 6 to 60 Hz, with voltage proportional to frequency throughout the voltage range.
2. Starting Torque: 100 percent of rated torque, or as indicated.
3. Speed Regulation: Plus or minus 1 percent.
4. Ambient Temperature: 0° C to 40° C.
5. Efficiency: 98 percent at normal power levels.

F. Isolated Control Interface: Allow the controller to follow one of the following over an 11:1 speed range:
1. Electrical Signal: 4 to 20 milliamperes at 24 V.

G. Internal Adjustability: Provide the following internal adjustment capabilities:
1. Minimum Speed: 5 to 25 percent of maximum RPM.

2. Maximum Speed: 80 to 100 percent of maximum RPM.
3. Acceleration: 2 to 22 seconds.
4. Deceleration: 2 to 22 seconds.
5. Current Limit: 50 to 110 percent of maximum rating.

H. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors.
2. Snubber networks to protect against malfunction due to system voltage transients.
3. Motor Overload Relay: Adjustable and capable of NEMA class 10 performance.
4. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
5. Instantaneous Overcurrent Trip.
6. Loss of Phase Protection.
7. Reverse Phase Protection.
8. Under- and Over-Voltage Trips.
9. Overtemperature Trip.
10. Short Circuit Protection.

I. Automatic Reset/Restart: Attempt three restarts after controller fault or on return of power to the system following an interruption and before shutting down for manual reset or fault correction. Provide for restarting during deceleration without damage to the controller, motor, or load.

J. Serial Communications: The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus and BACnet MS/TP. The use of third party gateways and multiplexers is not acceptable. All protocols shall be certified by the governing authority (i.e. BTL Listing for BACnet).

K. EMI / RFI filters: All VFDs shall include onboard EMI/RFI filters. The onboard filters shall allow the entire VFD assembly to be CE Marked and the VFD shall meet product standard EN61800-3 for the First Environment restricted. No Exceptions.

L. Operation and Maintenance Features: Include:
1. Status Lights: Door-mounted LED indicators to indicate power on, run, overvoltage, line fault, overcurrent, and external fault.
2. Elapsed Time Meter.
3. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer.
4. Current-Voltage-Frequency Indicating Devices: Mount meters or digital readout device and selector switch flush in controller door and connect to indicate controller output.
5. Provide with non-fused disconnect rated for drive capacity. Disconnect shall be UL 98 suitable for service entrance.

M. For drives to be mounted outside install in a NEMA 3R enclosure with ventilation fan to control cabinet temperature below 135ºF.

N. Acceptable Manufacturers: Subject to compliance with requirements.
1. ABB Power Distribution, Inc.

2.04 ACCESS PANELS

A. Manufacturers: Inryco/Milcor, Bilco, Elmdor, Karp, Potter-Roemer or accepted substitute. Inryco/Milcor Style DW, K, or M panels as required by construction.

B. Construction: Flush style, fire rated in fire rated partitions and ceilings. Provide flush key cylinder locks on all access panels less than 8' above the floor in public spaces. Turn keys over to Owner at project completion. Screwdriver latches on all others.

C. Floor Access Doors:
1. Provided with recessed pan to receive floor material to match adjacent.
2. Frame shall be 1/4" extruded aluminum with built-in neoprene cushion and continuous anchor flange.
3. Door shall be 1/4" aluminum plate reinforced with aluminum stiffeners as required.
4. Stainless steel hinges shall be bolted to underside and pivot on torsion bars that counterbalance the door for easy operation.

5. Door shall open 90 degrees and lock automatically in that positon. A vinyl grip handle shall be provided to release the cover for closing.
6. Door shall be built to withstand a live load of 150 lbs per sq. ft. and equipped with a cylinder lock and threaded cover plug.
7. Aluminum shall be mill finish.
8. Installation shall be in accordance with manufacturer's instructions.
9. Manufacturer shall guarantee against defects in material or workmanship for a period of five years.
10. Bilco Type TER or approved.

2.05 EXPANSION JOINTS AND LOOPS

A. Flexible Expansion/Seismic Loop: Factory fabricated assembly consisting of two 90 degree elbows, two lengths of flexible hose, and a 180 degree return bend to allow free movement in three axis. Return bend shall include attachment point for support and a drain/vent fitting. Hose shall be corrugated metal style with metal overbraid. Connections to match piping system except connection 2" and larger shall be flanged style. Metraflex "Metraloop."

2.06 METERS AND GAUGES

A. General: Install meters and gauges where shown on the plans or specified elsewhere in these specifications.

B. Pressure-Temperature Test Plugs:
1. ¼" or ½" NPT fitting of solid brass capable of receiving either an 1/8" OD pressure or temperature probe and rated for zero leakage from vacuum to 1000 psig. Neoprene valve core for temperatures to 200 deg. F., Nordel to 350 deg. F.
2. Provide for each test plug a pressure gauge adapter with 1/16" or 1/8" OD pressure probe.
3. Furnish a test kit containing one 2-1/2" dial pressure test gauge of suitable range, one gauge adapter with 1/16" or 1/8" OD probe and two 5" stem pocket test thermometers – one 0 to 220 degrees F and one 50 to 550 degrees F. Turn the kit over to the Architect.
4. Cisco "P/T Plugs," Peterson "Pete's Plug" or approved substitute.

C. Thermometers: Liquid-in-glass, adjustable stem, separable sockets, plus 40 to 240 degrees F range (unless indicated otherwise). Weiss numbers are listed. Equivalent Taylor, Trerice, Weksler or approved substitute.
1. Wide case (9") in equipment rooms and all major equipment items. Weiss "9VS" Series.
2. Narrow case (7") in all other locations. Weiss "7VS" Series.

D. Pressure Gauges: Install on suction and discharge of all pumps and where shown on Drawings 4-1/2" dial, 0-100 psig graduation pressure gauges with Ashcroft No. 1106 pulsation dampers and stop cocks. Weiss UGE-1 or equivalent Ashcroft, Marsh, Trerice, Weksler.

2.07 VALVES

A. General: Provide factory fabricated valves of the type, body material, temperature and pressure class, and service indicated. Bronze gate, globe and check valves shall comply with MSS-SP-80. Ball valves shall comply with MSS-SP-110. Iron gate and globe valves shall comply with MSS-SP-70. Iron check valves shall comply with MSS-SP-71. Butterfly valves shall comply with MSS-SP-67. Valve size same as connecting pipe size.

B. Acceptable Manufacturers: Milwaukee, Crane, Grinnell, Nibco, Hammond, Stockham, Legend, Watts, and Walworth. Grooved end valves Victaulic, Gruvlock, or accepted substitute. NIBCO numbers are given except as noted. Where possible, provide valves from a single manufacturer.

C. Valve Styles: See individual Division 23 sections for valve styles.

D. Butterfly Valve Operators: Locking lever for shut-off service; "Memory Stop" for lever handle with 10-position throttling plate for throttling service; gear operator with babbitt sprocket rim for chain-operated valves and gear operators on all 8" or larger valves.

E. Butterfly Valve Style: Lug-type with cap screws for all valves utilized for equipment isolation for servicing. Lug and grooved style valves shall be capable for use as isolation valves and recommended by manufacturer for dead-end service at full system pressure.

F. Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper manner to receive insulation.

G. Mechanical Actuators: Provide mechanical actuators with chain operators where indicated, where valves 4" and larger are mounted more than 7' above the floor, and where manual operation is difficult because of valve size, pressure differential or other operating conditions. Drop chains to 6'-6" above the floor.

H. Selection of Valve Ends (Pipe Connections): Select and install valves with ends matching the types of pipe/tube connections.

2.08 HANGERS AND SUPPORTS

A. General: Provide factory-fabricated horizontal piping hangers, clamps, hanger rod, inserts, supports, etc., of the indicated MSS type and size. The Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry Practice SP-58 and SP-69 are referenced in this section.

B. Manufacturers: B-Line, Carpenter & Paterson, Grinnell, Michigan, Superstrut, Tolco, Erico, or accepted substitute. Grinnell figure numbers in parentheses where applicable (or other manufacturers as noted).

C. Corrosion Protection: Provide materials which are zinc plated or factory painted to prevent corrosion. Prevent electrolysis in the support of copper tubing by the use of copper hangers (copper coated alone is not sufficient), strut cushion, or at least two layers of UPC 10 mil tape.

D. Seismic Requirements: Provide seismic restraints in accordance with OSSC Section 1613. Design restraint systems in accordance with "Seismic Restraint Manual: Guidelines for Mechanical Systems," Second Edition, 1998, SMACNA, or “A Practical Guide to Seismic Restraint” ASHRAE RP-812, 1999.

E. Horizontal Piping Hangers and Supports:
1. Adjustable Clevis Hanger: MSS Type 1 (Fig. 260).
2. Adjustable Band Hanger: MSS Type 7 (Fig. 97), fabricated from steel.
3. Adjustable Swivel-Band Hanger: MSS Type 10 (Fig. 70).
4. Clamp: MSS Type 4 (Fig. 212, 216).
5. Double-Bolt Clamp: MSS Type 3 (Fig. 295A, 295H), including pipe spacers.
6. Adjustable Saddle-Support: MSS Type 36 (Fig. 258) and MSS Type 37 (Fig. 259), including saddle, pipe and reducer. Fabricate base-support from steel pipe and include cast-iron flange or welded-steel plate.
7. Channel Support System: Galvanized, 12 gauge channel and bracket support systems, single or double channel as indicated on the Drawings or as required by piping and equipment weights. Grinnell "Power Strut" channel. Acceptable Manufacturers: Super Strut, Globestrut, Bee, Kindorf or Unistrut.

F. Vertical Pipe Clamps:
1. Two-Bolt Riser Clamp: MSS Type 8 (Fig. 261).
2. Four-Bolt Riser Clamp: MSS Type 42 include pipe spacers at inner bolt-holes.

G. Hanger Attachment:
1. Hanger Rod: Rolled threads, zinc plated. Right hand threaded.
2. Turnbuckles: MSS Type 13 (Fig. 230).
3. Weldless Eye-Nut: MSS Type 17 (Fig. 290).
4. Malleable Eye-Socket: MSS Type 16 (Fig. 110R).
5. Clevises: MSS Type 14 (Fig. 299).

H. Building Attachments:
1. Concrete Inserts: MSS Type 18 (Fig. 282), steel or Grinnell Power-Strut PS349 continuous channel. Acceptable Manufacturers: Michigan Hanger, Globestrut, Unistrut, Super Strut.

2. Clamps: MSS Type 19 (Fig. 285, 281), Type 20, 21 (Fig. 225, 226, 131), Type 23 (Fig. 86, 87, 88), Type 25 (Fig. 227), Type 27 through 30 where applicable.

2.09 IDENTIFICATION MARKERS

A. Pipe Markers:
   1. Adhesive pipe markers of width, letter size and background color conforming to ANSI A13.1.
   2. Acceptable Manufacturers: Brady B946 with arrow banding tape or similar Seaton, Zeston, MSI.

B. Duct Markers:
   1. Adhesive duct markers 2¼”x14” with black text indicating contents on white background with directional flow arrow.
   2. Acceptable Manufacturers: Brady B946 or similar Seaton, Zeston, MSI.

C. Nameplates:
   1. Engraved nameplates, 1/16" thick, laminated 2-ply plastic, bottom ply white, outer ply black, letters formed by exposing bottom ply.
   2. Size: 2" by 4" nameplates with 1/4" high letters.

D. Valve Tags:
   1. 2" diameter, 18-gauge polished brass tags with 3/16" chain hole and 1/4" high stamped, black-filled service designation.
   2. Acceptable Manufacturers: Seaton, Brady, MSI.

E. Valve Identification: Tag all valves with brass disc and chain. Prepare valve charts indicating valve number, size, location, concealed or exposed, function, valve manufacture and model number, and normal position. Provide floor plan as part of record Drawings. Use no duplicate numbers in Plumbing and Heating systems. Mount glazed frames containing one set of valve charts in the building mechanical room.
   1. Include floor plan of each floor level with valve tag numbers indicated at approximate valve locations. Provide separate maps for plumbing valves and HVAC valves. Maps are to be 11"x17".
   2. Label all ceilings directly below or access panels directly in front of plumbing or HVAC valves using engraved, printed labels or hanging tags stating the valve ID as shown on the Valve Map and the Valve Tag Directory.

2.10 PENETRATION FIRE STOPPING

A. Through-penetration fire stopping system tested and listed by Underwriters Laboratories. 3M, Metacaulk, SpecSeal, or approved.

B. Select system for proper application based on wall construction, type of penetrating item, wall rating, etc.

C. Sealants and Primers – General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.

2.11 PENETRATION AT ACOUSTICAL PROTECTION WALLS

A. See details on Drawings.

B. Materials:
   1. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.
      a. Architectural Sealants: 250 g/L.
      b. Sealant Primers for Porous Substrates: 775 g/L.
      c. Sealant Primers for Porous Substrates: 775 g/L.
   2. Acoustical Joint Sealant: Manufacturer’s standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

a. Products:
1) Pecora Corporation; AC-20 FTR.
2) Tremco Incorporated; Tremflex 834.
3) USG Corporation; SHEETROCK Acoustical Sealant.

3. Joint Backing: Round, closed cell, non-gassing foam rod compatible with sealant; ASTM C 1330 Type B, cylindrical, bi-cellular material; oversized 30 to 50 percent larger than joint width.
a. Products:
1) Sof Rod manufactured by Nomaco Inc.
2) Sonolastic Soft Backer-Rod manufactured by BASF.

4. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC content than require by South Coast Air Quality Management District Rule No. 1168.

PART 3 EXECUTION

3.01 LAYOUT AND COORDINATION

A. Site Examination: Before starting work, carefully examine site and all contract Drawings. Become thoroughly familiar with conditions governing work on this project. Verify all indicated elevations, building measurements, roughing-in dimensions and equipment locations before proceeding with any of the work.

B. Utility Locations: The location of existing utilities, wires, conduits, pipes, ducts, or other service facilities are shown in a general way only on the Drawings and are taken from existing records. Ascertain whether any additional facilities other than those shown on the plans may be present and determine the exact location and elevations of all utilities prior to commencing installation.

C. Sleeves, Inserts, Cast-in-Place Work: Provide sleeves, inserts, anchoring devices, cast-in-place work, etc. which must be set in concrete sequenced at the proper time for the project schedule.

D. Coordination:
1. The Drawings are based on equipment of a certain manufacturer and may be identified as such. Where alternate manufacturers or approved substitutes are incorporated into the work, any required design changes are the responsibility of the contractor. Such changes may include changes in utility or system connection sizes, location, or orientation, service clearances, structural support or acoustic considerations.
2. Prepare accurate AutoCAD shop drawings showing the actual physical dimensions required for the installation for duct work, piping and mechanical devices. Submit drawings prior to purchase/fabrication/installation of any of the elements involved in the coordination. Provide drawing files to other trades for coordination.
3. Cooperate with other trades in furnishing material and information for sleeves, bucks, chases, mountings, backing, foundations and wiring required for installation of mechanical items.
4. Coordinate all work with other trades and determine in advance where interfacing of the mechanical work and other work are required to be connected together. Provide all materials and equipment to make those connections. Submit shop drawings showing required connections where special conditions exist.

E. Discrepancies: Report immediately any error, conflict or discrepancy in Plans, Specifications and/or existing conditions. Do not proceed with any questionable items of work until clarification of same has been made. Should rearrangement or re-routing of piping be necessary, provide for approval the simplest layout possible for that particular portion of the work.

3.02 UTILITY COORDINATION

A. Utility Coordination: Coordinate all aspects of the incoming utility services indicated with the City Engineer, serving utility, and the off-street improvements Contractor. Requirements of the utility company which exceed the provisions made on the Drawings or covered by these Specifications shall take precedence. Provisions made on the Drawings or Specifications in excess of the utility company's requirements shall take precedence. No additional compensation will be allowed the Contractor for connection fees or additional work or equipment not covered in the Drawings or Specifications which are a result of policies of the serving utilities.

3.03 MECHANICAL EQUIPMENT WIRING

A. Provide all mechanical equipment motors, automatic temperature, limit, float and similar control devices required, with wiring complete from power source indicated on Electrical Drawings.

B. Provide properly rated motor overload and undervoltage protection and all manual or automatic motor operating devices for all mechanical equipment.

C. Equipment and systems shown on the Drawings and/or specified, are based upon requirements of specific manufacturers which are intended as somewhat typical of several makes which may be approved. Provide all field wiring and/or devices necessary for a complete and operable system including controls for the actual selected equipment/system.

D. Provide all starters for mechanical motors. Review Electrical Specifications and Drawings to determine starter sizes. Adjust fusing/time delay on all starters once installed.

3.04 GENERAL INSTALLATION

A. Locating and Positioning Equipment: Observe all Codes, Regulations and good common practice in locating and installing mechanical equipment and material so that completed installation presents the least possible hazard. Maintain adequate clearances for repair and service to all equipment and comply with Code requirements.

B. Arrangement: Arrange piping parallel with primary lines of the building construction, and with a minimum of 7' overhead clearance in all areas where possible. Unless indicated otherwise, conceal all piping. Locate operating and control equipment properly to provide easy access, and arrange entire mechanical work with adequate access for operation and maintenance. Give right-of-way to piping which must slope for drainage. Set all equipment level or as recommended by manufacturer. Under no conditions shall beams, girders, footings or columns be cut for mechanical items. Casting of pipes into concrete is prohibited unless so shown on Drawings.

C. Drip Pans: Provide drip pans under all above ceiling in-line pumps and cooling coils. Locate pan immediately below piping and equipment, and extend a minimum of 6" on each side and lengthwise 18" beyond equipment being protected. Fabricate pans 2" deep, of reinforced 20 gauge galvanized sheet metal with watertight seams and rolled or hemmed edges. Provide 3/4" drainage piping, properly discharged to over floor drain or as shown on the Drawings. Comply with Mechanical Code for overflow protection and pipe sizing.

D. Access Panels: Provide access panels with proper backing reinforcement for all equipment, dielectric unions, valves and items requiring service and installed above ceilings, behind walls, or in furring, complete with correct frame for type of building construction involved. Exact size, number and location of access panels are not necessarily shown on Drawings. Use no panel smaller than 12" by 12" for simple manual access or smaller than 16" x 20" where personnel must pass through.

E. Adjusting: Adjust and calibrate all automatic mechanical equipment, temperature controls, float devices, etc. Adjust flow rates at each piece of equipment or fixture.

F. Building Vapor Barrier: Wherever the building insulation vapor barrier is penetrated by piping, hangers, conduits, etc., provide clear self-adhesive tape recommended by the insulation manufacturer around the penetrations.

G. Housekeeping Pads: Construct minimum 6" thick with chamfered edges using 3000 psi concrete. Provide #4 reinforcing bars 8" on center in each direction and within 4" of each edge, centered in pad thickness. Provide ½" dowel with 3" embedment into floor slab for each 2 square feet of pad area. Dowels and equipment anchor bolts shall be spaced a minimum of 6" from pad edges.

3.05 VALVE INSTALLATION

A. General: Comply with the following requirements:
1. Install valves where required for proper operation of piping and isolation of equipment, including valves in branch lines where necessary to isolate sections of piping, and where shown on the drawings. Install valves at low points in piping systems that must be drained for service or freeze protection.
2. Locate valves in accessible spaces (or behind access panels) and so that separate support can be provided when necessary.
3. Install valves with stems pointed up, in the vertical position where possible, but in no case with stems pointed downward from a horizontal plane.

B. Insulated Valves: Install extended-stem valves in all piping specified as insulated, and arrange in the proper manner to receive insulation.

C. Valve Access: Provide access panels to all valves installed behind walls, in furring or otherwise inaccessible.

3.06 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Proceed with the installation of hangers, supports and anchors only after the required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) the proper placement of inserts, anchors and other building structural attachments.
1. Install hangers, supports, clamps, and attachments to support piping and equipment properly from the building structure. Use no wire or perforated metal to support piping, and no supports from other piping or equipment. For exposed continuous pipe runs, install hangers and supports of the same type and style as installed for adjacent similar piping.
2. Prevent electrolysis in the support of copper tubing use of at least 2 layers of UPC listed 10 mil tape at all bearing surfaces or strut clamp cushion. Copper plated hangers alone are not sufficient.
3. Arrange supports to prevent eccentric loading of joists and joist girders. Locate supports at panel points only.

B. Provisions for Movement:
1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate the action of expansion joints, expansion loops, expansion bends and similar units. Install specified seismic restraints to restrict excessive movement.
2. Install hangers and supports so that equipment and piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
3. Install hangers and supports to provide the indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded. Comply with the following installation requirements:
    a. Clamps: Attach clamps, including spacers (if any), to piping outside the insulated piping support. Do not exceed pipe stresses allowed by ANSI B31.
    b. Insulated Pipe Supports: Insulated pipe supports shall be supplied and installed on all insulated pipe and tubing.
    c. Load Rating: All insulated pipe supports shall be load rated by the manufacturer based upon testing and analysis in conformance with ASME B31.1, MSS SP-58, MSS SP-69 and MSS SP-89.
    d. Support Type: Manufacturer's recommendations, hanger style and load shall determine support type.
    e. Insulated Piping Supports: Where insulated piping with continuous vapor barrier or where exposed to view in finished areas is specified, install hard maple wood insulation shields (Elcen Fig. 216) or steel pipe covering protection shields (MSS type 39) at each hanger.

C. Pipe Support:
1. Vertical Spacing: Support at base, at equivalent of every floor height (maximum 10' as required by Code) and just below roof line.
2. Screwed or Welded Steel or Copper Piping: Maximum hanger spacing shall be as follows:

	Steel	Copper
1-1/4" and smaller	7' span	6' span
1-1/2" pipe	9' span	6' span
2" pipe	10' span	10' span
2-1/2" & larger	12' span	10' span

3. Install additional hangers or supports at concentrated loads such as pumps, valves, etc. to maintain alignment and prevent sagging.
4. Support Rod: Hanger support rods sized as follows:

Pipe and Tube Size		Rod Size	
Inches	mm	Inches	mm
1/2” to 4”	12.7 to 101.6	3/8”	9.5
5” to 8”	127.0 to 203.2	1/2”	12.7
10” to 12”	254.0 to 304.8	5/8”	15.9

5. Provide manufactures approved channel continuously below all horizontal PEX or other plastic pipe where hung from structure.

D. Adjust hangers and supports to bring piping to proper levels and elevations.

E. Provide all necessary structural attachments such as anchors, beam clamps, hanger flanges and brackets in accordance with MSS SP-69. Attachments to beams wherever possible. Supports suspended from other piping, equipment, metal decking, etc., are not acceptable.

F. Horizontal banks of piping may be supported on common steel channel member spaced not more than the shortest allowable span required on the individual pipe. Maintain piping at its relative lateral position using clamps or clips. Allow lines subject to thermal expansion to roll axially or slide. Size channel struts for piping weights.

G. Installation of drilled-in concrete anchors shall comply with the manufacturer’s instructions for working load, depth of embedment, and spacing between anchors and from the edge of the slab. Use only wedge-style anchors.

H. Seismic Restraints: Install restraints where recommended in SMACNA "Seismic Restraint Manual" and as required by code. Show analysis of supporting structure, anchorages, and restraints in accordance with OSSC Section 16 and reference ASCE standard. Seismic restraint system components shall be approved by the California Office of Statewide Health Planning and Development (OSHPD). Acceptable Manufacturers: Amber/Booth, Mason Industries, Tolco, or approved. Contractor shall submit calculations and shop drawings, sealed and signed by a Professional Engineer, showing seismic restraint design for all equipment, piping and ductwork required to be braced. **Seismic importance factor for new building is 1.5. For remodeled areas seismic importance factor is 1.0.**

I. Ensure all copper piping is protected from contact with non-copper supports. Provide strut cushion below clamp or 2 layers of UPC listed 10 mil tape.

3.07 HVAC SYSTEM IDENTIFICATION

A. Piping System: Indicate each pipe system by its generic name (abbreviated) as shown/scheduled/specified. Comply with ANSI A13.1 for marker locations, letter sizes, and colors. Include arrows to show direction of flow and "Electric Traced" signs to identify heat cable wrapped piping. Locate pipe labels in accessible areas as follows:
1. Near each valve, meter, gauge, or control device.
2. Near equipment such as pumps, heat exchangers, water heaters, etc.
3. At piping branch connections.
4. At penetrations (each side) of walls, ceilings, and floors.
5. At access panels and doors.

6. At 25 foot maximum intervals. Provide a minimum of one label above each room where lift-out ceiling is installed. Reduce intervals in congested areas such as mechanical rooms.

B. Equipment: Provide engraved plastic-laminate signs at locations of major equipment such as heat exchangers, pumps, etc. Identify equipment in field same as on drawings. Permanently mount in an appropriate and effective location.

C. Operation Tags: Where needed for proper and adequate information on operation and maintenance of mechanical systems, provide tags of plasticized card stock, either pre-printed or hand printed to convey the message; example: "DO NOT CLOSE THIS VALVE EXCEPT WHEN THE PUMP IS OFF."

3.08 EQUIPMENT CONNECTIONS

A. Provide complete connections for all items of equipment requiring such connections, including incidental piping, fittings, trim and labor necessary for a finished working installation.

B. Verify the rough-in and finish requirements for all equipment provided under other Divisions of the work and requiring HVAC piping or duct connections with equipment supplier and installer prior to rough-in.

3.09 PROTECTION

A. Protect all work and materials against loss or damage. Close all pipe openings with caps or plugs. At final completion, thoroughly clean and deliver all work and equipment in an unblemished new condition. Keep all motors and bearings in watertight and dustproof covers during entire course of installation.

B. Protect floors, walls, framing and sheathing where pipe cutting and threading operations are conducted with plastic sheeting under plywood sheets. Extend plastic sheeting beyond the plywood. Clean-up metal cuttings, oil, etc., daily or as necessary to prevent debris from being tracked beyond the protected area. Damages, as determined by the Architect, due to the pipe cutting/threading operation shall be repaired by the responsible trade.

3.10 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of mechanical work. Do all necessary cutting and patching of existing building and yard surfaces required for completion of the mechanical work. Patch to match finish and color of adjacent surfaces. Coordinate work in remodel and new areas to avoid cutting of new finished surfaces.

3.11 PIPE PENETRATION FIRE STOPPING

A. Install as recommended by manufacturer and in accordance with the product's UL listing. Below are the minimum installation requirements.
1. Install specified penetrating item(s) with required annular spacing in proper size wall or floor opening. Support penetrating item(s) adequately on both sides of construction.
2. Clean all opening and penetrating item surfaces in penetration area to remove loose debris, dirt, oil, wax, grease, old caulking, etc.
3. If needed or required for gypsum or concrete block walls, install specified galvanized steel wire mesh or sleeve recessed and centered inside wall around penetrating item(s) so that it is snug against perimeter of opening.
4. When required, install specified type and depth of backing material in annular space, recessed to required fill depth of fire stopping caulking.
5. Gun, trowel, and/or pump fire stopping sealant to specified depth in annular space around penetrating item(s). Trowel sealant surfaces flush with wall or floor surfaces to a smooth, defect-free finish. Where required, apply specified size caulking bead around penetrating item(s) at zero annular contact areas and tool smooth.

B. Drawings show some, not all, of the penetration. Review architectural drawings for all fire walls.

C. Sealants and Primers – General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No. 1168.

3.12 MECHANICAL PAINTING

A. Minimum Requirements: Comply with minimum requirements of Division 9, Painting**.** All mechanical equipment, piping, insulation, etc., exposed in finished areas, storage rooms and other locations except mechanical equipment rooms will be painted under Section 09 9000.

B. Iron Work: Paint hangers, rods, anchors, guides, threads of galvanized pipe, bases, supports, uncoated sheet metal and other iron work without factory finish, exposed to weather, one coat acid-resisting black paint. Apply one (1) coat Dixon's Aluminum Graphite No. 209 paint over the (1) coat primer as recommended by paint manufacturer to all hot metal surfaces.

C. Sheet Metal: Apply one coat of zinc chromate to mechanical sheet metal exposed to weather, except no painting required on aluminum or stainless steel. Apply one coat of flat black paint to the inside of unlined ducts behind all grilles and registers.

3.13 HVAC WORK CLOSEOUT

A. General: Refer to the Division 1 sections for general closeout requirements. Calibrate all equipment requiring same. Complete each system as shown or specified herein and place in operation except where only roughing-in or partial systems are called for. Each system shall be tested and left in proper operation free of leaks, obstructions, or contamination.

B. Record Drawings: Submit record set of Drawings required in Division 1 as previously specified in this Section.

C. Closeout Equipment/Systems Operations: Sequence operations properly so that work of project will not be damaged or endangered. Coordinate with seasonal requirements. Operate each item of equipment and each system in a test run of appropriate duration with the Architect present, and with the Owner's operating personnel present, to demonstrate sustained, satisfactory performance. Adjust and correct operations as required for proper performance. Clean and lubricate each system and replace dirty filters, excessively worn parts and similar expendable items of the work.

D. Operating Instructions: Conduct a walk-through instruction seminar for the Owner's personnel who are to be involved in the continued operation and maintenance of the HVAC equipment and systems. Provide written instructions outlining and explaining the identification system, operational diagrams, emergency and alarm provisions, sequencing requirements, seasonal provisions, security, safety, efficiency and similar features of the systems.

END OF SECTION

SECTION 23-0548
MECHANICAL SOUND AND VIBRATION CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the vibration isolation for mechanical equipment specified elsewhere.

1.02 QUALITY ASSURANCE

A. Isolator Engineering: Selected and furnished by the equipment manufacturer. Select isolators for 98% efficiency unless indicated otherwise on the Drawings.

B. Manufacturer: Provide field installed isolation required from a single manufacturer where possible.

1.03 SUBMITTALS

A. Provide product data sheets on all vibration isolators and seismic restraints.

B. Provide itemized list showing the items of equipment or piping to be isolated, isolator type and model number selected, isolator loading and deflection, and reference to specified drawings showing frame and construction.

C. Provide manufacturer's drawings showing equipment frame construction for each item including dimensions, structural member sizes and support locations.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Amber/Booth, Mason Industries, Vibration Mountings and Controls, Kinetics Noise Control.

B. Manufacturer Model Numbers: Amber/Booth figure numbers are listed unless indicated otherwise.

2.02 VIBRATION ISOLATORS

A. Types of Isolators:
   1. Hanger with Spring and Rubber Stop: Combination neoprene element and spring hangers – Hangers shall consist of a steel frame containing a neoprene isolation element at the top and a coil steel spring seated in a neoprene cup on the bottom. Both the element and the cup shall be molded with a neoprene bushing that passes through the steel frame. The neoprene element shall be capable of an average deflection of 0.35". The steel springs shall be capable of a minimum static deflection of 0.75" with a minimum additional travel to solid of ½". Spring diameters and hanger box lower hole size shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the box and short circuiting the spring. Hangers shall be factory precompressed 60% of the total deflection determined by the assigned load per hanger. Hangers shall b manufactured with provision for bolting or attaching to ceiling flat iron straps, rods or steel runners. Hangers shall be of a fail-safe design. Amber / Booth BSRA.

2. Neoprene Pads: Neoprene pads shall be of waffle or ribbed design, 1/4" – 3/8" thick. They shall be installed as a single layer or in multiple layers with 16 gauge steel shims cemented between so that the combination of stiffness and total neoprene thickness achieves the static deflection listed in the vibration isolation schedule in conjunction with a distributed load area that will maintain 10-50 psi. If the equipment support location does not completely cover the pads or does not consist of flat steel footing, an additional full coverage, load distribution plate of minimum 3/8 steel shall be placed between the pad and attached to the equipment support. There shall be no rigid structure between top and bottom of mount. Amber / Booth Type NR Ampad.

B. Neoprene Mounts: Neoprene mounts shall be one piece, neoprene molded assemblies with a minimum loaded static deflection of 0.25". The mount shall incorporate both rubber-in-shear and compression load characteristics. All metal surfaces shall be neoprene covered. The mount shall have friction pads both top and bottom. Bolt holes shall also be provided for both surfaces. The top bolt hole shall be threaded. There shall be no rigid structure between top and bottom supports. Amber / Booth Type RV.

C. Noise and Vibration Barrier Hanger: For ductwork and piping where indicated. Target Enterprises Inc. "ARH-1" or accepted substitute.

D. Seismic and Start-Up Restraints: Select all isolators to withstand seismic loads equivalent two times the isolator load rating applied from any direction. Mason Industries type Z-1011 on all isolated equipment not utilizing isolators with integral restraints.

E. Flexible Pipe Connectors - Type SS: All stainless steel hose and braid with carbon steel connections. Male thread ends on flexible connectors 2" and smaller, and flanged connections on 1-1/2" and larger connectors.

F. Ductwork Flexible Connections:
1. Typical connections shall be made of 30 ounce woven glass fiber, coated with neoprene, sewn together at the edges and joints.
2. The flexible connections shall be approximately 6" long and held in place with 1" wide bands of 12 gauge galvanized steel bolted to duct and to outlets and inlets of the units and fans with 1/8" stove bolts, 5" o.c.
3. It is the intent that these flexible connections shall withstand the operating air pressure, shall not permit air leakage and shall not transmit vibration.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install vibration isolators and flexible connectors as specified herein, as shown on the Drawings and as recommended by manufacturer.

B. Ductwork Flexible Connections: Install flexible duct connections on all externally spring isolated air handling units including roof mounted units down through roof curbs (and/or to unit side duct connections). Fan connections, both at inlet and discharge, shall be made with flexible materials so as to prevent the transfer of vibration from fans to ductwork connected thereto.

C. Flexible Pipe Connections:
1. Provide flexible connections on all piping to spring isolated equipment, where indicated on Drawings and for all coils mounted in spring isolated air handling units or plenums. Coils in rigid units and plenums do not require flexible connectors. Provide a flexible connection in both the supply and return connections to the coil as near the coil as possible.
2. Install connectors in a straight line as recommended by the manufacturer without offsets or twists and support pipe without any load on flexible connectors. Minimum live length shall be as follows:

Pipe Size	Minimum Live Length
1" through 1-1/2"	8"
2" through 2-1/2"	10"
3" through 4"	12"
Over 4"	18"

D. Anchorage: Anchor all isolators to the floor, wall or ceiling structure and anchor points reinforced where necessary. Anchor bolts, cap screws, etc., shall not be continuous through the isolator such that vibrations are transmitted to the structure.

E. Adjustment: Adjustable during and after installation, to ensure sufficient clearance between vibration isolation element and rigid restraining device. Do not install isolators until they have been loaded and adjusted to achieve the specified static deflection and clearances.

F. Housekeeping Pads: Construct minimum 3" thick with chamfered edges using 3000 psi concrete. Provide #4 reinforcing bars 8" on center in each direction and within 4" of each edge, centered in pad thickness. Provide ½" dowel with 3" embedment into floor slab for each 2 square feet of pad area. Dowels and equipment anchor bolts shall be spaced a minimum of 6" from pad edges.

3.02 EQUIPMENT RESTRAINTS

A. All equipment shall be anchored to resist displacement including sliding, swinging, and overturning due to seismic forces. Friction due to equipment weight shall not be considered as anchorage.

B. Contractor shall submit shop Drawings showing seismic restraint design for all equipment weighing 400 lbs. or more. Design shall show analysis of supporting structure, anchorages, and restraints in accordance with OSSC Section 16.

END OF SECTION

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SECTION 23-0590
TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included: After completion of the work of installation, test and regulate all components of the new heating, air conditioning and ventilating systems to verify air volumes and heating-cooling flow rates indicated on the Drawings.

B. Balancing Organization:
   1. Balancing of the Heating and Air Conditioning Systems: Performed by a firm providing this service established in the State of Oregon.
   2. Balancing Organization: Approval by Architect. Air Balancing Specialties, Neudorfer Engineers**,** Northwest Engineering Services, or approved.
   3. Provide all necessary personnel, equipment, and services.

C. Balancer shall perform work as a Contractor to the General Contractor directly, not through the Mechanical Contractor.

1.02 QUALITY ASSURANCE

A. Balancing of the Heating and Air Conditioning Systems: Agency shall be a current member of NEBB or AABC specializing in the adjusting and balancing of systems specified with a minimum of 10 years documented experience.

B. Testing, adjusting, and balancing shall be performed under direct field supervision of a Certified NEBB Supervisor or a Certified AABC Supervisor.

C. See Commissioning Specification for additional requirements.

1.03 SUBMITTALS

A. See Section in Division 1, Administrative Requirements, for submittal procedures.

B. Submit name of adjusting and balancing agency for approval within 30 days after award of Contract.

C. Field Reports: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit under provisions of Section 23 0500.
   2. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
   3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
   4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   5. Include detailed procedures, agenda, sample report forms, and copy of AABC National Project Performance Guaranty or other certifying agency prior to commencing system balance.
   6. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE 111, NEBB forms, or forms containing information indicated in Schedules.
   7. Include the following on the title page of each report:
      a. Name of testing, adjusting, and balancing agency.
      b. Address of testing, adjusting, and balancing agency.
      c. Telephone number of testing, adjusting, and balancing agency.
      d. Project name.
      e. Project location.
      f. Project Architect and Owner.

g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

D. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

E. Provide a list of equipment, air supply, return and exhaust, heating water, and chilled water systems not in compliance with tolerances subsequently specified.

PART 2 PRODUCTS

-- NOT USED --

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

C. Beginning of work means acceptance of existing conditions.

3.02 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus 10 percent or minus 5 percent of design for supply systems and +/- 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent or minus 5 percent of design to space. Adjust outlets and inlets in space to within +/- 10 percent of design.

C. Hydronic Systems: Adjust to within +/- 10 percent of design.

3.03 ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.04 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust noise distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.02” (12.5 Pa) positive static pressure near the building entries.

M. For variable air volume system powered units, set volume controller to air flow setting indicated. Confirm connections are properly made and confirm proper operating for automatic variable air volume temperature control. Adjust drives to maximum airflow for highest static condition (maximum amps of motor). Allow VFD to regulate airflow per specification.

N. Space pressure Control, Return Fan Speed Endpoints: For variable air volume system with terminal unit zoning, attain return fan speed control endpoints based on the following values for the given operating mode. Coordinate with the HVAC Control Contractor for system setup and provide values when determined.

Return Fan Speed Endpoint Values				
Mode	**Supply Fan Speed Hi/Lo Reset Limits**	**Desired Space Pressure (InH2O)**	**Economizer Position**	**Return Fan Speed**
Full Heating (All terminal units are operating at heating flow setpoints)	TBD – Noted during the full heating condition	**Ideal - 0.02** Acceptable Test Range: 0.01 – 0.03	Min-Min (25% of the minimum ventilation requirement)	Minimum Return Fan Speed-TBD
Full Cooling (All terminal units are operating at cooling flow setpoints)	TBD – Noted during the full cooling condition	**Ideal - 0.02** Acceptable Test Range: 0.01 – 0.03	Min-Max (100% of the minimum ventilation requirement)	Maximum Return Fan Speed-TBD

O. CO2 controller set points – minimum CO2 setpoint (ppm), maximum CO2 setpoint (ppm)(setting for min OSA at full occupancy).

P. Outside air intake damper settings at minimum CO_2 and maximum CO_2 setpoint.

3.05 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
1. Plumbing pumps
2. HVAC pumps
3. Air cooled water chillers
4. Air coils
5. Fan coil units
6. Air handling units
7. Fans
8. Air filters
9. Air terminal units
10. Air inlets and outlets

B. Report:
1. Summary Comments:
   a. Design versus final performance
   b. Notable characteristics of system
   c. Description of systems operation sequence
   d. Summary of outdoor and exhaust flows to indicate amount of building pressurization.
   e. Nomenclature used throughout report
   f. Test conditions
2. Instrument List:
   a. Instrument
   b. Manufacturer
   c. Model number
   d. Serial number
   e. Range
   f. Calibration date

C. Electric Motors:
1. Manufacturer
2. Model/frame
3. HP/BHP
4. Phase, voltage, amperage; nameplate, actual, no load
5. RPM
6. Service factor
7. Starter size, rating, heater elements

8. Sheave make/size/model

D. V-Belt Drives:
   1. Identification/location
   2. Required driven RPM
   3. Driven sheave, diameter, and RPM
   4. Belt, size, and quantity
   5. Motor sheave diameter and RPM
   6. Center to center distance, maximum, minimum, and tested

E. Refrigerant Cooling Coils:
   1. Identification/number
   2. Location
   3. Service
   4. Manufacturer
   5. Air flow, design and actual
   6. Entering air DB temperature, design and tested
   7. Entering air WB temperature, design and tested
   8. Leaving air DB temperature, design and tested
   9. Leaving air WB temperature, design and tested
   10. Air pressure drop, design and tested
   11. Saturated suction temperature, design and tested

F. Heating Coils:
   1. Identification/number
   2. Location
   3. Service
   4. Manufacturer
   5. Air flow, design and tested
   6. Entering air temperature, design and tested
   7. Leaving air temperature, design and tested
   8. Air pressure drop, design and tested

G. Air Moving Equipment:
   1. Location
   2. Manufacturer
   3. Model number
   4. Serial number
   5. Arrangement/Class/Discharge
   6. Air flow, specified and tested
   7. Return air flow, specified and tested
   8. Outside air flow, specified and tested
   9. Total static pressure (total external), specified and tested
   10. Inlet pressure
   11. Discharge pressure
   12. Sheave make/size/bore
   13. Number of Belts/Make/Size
   14. Fan RPM

H. Return Air/Outside Air:
   1. Identification/location
   2. Supply air flow, design and tested
   3. Return air flow, design and tested
   4. Outside air flow, design and tested
   5. Return air temperature
   6. Outside air temperature
   7. Mixed air temperature, design and tested

I. Exhaust Fans:
   1. Location
   2. Manufacturer
   3. Model number
   4. Serial number
   5. Air flow, specified and tested

6. Total static pressure (total external), specified and tested
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

J. Duct Traverses:
1. System zone/branch
2. Duct size
3. Area
4. Design velocity
5. Design air flow
6. Test velocity
7. Test air flow
8. Duct static pressure
9. Air temperature
10. Air correction factor

K. Terminal Unit Data:
1. Manufacturer
2. Type, constant, variable, single, dual duct
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum air flow, design and tested
9. Maximum air flow, design and tested
10. Inlet static pressure, design and tested

L. Air Distribution Tests:
1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

3.06 DETAILED REQUIREMENTS

A. Adjusting and Balancing:
1. Adjust and balance all portions of the mechanical systems to produce indicated results within limits of minus 5 or plus 10 percent or as subsequently directed by the Architect.
2. Balancing data may be spot checked with instruments similar to that used by the balancing firm.
3. If, in the judgment of the Architect, the discrepancies warrant additional adjustment, readjust and rebalance the systems at no additional project cost.

B. Duct Pressure Test: To be conducted and/or witnessed by balancer.

END OF SECTION

SECTION 23-0700
HVAC INSULATION

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the insulation of mechanical equipment specified elsewhere in these specifications.

B. Related Work: The requirements of Section 23 0500, Common HVAC Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Insulation Thickness and Thermal Performance: Comply with provisions of the State of Oregon Energy Code.

B. Composite (Insulation, Jacket or Facing and Adhesives) Fire and Smoke Hazard Ratings: Not to exceed a flame spread of 25 or smoke development of 50 and containing less than 0.1% by weight deca-PDE fire retardant.

C. Component Ratings of Accessories (Adhesives, Mastics, Cements, Tapes, Finishing Cloth for Fittings): Same as "B" requirements above and permanently treated. No water soluble treatments.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General: In addition to the requirements specified in Section 23 0500, the following apply:
   1. Deliver insulation, coverings, cements, adhesives and coatings to the site in factory-fabricated containers with the manufacturer's stamp or label affixed showing fire hazard ratings of the products. Store insulation in original wrappings and protect from weather and construction traffic.
   2. Protect insulation against dirt, water, chemical and mechanical damage. Do not install damaged insulation. Remove such insulation from project site.

1.04 SUBMITTALS

A. Submit catalog data and performance characteristics for each product specified.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Insulating Manufacturers: Johns Manville, Knauf, Armstrong, Owens-Corning, Pittsburgh Corning, Pabco, Imcoa or Certain Teed. Johns Manville products are listed unless indicated otherwise.

B. Adhesive Manufacturers: Foster, 3M, Insul-Coustic, Borden, Kingco or Armstrong.

2.02 PIPING INSULATION

A. Interior and Exterior Piping Systems 50 to 850 Deg. F: Glass fiber preformed pipe insulation with a minimum K-value of 0.23 at 75 Deg. F, a minimum density of 3.5 pounds per cubic foot within all-service vapor barrier jacket, vinyl or pre-sized finish and pressure sensitive seal containing less than 0.1% by weight deca-PDE fire retardant.

B. Exterior Installations: Same as for interior installations except 0.016" aluminum finish jacket

C. Pipe Temperatures Minus 30 to 180 Deg. F: Flexible, preformed, pre-slit, self-sealing elastomeric pipe insulation up to 2-1/8" ID, thermal conductivity of 0.27 BTU/hr. sq. ft./in. at 75 deg. F and vapor transmission rating of 0.2 perms/inch. Apply in thickness necessary to prevent condensation on the surface at 85 deg. F and 70% RH. Armstrong "Armaflex 2000" or, in concealed locations, Imcoa or Nomaco also approved.

D. Interior Piping Systems 32 to 50 Deg. F: Glass fiber preformed pipe insulation with a minimum K-value of 0.23 at 75 deg. F, a minimum density of 3.5 pounds per cubic foot. Polymer vapor barrier jacket containing less than 0.1% by weight deca-PDE fire retardant and with pressure sensitive seal and wicking system to remove condensation from pipe surface. Owens Corning “VaporWick.”

2.03 DUCT INSULATION

A. Interior Above Grade Ductwork: Glass fiber formaldehyde-free blanket with "FSK" facing, k value = 0.31 at 75 deg. F, 0.2 perms, and UL 25/50 surface burning rating. Johns Manville "Microlite."

2.04 EQUIPMENT INSULATION

A. Equipment Temperatures Below 70 Deg. F: Flexible, closed cell, elastomeric sheet insulation of 5.5 #/cubic feet density and 0.27 thermal conductivity at 75 deg. F. Armstrong "Armaflex."

B. Equipment Temperatures From 70 to 450 Deg. F: Glass fiber 3 pound density insulation with a 0.23 thermal conductivity at 75 deg. F. Johns Manville "814 Spin-Glas" with "FSK" jacket containing less than 0.1% by weight deca-PDE fire retardant or finished as recommended by manufacturer.

2.05 INSULATION ACCESSORIES

A. Insulation Compounds and Materials: Provide rivets, staples, bands, adhesives, cements, coatings, sealers, welded studs, etc., as recommended by the manufacturers for the insulation and conditions specified except staples not permitted on chilled water lines.

B. Interior Tanks and Equipment Insulation Covering: Finished metal jacket or as recommended by the manufacturer for insulation material specified.

C. PVC Protective Jacketing and Valve and Pipe Fitting Covers: Johns Manville Zeston 2000, Proto LoSmoke, or Ceel-Co Ceel-Tite 100 Series with precut fitting fiberglass insulation or approved.

D. Jacket Lap Sealing Adhesives: Foster Drion 85-75 contact cement or approved substitute.

E. Saddles and Shields: Unless otherwise indicated and except as specified in piping system specification sections, install the following types:
   1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

PART 3 EXECUTION

3.01 PIPING INSULATION

A. General: Do not insulate underground piping except at joints and fittings on preinsulated piping unless indicated otherwise.

B. Refrigerant Piping Insulation: Insulate suction piping with minimum 1/2" thick foamed plastic for lines smaller than 1”. For lines 1” or larger use 1” thick foamed plastic. Where possible, slip insulation over the piping as it is installed. Seal all joint and seams.

C. Pipe Fittings:
   1. Insulate and finish all fittings including valve bodies, bonnets, unions, flanges and expansion joints with fitting of same material as pipe insulation. Seal to adjacent insulation for continuous vapor barrier covering over all fittings.
   2. Provide removable/reusable insulation covers on 4" and larger valves, unions, flanges, pump casings, strainers and similar fittings or equipment requiring periodic service.

D. Protective Covering: Install continuous protective PVC or metal covering on all piping and fittings in mechanical rooms below 8' AFF, and where insulation may be subject to damage. Install with rivets or cement seams and joints. Piping in tunnels need not be covered with PVC jacketing.

E. Insulated Piping: Comply with the following.
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.9.
   2. Install MSS SP-58, Type 39 or Type 40 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) and larger if pipe is installed on rollers.
   3. Shield Dimensions for Pipe: Not less than the following.
      a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
      b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
      c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
      d. NPS 8 and NPS 14 (DN200 and DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
      e. NPS 16 and NPS 24 (DN400 and DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
   4. Pipes NPS 8 (DN200) and Larger: Include wood inserts.
   5. Insert Material: Length at least as long as protective shield.
   6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

F. Piping Insulation Lap Seams and Butt Joints: Install insulation jacket in accordance with manufacturer's recommendation. Where jacket joint and lap seams have not adhered, remove affected section of insulation and reinstall or apply lap sealing adhesive in accordance with manufacturer's instructions.

3.02 DUCTWORK INSULATION

A. Ductwork: Insulate the following:
   1. All supply ductwork.
   2. All supply and return ductwork in systems routed in unconditioned spaces or exposed to the outside conditions.
   3. All outside air intake ducts.
   4. All ductwork required to be insulated by code.
   5. All relief ducts.

B. Insulation Thickness: Select board and blanket insulation of thickness required to provide the following installed R-value.
   1. All heating or cooling system supply and return ducts located on the exterior of the insulated building envelope and all outside air intake ducts.
      a. R-8
   2. All heating and cooling system supply ducts located inside of building envelope or in unconditioned spaces, R-5.
   3. All heating and cooling system return ducts located in vented spaces, R-8.

C. Fittings: Wire and duct adhesive as required. To prevent sagging on all rectangular or square ducts over 24" wide, install Gramweld or equal welding pins on the bottom. Maximum spacing 18" on center in both directions.

D. Installation: Applied with butt joints, all seams sealed with vapor seal mastic or taped with 2" wide vapor-proof, pressure-sensitive tape. Seal all penetrations with vapor barrier adhesive.

E. Internally Lined Ductwork: Where internally lined ductwork is indicated on the Drawings and/or specified, no exterior insulation is required. Select duct lining to provide the required R-value. Carefully lap the ends of the exterior insulation a minimum of 6" past the interior insulation unless otherwise shown. Seal the end of vapor barrier jacket to the duct with mastic where the vapor barrier is required. Duct lining is specified in Section 23 3000.

3.03 EXPANSION JOINTS

A. Insulation: Insulate expansion joints on heating and/or cooling piping to match thickness of adjacent piping. Build up piping insulation adjacent to the expansion joints sufficiently to allow internal clearance within the insulation for the diameter of the expansion joint. Fasten one end of the expansion joint insulation securely and provide aluminum or sheet metal on the built-up insulation at the other end to permit movement of the insulation without damage.

B. Finish: Finish as specified for adjacent piping with fireproof covering.

END OF SECTION

SECTION 23 2100
HYDRONIC PIPING AND PUMPS

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the HVAC heating and cooling water systems. Provide pipe, pipe fittings, pumps, and related items required for complete piping system.

B. Related Work: The requirements of Section 23 0500, Common HVAC Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. General: ASTM and ANSI Standards are indicated. In addition, special standards are referenced where neither ASTM nor ANSI Standards are applicable.

B. Labeling: All piping shall be continuously and legibly labeled on each length as required by codes and standards and including as a minimum, country of origin, manufacturers identification marking, wall thickness designation, and applicable standards and approvals. Fittings shall be labeled as required by the referenced standard.

C. Concealed Plastic Piping: No concealed plastic piping inside the building unless approved by Code or Governing Authorities.

D. Definitions: Where piping fluid is not indicated in the following paragraphs, provide similar piping materials for similar fluids.

E. All grooved couplings, and fittings, valves and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
   1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.03 STORAGE AND HANDLING

A. Provide factory-applied end caps on each length of pipe and tube. Maintain end caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

1.04 SUBMITTALS

A. Submit catalog data, construction details, performance characteristics for all equipment.

B. Submit operating and maintenance data.

C. Grooved joint couplings and fitting shall be referred to on drawings and product submittals, and be identified by the manufacturer's listed model or series designation.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Copper Pipe and Tube:
   1. Application:
      a. Radiant Heating water, above grade only in Mechanical Room.
   2. Pipe: Type L hard temper copper with soldered joints, ASTM B88.
   3. Fittings: Wrought copper solder-joint fittings, ANSI B16.22.

B. Plastic Pipe:
   1. Application:

a. Radiant Heat system above grade where continuously supported per specifications and sizes 1 1/2 " or smaller.
b. Radiant system below grade.
c. Heating water system below grade.

2. Pipe:
   a. Cross-linked polyethylene (PEX) tubing manufactured by PEX-a or Engel Method for closed loop heating service (with oxygen barrier): Tested/listed to ASTM E84, ASTM F876 and F877, and CSA B137.5 listed certified to NSF standards 14 and 61. Rated for 100 PSI at 180º F. WirsbohePEX or approved. Provide and install with metal or plastic bend supports all 90 to 180 degree diretions changes in the slab to maintain on center distances. Tubing to be tied every 18".
   b. Heating Water system to be insulated with multi-layer, closed-cell, PEX-foam insulation and water resistant, corrugated HDPE jacket, Exoflex thermal twin, or approved. (No insulation under radiant floor).
3. Fittings: ASTM F1960 cold expansion fittings. Provide fittings of the type matching piping manufacture and recommended by the piping manufacturer for the service indicated.

2.02 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Insulating (Dielectric) Fittings: Provide standard products recommended by the manufacturer for use in the service indicated, and which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and reduce corrosion. Victaulic "Clear Flow."

B. Welding Materials: Provide welding materials as determined by the installer to comply with installation requirements.

C. Soldering and Brazing Materials: Provide soldering materials as determined by the installer to comply with installation requirements.
1. Tin-Antimony Solder: ASTM B32, Grade 95TA.
2. Lead-Free Solder: ASTM B32, Grade HB. Harris "Bridgit" approved.
3. Silver Solder: ASTM B32, Grade 96.5TS.

D. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges. Pressure and temperature rating required for the service indicated.

E. Grooved Joint Lubricants: Lubricate gaskets in accordance with the manufacturer's published installation instructions, using lubricant compatible with the gasket elastomer and fluid media. Basis of Design: Victaulic Vic-Lube.

F. Sleeve Seal: Rubber-link pipe wall and casing closure. Thunderline Link-Seal. For fire rated wall, floor or ceiling penetrations, 3-M "CP-25" caulk, "No. 303" putty and/or "PSS 7904" sealing system.

G. Strainers: "Y-pattern," 300-psig ductile iron body, or Class 125 [cast iron body] [bronze body] with tapped blow-off connection and removable [20 mesh] [1/16" perforations] [1/8" perforations] stainless steel screen. Victaulic Style 732 / W732, NIBCO, or engineer approved equal.

H. Tracer Wire: 14 gauge, single strand, copper wire with blue insulation for water, green for sanitary and storm sewers, and yellow for gas. 3M "DBY" direct bury splice kit required at all splices.

I. Valves up to 12":
1. Ball (to 2"):
   a. Two-piece, cast bronze body, full port, 600 psi WOG, T/S 585-70.
   b. Two-piece, forged bras body, standard port, 300 psi CWP, Victaulic P589.
2. Gate (to 3"): Bronze body, non-rising stem, 200 psi WOG, T/S-133.
3. Gate (4" to 12"): Iron body, non-rising stem, solid wedge, bolted bonnet, 200 psi WOG, F-619.
4. Globe (shutoff): Bronze body, Teflon disc, 200 psi WOG, T/S-211Y.
5. Globe (throttling): Bronze body, full plug stainless steel disc, 600 psi WOG, T-276AP.
6. Butterfly: Ductile iron body, aluminum bronze, stainless steel, or electroless-nickel coated ductile iron disc, pressure responsive seat, and stem offset from the disc centerline to provide complete 360-degree circumferential seating. 300 psi WOG, Lugged body – LD-2000, Wafer body – WD-2000, Grooved body Victaulic Vic-300 MasterSeal / AGS-Vic300.

7. Check: Bronze or iron body spring-assisted swing check for vertical or horizontal installation, 230 psi WOG, T/S-413B and F-918B, or Victaulic Series 716 and W715.

2.03 HEATING WATER SPECIALTIES

A. Air Vents: Install at all system high points whether shown or not; fabricate of 2" diameter or larger pipe at least 12" long. At the high point of each main install an automatic air vent. Spirotherm “Spirotop”, Armstrong No. 1AV autovent, or equivalent Taco, Bell & Gossett, Armstrong, Dunham-Bush approved substitute.

B. Flow Indicators: Install, where shown on plans, flow indicating orifice or venturi fittings complete with quick disconnect meter valves, size and series identification tags. Install as recommended by manufacturer. Barco, Taco, Venturi Meter Co, Bell & Gossett, Thrush, Armstrong or approved substitute.

C. Glycol Feeder, 4.5 gallon feeder with fill/access opening and cover, pump suction hose with inlet strainer, pressure pump with fuse protection, low fluid level pump cut-out float switch, manual diverter valve for purging air, digital pressure switch adjustable from 0-45 psig cut-out pressure, digital pressure display, visual alarm on low level, low level alarm comes with remote dry contacts, wall mounting bracket. Unit to be UL Listed and fused power supply adapter with LED power indicator light. 120/1. Solution to be 30% polypropylene glycol. AXIOM, DMF150.

2.04 EXPANSION JOINT

A. Stainless steel bellows type with flanged ends, controlled flexing, internal liner rated at a minimum of 28,000 average life cycles. Provide amount of expansion indicated at each joint as shown on Drawings. Carefully align joint and make proper allowance for temperature of pipe at time of installation. Flexonics, Hyspan, or approved substitute.

2.05 PIPE ALIGNMENT GUIDES

A. Manufactured steel guide which consists of heavy steel spider rigidly attached to pipe and housed in steel which is rigidly anchored. Guides same as expansion joint manufacturer.

2.06 ELECTRIC BOILER

A. Electric Water Heater: ASME, Instantaneous, flow through electric heater rated at full 208 volt operating voltage, with integral ECM pump and pre-charged expansion tank. Capacities as shown on the Drawings. Supply water temp and pump speed to be controlled by internal controller. Electro-Industries, EZB-ECP, or approved equal.

2.07 BACKFLOW PREVENTOR

A. Where indicated on the Drawings and on all boiler make-up water, install a reduced pressure backflow preventor complete with shutoff valves, two separate check valves, differential relief valve and test cocks. The unit shall be approved by USC Foundation for Cross Connection control, State Health Officials and serving utilities. Units 2" and smaller shall have bronze bodies, units 2-1/2" and larger shall have cast iron bodies with bronze trim.

2.08 BACKFILL MATERIALS

A. Subbase Materials: A graded mixture of gravel, sand, crushed stone or crushed slag.

B. Finely-Graded Subbase Material: Well graded sand, gravel, crushed stone or crushed slag, with 100% passing a 3/8" sieve.

C. Backfill Material: Soil material suitable for compacting to the required densities, and complying with AASHTO designation M145, Group A-1, A-2-4, A-2-5, or A-3.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

A. General: Install pipe, tube and fittings in accordance with recognized industry practices. Install each run accurately aligned with a minimum of joints and couplings, but with adequate and accessible unions and flanges for disassembly, maintenance and/or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings.

B. Piping Runs: Route piping close to and parallel with walls, overhead construction, columns and other structural and permanent-enclosure elements of the building (pitched for drainage). If not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building or equipment and avoid diagonal runs. Wherever possible in finished and occupied spaces, conceal piping from view. Do not encase horizontal runs in solid partitions.

C. For pipes below grade backfill should be tamped compactly in place so as to assure a stable surface. No rock should be used in the first foot of backfill. 24 inches, top to pipe to grade, of compacted fill shall meet H-20 Highway Loading.

D. For radiant heat piping in concrete, provide and install with metal or plastic bend supports all 90 to 180 degree direction changes in the slab to maintain on center distances. Tubing to be tied every 18”. Piping joints/splices not permitted in concrete; All below grade pex connections shall be made in manifold/boxes only.

3.02 PIPING JOINTS

A. General: Provide joints of the type indicated in each piping system, and where piping and joint as manufactured form a system, utilize only that manufacturer's material.

B. Ferrous Threaded Piping: Thread pipe in accordance with ANSI 82.l; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave no more than 3 threads exposed.

C. Solder Copper Tube and Fitting Joints: In accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in a manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens. "T-Drill" field formed tees may be utilized where the main is at least two pipe sizes larger than the branch.

D. Braze Copper Tube and Fitting Joints: Where indicated, in accordance with ANSI/ASME B31.5. Pass a slow stream of dry nitrogen gas through the tubing at all times while brazing to eliminate formation of copper oxide.

E. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gasket.

F. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards:
   1. Heat Joining of Thermoplastic Pipe: ASTM D-2657.
   2. Making Solvent-Cemented Joints: ASTM D-2865 and ASTM F-402.

G. Insulating (Dielectric) Fittings: Comply with manufacturer's instructions for installing unions or fittings. Install in a manner which will prevent galvanic action and stop corrosion where the "joining of ferrous and non-ferrous piping" is indicated.

H. Changes in Direction: Use fittings for all changes in direction. Run lines parallel with building surfaces.

I. Line Grades: Pitch hydronic piping 1" to 40' minimum to low point drips or drains.

J. Unions and Flanges: At all equipment to permit dismantling and elsewhere as consistent with good installation practice.

K. Unions and flanges for servicing and disconnect are not required in installations with grooved mechanical joint couplings. (The couplings shall serve as disconnect points.)

L. Expansion: Provide loops, swing joints, anchors, runouts and spring pieces to prevent damage to piping or equipment.
   1. For water systems, Victaulic flexible couplings may be used to accommodate thermal growth, contraction, and for the elimination of expansion loops. (In accordance with the manufacturer's written recommendations.) Where loops are required, use flexible couplings on the loop.

M. Expansion: Provide loops, swing joints, anchors, runouts and spring pieces to prevent damage to piping or equipment.

N. No pipe joints shall be permitted below concrete for radiant floor system.

3.03 MISCELLANEOUS PIPING EQUIPMENT

A. Floor, Wall and Ceiling Plates: Chrome plated pressed steel or brass screw locked split plates on all pipe penetrations in finished spaces.

B. Strainers: Install in a manner to permit access for cleaning and screen removal and with blow-off valve.

C. Sleeves: At all penetrations of concrete or masonry construction. PVC, 24 gauge galvanized steel or Schedule 40 galvanized steel pipe. Use steel pipe sleeves through beams, footings, girders or columns and for all penetrations of walls or floors below grade. Where floor finish is ceramic tile, terrazzo, or similar material extend standard steel pipe sleeves 1-1/2" above finished floor. Fabricate sleeves 1" diameter larger than pipe or insulation. PVC and sheet metal sleeves at non-structural penetrations only.

D. Sleeve Caulking: Grout uninsulated pipe with cement mortar or approved waterproof mastic. All caulking or grouting shall extend full depth of sleeve. Install UL sealing caulk, putty and/or system at all penetrations of fire rated walls, floors and ceiling.

E. Valves: Install valves in accordance with Section 23 0500. Install control valves specified in other Division 23 sections.

3.04 EXCAVATING

A. General: Do not excavate for mechanical work until the work is ready to proceed without delay, to minimize the total time lapse from excavation to completion of backfilling. Comply with all applicable Federal and state safety regulations.

B. Width: Excavate for piping with 6" to 9" clearance on both sides of pipe, except where otherwise shown or required for proper installation of pipe joints, fittings, valves and other work. Excavate for other mechanical work to provide minimum practical but adequate working clearances.

C. Depth for Direct Support: For work to be supported directly on undisturbed soil, do not excavate beyond indicated depths, and hand-excavate the bottom cut to accurate elevations. Support the following work on undisturbed soil at the bottom of the excavations:
   1. Piping of 5" and less pipe/tube size.
   2. Cast-in-place concrete.

D. Depth for Subbase Support: For large piping (6" pipe size and larger), tanks and where indicated for other mechanical work, excavate for installation of subbase material in the depth indicated, or, if not otherwise indicated, 6" below bottom of work to be supported.

E. Depth for Exterior Piping: Excavate for exterior water-bearing piping so that the top of piping will not be less than 3' vertical distance below finished grade.

F. Depth for Unsatisfactory Soil Conditions: Where unsatisfactory soil condition at the bottom of excavation exists, excavate additional depth as directed to reach satisfactory soil-bearing condition. Backfill with subbase material, compacted as directed, to indicated excavation depth.

3.05 DEWATERING

A. Maintain dry excavation for mechanical work, by removing water. Protect excavations from inflow of surface water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water, by installing temporary sheeting and waterproofing. Provide adequate barriers which will protect other excavations and below-grade property from being damaged by water, sediment or erosion from or through mechanical work excavations. Comply with local erosion control regulations where applicable.

3.06 BASE PREPARATION

A. Subbase Installation: Where indicated, install subbase material to receive mechanical work, and compact by tamping to form a firm base for the work. For 4" and larger piping, horizontal cylindrical tanks and similar work, shape and subbase to fit the shape of the bottom 90 degrees of the cylinder, for uniform continuous support. Provide finely-graded subbase material for wrapped, coated and plastic pipe and tank. Shape subbases and bottoms of excavation with recesses to receive pipe bells, flanged connections, valves and similar enlargements in the piping systems and set bottom of trench at proper pitch and correct elevations with subbase material.

B. Concrete Encasement: Where piping under roadways is less than 2'-6" below surface of roadway, provide 4" base slab of concrete to support piping. After piping is installed and tested, provide 4" thick encasement (sides and top) of concrete before backfilling. Provide Class 250 concrete for encasement and slab.

3.07 BACKFILLING

A. Do not backfill until installed mechanical work has been tested and accepted wherever testing is indicated. Install drainage fill where indicated, and tamp to a uniform firm density. Backfill with finely-graded subbase material to 6" above wrapped, coated and plastic piping and tanks, and to center line of other tanks (where recommended by tank manufacturer, use "pea gravel" backfill). Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to the required densities. Do not backfill with frozen materials.

3.08 EQUIPMENT INSTALLATION

A. Installation and Arrangement: Install and arrange as shown on the Drawings. Comply with manufacturer's recommendations for installation connections and start-up.

B. Lubrication: Lubricate all moving and rotating parts in accordance with the manufacturer's recommendations prior to start-up.

C. Expansion Joint and Compensator Installation: Carefully align joint or compensator and make proper allowance for temperature of pipe at time of installation.

D. Air Vents: Conduct 1/4" copper tubing from high end of air chambers to accessible locations and terminate with screwdriver cock. Conduct 1/4" copper tubing from outlets of automatic air vents to floor drains indicated or to the outside when approved by Governing Authorities. **[and Architect.]**

E. Pumps: Mount in a manner to allow disassembly of pump and motor without disturbing piping.

3.09 CLEANING

A. General: Clean all dirt and construction dust and debris from all mechanical piping systems and equipment and leave in a new condition. Touch up paint where necessary.

B. Heating Water Piping Systems:

1. Add cleaning chemical in proper concentration to clean system of manufacturing and installation contamination and residue.
2. Fill, vent and circulate the system with this solution at design operating temperature. After circulating for four hours, bleed out cleaning solution by the addition of fresh water to the system.
3. Test for pH and add sufficient amount of the cleaning chemical to obtain a pH between 7 and 8.
4. Clean all strainers and remove start-up strainers (from suction diffusers) after the system has operated for one week.

3.10 TEST

A. General:
1. Minimum duration of two hours or longer, as directed for all tests. Furnish report of test observation signed by qualified inspector. Make all tests before applying insulation, backfilling, or otherwise concealing piping or connecting fixtures or equipment. Where part of the system must be tested to avoid concealment before the entire system is complete, test that portion separately, same as for entire system.
2. Provide all necessary temporary equipment for testing, including pump and gauges. Remove control devices before testing and do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for the indicated pressure and time.
3. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.

B. Repair:
1. Repair piping system sections which fail the required piping test by disassembly and re-installation, using new materials to the extent required to overcome leakage. Do not use chemical stop-leak compounds, solder, mastics, or other temporary repair methods.
2. Drain test water from piping systems after testing and repair work has been completed.

C. Heating, Solar, Chilled and Condensing Water Piping: 75 psig hydrostatic for 30 psig systems without loss for four hours.

D. Tanks and Equipment: Hydrostatic pressure to 1.5 times operating pressure.

3.11 CONTROLS

A. Wiring: All wiring shall be in accordance with the National Electrical Code and local electrical codes. All control wiring shall be routed in conduit. See Drawings for more detail. Provide all material and labor for installation, calibration, testing and documentation of controls for operation of snow melt systems and other systems scheduled in the Drawings.

B. Radiant Heat System: Heat Link model numbers listed, Equal Uponor approved.
1. Controller: Zone Control Module, Caleffi ZVR 06.
2. Slab Sensor: Heat Link #30072, #30073.
3. Heat only Room T-stat (with input to remote slab sensor and programmable Time clock) : Heat Link #46645.

END OF SECTION

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SECTION 23 2500
HVAC WATER TREATMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. The requirements of this section apply to the chemical treatment of the mechanical systems. Provide shot feeding of treatment chemicals for closed loop hydronic systems. Provide continuous treatment for open loop systems, including steam systems.

B. Related Work: The requirements of Section 23 0500, Common HVAC Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Regulations: Comply with all DEQ, EPA, OSHA, OSEA, local sewerage agency and Fire Marshal requirements concerning allowable amounts of each chemicals which can be disposed of through the sewer system or in proximity of personnel.

B. Codes: Comply with applicable sections of the State of Oregon Health and Safety Code, OAR Chapter 437, Div. 155, Hazard Communication.

C. Chemical treatment system design, installation, and startup shall be performed by an experienced HVAC system chemical treatment contractor. The chemical representative on site is to have no less than five years' experience. The vendor must have representation within a 200 mile radius of the site. Vendor must have local research and development facility and local in-house manufacturing. Mt. Hood Chemical Co. or approved.

D. Field Wiring: It is the intent of these specifications that all systems shall be complete and operable. Refer to all drawings and specifications, especially the electrical drawings, to determine voltage, phase, circuit ampacity and number of connections provided. Provide all necessary field wiring and devices from the point of connection indicated on the electrical drawings. Bring to the attention of the Architect in writing, all conflicts, incompatibilities, and/or discrepancies prior to bid or as soon as discovered.

1.03 SUBMITTALS

A. Submit catalog data of chemical treatment equipment, installation details and list of likely chemicals to be used.

B. Submit all chemical Material Safety Data Sheets for each chemical.

C. Submit operating and maintenance data.

1.04 DELIVERY AND HANDLING

A. Chemical Containers Label: The following shall be included as a minimum label on chemical containers:
1. Chemical contents.
2. Hazard warnings prominently displayed.
3. Manufacturer's and/or supplier's name and address.

B. Delivery: All chemical containers shall be factory sealed and unopened.

PART 2 PRODUCTS

2.01 PERFORMANCE CRITERIA

A. Corrosion: Provide a system to limit annual metal corrosion rates as follows:
1. Cast iron < 0.002" per year.
2. Copper < 0.0005" per year.

3. Mild steel < 0.002" per year.
4. Stainless steel < 0.0001" per year.

B. Scaling: System shall prevent no greater than 1% loss of heat transfer efficiency in any component or piece of equipment by preventing deposit formation.

C. Fouling: Recommend methods to keep fouling to a minimum. Set blow down rates and/or schedules.

D. Biological Contamination:
1. Closed Loop Systems: Keep biological counts (algae, bacteria and fungi) to near zero readings.
2. Open Loop Systems: Maintain total count to less than 1,000,000 per milliliter in a cyclical manner to achieve optimum control with minimum chemical consumption.

PART 3 EXECUTION

3.01 PIPING INSTALLATION

A. Refer to applicable Sections for Valves, Insulation, Painting, etc.

3.02 EQUIPMENT INSTALLATION

A. Installation and Arrangement: Install and arrange as shown on the Drawings. Comply with manufacturer's recommendations for installation connections and start-up.

B. Lubrication: Lubricate all moving and rotating parts in accordance with the manufacturer's recommendations prior to start-up.

3.03 CHEMICAL TREATMENT OF HEATING WATER SYSTEM

A. General: Provide chemical treatment for the heating and chilled water systems. The treatment specialist shall recommend the proper treatment for the systems and initiate the various treatments, including the required chemicals.

B. Standards: Chemical treatment shall be in accordance with currently accepted standards for the Environmental Protection Agency (EPA). Chemicals shall be EPA registered and labeled in accordance with EPA Standards.

C. Implement the treatment and instruct the Owner's personnel in the proper care, use, and maintenance of the systems. Include testing procedures to maintain proper control and to assure adequate corrosion protection and control of water side deposits and scale.

D. Provide an initial start-up supply of chemicals, add them to the systems, and maintain the system at proper chemical level until project final completion. Following project final completion, provide a 12 month supply of chemicals for the systems.

E. Upon completion of cleaning and chemical treatment, tag each system as follows: "This piping system has been cleaned and chemically treated. Do not disturb unless authorized." Locate tag to be plainly visible.

F. For snow melt system, mix glycol and water blend in a container and inject into the system. Do not add water and glycol separately.

END OF SECTION

SECTION 23-3000
AIR DISTRIBUTION

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide Air Distribution Materials as specified herein and as shown on the Drawings.

B. Material characteristics and size shall be as indicated on the Drawings.

C. Related Work: The requirements of Section 23 0500, Common HVAC Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Air Distribution Equipment Rating: In accordance with AMCA certified rating procedures and bearing the AMCA label.

B. See Commissioning specification for additional requirements.

1.03 SUBMITTALS

A. Submit catalog data, construction details and performance characteristics for all manufactured materials.

B. Submit operating and maintenance data.

C. For adhesives and sealants used on the interior of the building (inside the waterproofing system), include printed statement of volatile organic compound (VOC) content.

PART 2 PRODUCTS

2.01 SHEET METAL

A. Sheet Metal Materials:
1. General Material Requirements: Comply with the Mechanical Code and SMACNA'S "HVAC Duct Construction. Standards – Metal and Flexible, Third Edition" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other perfections.
2. All interior ducts shall be constructed with G-60 or better galvanized steel conforming to ASTM A653/A653M and A924/A924M Standards, LFQ, chem treat. Exterior ductwork or duct exposed to high humidity conditions (that is: kitchen exhausts, etc.) shall be G-90 or better galvanized steel, conforming to ASTM A653/A653M and A924/A924M Standards, LFQ, chem. treat.
3. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, and having a No. 2D finish for concealed ducts and No. 2B, No. 2D, No. 3 or No. 4 for exposed surfaces**. Stainless steel shall be used for outside air plenums and outside air ductwork until mixed with return air.**
4. Aluminum Sheets: Comply with ASTM B209/B209M, Alloy 3003, H14 temper; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
5. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.
6. Tie Rods: Galvanized steel, ¼ inch (6 mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8 inch (10 mm) minimum diameter for lengths longer than 36 inches (900 mm).

B. Duct Fabrication requirements: Metal gauges, joints and reinforcement in accordance with Mechanical Code, ASHRAE and SMACNA standards. Ductwork shall be fabricated to the following pressure classifications:
   1. Return and exhaust ducts: 2 “negative.
   2. Supply ducts from fan discharge to diffuser: 2” positive.

C. Acoustical Duct Lining: **Not acceptable in OSA duct.** Line ducts with 1" thick lining (unless noted otherwise) for installation inside the building insulation envelope, and 1-1/2” for installation outside the building insulation envelope. Density shall be 3 lb / ft^3 minimum. Owens Corning, QuietR, or equal Schueller, or Certain Teed. Meeting NFPA 90A and B requirements for maximum flame spread and smoke developed. Duct liner adhesive shall conform to ASTM C916.Mechanically attach lining to sheet metal duct with fasteners conforming to SMACNA Standard MF-1-1971, Schuller Grip Nails or Gramweld welding pins. Apply fire-retardant type adhesive similar to Schuller No. 44 adhesive, Benjamin Foster 81-99, Insul-Coustic 22 or 3M equivalent on all leading edges, joints and seams.

D. Duct Tapes, Sealants, Adhesives & Gaskets:
   1. Aluminum bonded to aluminized mylar reinforced with fiberglass mesh backing an elastomeric pressure sensitive adhesive specifically formulated for adhesion to galvanized metal. Hardcast AFG-1402 or accepted substitute.
   2. Two-part sealing system with woven fiber, mineral gypsum impregnated tape and non-flammable adhesive. Hardcast "DT" tape and "FTA-20" adhesive, United "Uni-Cast" system, or accepted substitute.
   3. For joints and seams exposed to the weather in lieu of soldering, United "Uni-Cast" system or approved.
   4. Joint & Seam Sealants (Water Based): Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
   5. Joint & Seam Sealants (Solvent Based): Flexible. Non sag, solvent-release-curing, for use in low temperature applications. Shall be resistant to UV light and shall be UL 723 Listed and meet NFPA requirements for Class 1 ductwork.
   6. Flange Gasket: Butyl rubber or EPDM polymer which complies with UL standard 181 and 723 testing. The gasket shall not contain vegetable oils, fish oils, or any other type of material that will support fungal and/or bacterial growth.
   7. Liner Adhesive: Water based, fire and moisture resistant, used to adhere insulation to metal duct. It shall comply with NFPA 90A and UL 723 requirements.
   8. Duct Liner Sealant: Water based sealant, fire and moisture resistant, used to encapsulate fiberglass duct insulation to eliminate airborne fibers. Must comply with UL requirements.

E. Optional Duct Joints for Sheet Metal Ducts: Prefabricated slide-on transverse duct connectors will be accepted. Duct constructed using prefabricated connection systems will refer to the manufacturer guidelines for sheet gage, intermediate reinforcement size and spacing, and proper joint reinforcements. "Ductmate System" by Ductmate Industries, Inc., Ward Duct Connectors, Inc., Mez Industries, Elgen, or acceptable substitute. Spiramir self-sealing round duct connector system meeting Class 3 leakage standards with EPDM o-ring seal.

F. Exterior and Roof Mounted Ductwork: Construct roof mounted ductwork and other ductwork exposed to outside weather of stainless steel outer jacket, two gauges heavier than equivalent ductwork with all joints soldered in a weather-proof manner with 2" of internal duct lining. Where indicated, provide an inner galvanized steel liner sealed against moisture. Submit shop drawings.

G. Exposed to View Spiral Seam Duct: Round and flat oval spiral seam duct shall be manufactured of galvanized steel sheet metal with spiral lock seam. Sizes up to 36" diameter or 36" wide shall be 22 gauge; sizes over 36" shall be 20 gauge. Reinforcement or bracing shall be as detailed on the Drawings. Matching fittings shall be manufactured of galvanized steel with continuous welded seams. Fittings up to 36" diameter or width shall be 20 gauge, fittings larger than 36" shall be 18 gauge.

H. Concealed Round Duct: Round and flat oval spiral seam duct shall be manufactured of galvanized sheet metal with spiral lock seam. Construction, gauges, and reinforcement in accordance with SMACNA standards. Fittings shall be manufactured of galvanized steel with spot welded or riveted and sealed seams or continuously welded seams. Snap lock longitudinal seam duct shall fully comply with SMACNA standards for duct gauge and seam type for appropriate pressure class. Adjustable elbows are prohibited.

I. Flexible Ductwork-Low Pressure: Insulated low pressure flexible duct, factory fabricated assembly consisting of a zinc-coated spring steel helix seamless inner liner, wrapped with a nominal 1" thick insulation for installation inside the building insulation envelope, and 1-1/2" for installation outside the building insulation envelope, 1 pound/cubic foot density fiberglass insulation. The assembly shall be sheathed in a vapor barrier jacket, factory vapor resistance sealed at both ends of each section. The composite assembly, including insulation and vapor barrier, shall meet the Class 1 requirements of NFPA Bulletin No. 90-A and be labeled by Underwriters Laboratories, Inc., with a flame spread rating of 25 or less and a smoke developed rating of 50 or under. The duct shall have factory sealed double air seal (interior and exterior) to assure an airtight installation. Genflex, ATCO, Wiremold, Thermaflex, Glassflex, Clevepak, Schuller, or accepted substitute.

2.02 ACCESSORIES

A. Manual Volume Dampers: Construct of material two gauges heavier than duct in which installed; single plate up to 12" wide; multiple over 12" wide. Hem both edges 1/2" and flange sides 1/2". Use Young, Duro-Dyne, MAT, or accepted substitute damper accessories. Young numbers are shown.
1. No. 605 bearing set with No. 403 regulator for dampers up to 24" long.
2. For dampers over 24" long use No. 660 3/8" rod, No. 656 end bearing and No. 403 regulator.
3. Where damper regulators are not readily accessible, use No. 660 or No. 661 rod extensions and No. 301 and No. 315 concealed damper regulators or MAT cable operated dampers as required.

Location of all volume dampers is not necessarily shown on Drawings; minimum required is one in each supply, return or exhaust main, and one in each branch.

B. Exterior Wall Louvers: Prefabricated extruded aluminum stormproof blades with frame to suit building construction. 1/2", 16 gauge aluminum wire mesh on back side of all intake louvers and insect screen on exhaust/relief louvers. 4" deep, 37½ degree fixed drainable type blade, AMCA 500 tested for 800 fpm without water penetration, and maximum of 0.07" wg intake pressure loss and 0.09" wg exhaust pressure loss. Provide 70% PVDF protective coating in color selected by Architect, and stainless steel fasteners. Ruskin ELF375X as basic pattern on blade and frame, Greenheck, Cesco, Pottorff, or approved. Louvers shall be coated for seashore applications.

C. Locking Connection Straps: 1/2" wide positive locking steel straps or nylon self-locking straps. Panduit or accepted substitute.

D. Connection Fittings: Connections to non-metallic ducts manufactured sheet metal "spin-in" fittings. Genflex, Wiremold, Thermaflex, Glassflex, Clevepak, Schuller, or accepted substitute.

E. Access Doors In Sheet Metal Work:
1. Hollow core double construction of same or heavier gauge material as duct in which installed. Use no door smaller than 12" by 12" for simple manual access or smaller than 18" by 24" where personnel must pass through infrequently. Use 24" by 60" minimum for filters and more frequent maintenance. Use Ventlok or accepted substitute hinges and latches on all doors.
   a. 100 Series hinges and latches on low pressure system doors up to 18" maximum dimension.
   b. 200 Series on larger low pressure system doors and 333 Series on high pressure systems.
2. Construct doors up to 18" maximum dimension with 1" overlap, furr and gasket with 3/4" by 1/8" sponge rubber. Fit larger doors against 1-1/2" by 1/8" or angle frame and gasket with 3/4" by 1/8" sponge rubber or felt.

F. Anti-Backdraft Dampers: Connected, gasket-edged aluminum blades set in 14 gauge or heavier steel frame; brass, nylon or Teflon bearings; equip with spring helper with tension adjustment feature or with adjustable counterweight and adjust to open when not more than 0.10" wg pressure is applied. Ruskin CBS-4, Greenheck, Pacific Air Products, Air Balance, Controlair or accepted substitute.

G. Opposed Blade Volume Damper: Install opposed blade volume damper in each zone supply duct on discharge of multi-zone units and where indicated on Drawings. Young No. 817 or accepted substitute.

H. Flexible Connections: Neoprene impregnated fiberglass connection. Ventglass, Duro-Dyne, or accepted substitute.

I. Control Dampers: Construct of aluminum frame and aluminum airfoil blades with axle shafts and/or operating “jackshafts” with interconnecting blade linkages in the side channels of the frame to provide coordinate tracking of all blades. Interlocking multi-blade type, except where either dimension is less than 6", a single blade may be used. Opposed blade type on all modulating dampers and parallel blades on all two position dampers. Provide with stainless steel, silicone, or vinyl jamb seal and vinyl or silicone blade seals. Damper assembly rated for maximum air leakage of 3 CFM per square foot at 1" wg pressure or less. Performance rating for the damper shall be tested under the AMCA Certified Ratings Program. Greenheck VCD-40, Ruskin CD 50, CESCO AAA or AAB, or TAMCO Series 1000. **Control dampers shall be constructed with stainless steel linkage and anodized aluminum blades and frame, when installed in outside air duct.**

2.03 GRILLES, REGISTERS AND DIFFUSERS

A. Description: Provide grilles, registers and diffusers as shown on the Drawings.

B. Finishes:
1. Steel: Flat white enamel prime coat, factory applied on ceiling diffusers. Others are to have a baked enamel finish, color as selected by Architect.
2. Aluminum: Anodized clear finish unless indicated otherwise.

C. Manufacturers: Carnes, Krueger, Titus, Price, Nailor, and Tuttle & Bailey are accepted substitutes where only Titus model numbers are listed. Where other manufacturer's products are listed and/or "accepted substitute" is indicated, only the products or an accepted substitute for that item shall be provided.

D. Ceiling Return and/or Exhaust Register: Perforated snap-in or concealed hinged face plate. Use in spaces containing ceiling diffusers and/or T-bar ceilings. Provide with damper except where dampered plenums are indicated. Match manufacturer of supply. E3 is 12x12 face. R4 is 48x24 face.

E. Sidewall Supply Grille or Register: Double deflection grille with face bars parallel to long dimension on ceiling type and horizontal on wall type; bars to be individually adjustable, spaced on 0.66" to 0.75" centers; key operated opposed blade volume damper. Titus 300RL.

F. Modular Core Ceiling Diffusers: 1 to 4-way pattern control. Pattern of distribution as indicated. Provide with opposed blade volume dampers and frame for unit as required. Titus MCD.

G. Sidewall or Ceiling Return or Exhaust Register: Face bars parallel to long dimension on ceiling type and horizontal on wall type; bars set at 35 degrees to 45 degrees, spaced on 0.66" to 0.75" centers; key operated opposed blade volume damper. Titus 350RL Series.

H. Heavy Duty, Adjustable Bars Low Return Grille: All welded construction with heavy 14 gauge, adjustable round edge steel horizontal face bars at 1/2" on centers and reinforced every 6" to 8". Titus 33 Series.

I. Steel Door Transfer Grilles and Sidewall Transfer grilles: All welded construction with 20 gauge, fixed inverted V-blades with a deflection angle of 77 so as to provide a sight proof design.

J. Plaster Frames: Provide plaster frames for all diffusers, grilles or registers installed in plaster walls or ceiling. Where register face is aluminum, the plaster frame shall be aluminum. Frame to match manufacturer of register or be of compatible size of listed manufacturer. Titus TRM/TRM-S.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Air Handling Equipment Installation and Arrangement: Install and arrange as shown on Drawings. Comply with the manufacturer's recommendations for installation, connection, and start-up.

B. Equipment Access Panels: Locate free of all obstructions such as ceiling bars, electrical conduit, lights, ductwork, etc.

C. Filters: Install specified filters or accepted substitute temporary construction filters in supply units and systems prior to start-up or use for drying and/or temporary heat. Replace prior to acceptance of project.

3.02 INSTALLATION OF GRILLES, REGISTERS AND DIFFUSERS

A. Size and air handling characteristics shall be as shown on the Drawings.

B. Locate, arrange, and install grilles, registers and diffusers as shown on the Drawings. Locate registers in tee-bar ceilings with diffusers centered on the tile unless indicated otherwise.

3.03 DUCTWORK INSTALLATION

A. Support: Install ductwork with 1" wide strap cradle hangers not more than 8' on centers or as required by code. Support terminal units independent of adjacent ductwork. Attach to available building construction according to good practices for materials involved. Manufactured hanger system acceptable in lieu of fabricated hangers at Contractor’s option. Ductmate “Clutcher” system or approved. Support flexduct where shown to be used for lengths beyond 4’ per above requirements. Comply with SMACNA Duct Construction Standard Figure 3-9 and 3-10.

B. Fan and Air Handling Unit Flexible Connections: Install neoprene impregnated fiberglass connections in ductwork at all rotating equipment. Ventglass, Duro-Dyne or accepted substitute.

C. Elbows and Fittings: Construct elbows with throat radius equal to duct width in plane of turn or make them square and provide double wall, air foil turning vanes.

D. Fittings: Make transitions and take-offs as shown on Drawings. Provide volume dampers and splitter dampers as indicated on Drawings and as specified. Saddle tees are not allowed.

E. Acoustical Duct Lining:
1. Acoustically line all fan unit intake and discharge plenums, all ductwork indicated as lined on the Drawings, all sheet metal ductwork specified per Section 23 0700 as insulated, where exposed to view or subject to damage in areas such as mechanical rooms, and, at the Contractor's option, all insulated ductwork specified in Section 23 0700 except outside air intake ducts. The duct size noted on the Drawings is the clear opening of the duct with insulation. Insulation shall not reduce duct size listed.

2. All duct designated to receive duct liner shall be completely covered with a fire-resistant, fiber-bonding coating, or covering (composite, polymer, vinyl or neoprene) that reduces airflow resistance and controls fiber release. The duct lining shall be adhered to the sheet metal with 100% coverage of a fire retardant adhesive. The coated surface of the duct liner shall face the airstream. When width of duct exceeds 12" and also when height exceeds 24", use corrosion resistant mechanical fasteners 12" on center maximum lateral spacing and 18" on center maximum longitudinal spacing. Start fastening within 3" of upstream transverse edge of the liner and within 3" of the longitudinal joint. Mechanical fasteners shall be either impact-driven or weld-secured and shall not pierce the duct walls. Fasteners and washers of the specified type and length shall be used assuring no greater than 10% compression of the liner thickness. Installation shall be made so that no fastener pins protrude into the airstream. No gaps or loose edges shall occur in the insulation. Top pieces shall be supported by the side pieces. Provide insulated build out frames for attaching dampers at running vanes where required.
3. All transverse and longitudinal abutting edges of duct lining shall be sealed and lapped 3" with a heavy coat of approved adhesive, in accordance wit the manufacturer's recommendations. All upstream transverse edges shall be installed with sheet metal nosings. All raw exposed edges of lining shall be 'buttered' with approved adhesive.

F. Manual Volume Dampers: Location of all volume dampers are not necessarily shown on the Drawings. Provide a minimum of one volume damper in each supply, return or exhaust branch. Do not install dampers closer than 3 duct diameters to the diffuser.

G. Duct Insulation: Specified in Section 23 0700.

H. Sleeves: Provide galvanized sheet metal plaster ring around ductwork penetrating exposed finished walls. Sleeve and flash all duct penetrations through exterior walls in an air tight and weatherproof manner.

I. Plenums: Construct sheet metal plenums and partitions of not lighter than 18 gauge galvanized steel and reinforce with 1-1/2" by 1/2" by 1/8" angles as required to prevent drumming or breathing.

J. Access: Install necessary access opening and covers for cleaning, wiring or servicing motors, filters, fans, both entering and leaving air sides of coils, fire and/or smoke dampers and to other equipment located within or blocked by sheet metal work.

K. Sealing: Caulk, seal, grout and/or tape ductwork and plenums to make airtight at seams, joints, edges, corners and at penetrations. Solder all seams, joints, etc., on all ductwork exposed to the weather. Install specified tape in accordance with manufacturer's requirements using degreaser on surfaces to be taped and wiped to eliminate moisture.

3.04 FIELD QUALITY CONTROL

A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.

B. Conduct test, in presence of Architect, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

C. Determine leakage from entire system or section of system by relating leakage to surface area of test section.

D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures).

E. Remake leaking joints and retest until leakage is less than maximum allowable.

F. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual.

3.05 NEW DUCTWORK CLEANING

A. Store all ductwork materials on pallets or above grade, protected from weather, dirt/mud and other construction dust.

B. Remove all accumulated dust, dirt, etc. from each duct section as it is being installed.

C. Prior to installation of diffusers, grilles and registers, install temporary system filters and cover all diffuser, grille and register openings with temporary 25% efficiency filter materials and start the fan systems. Operate fans a minimum of 8 hours. Remove all temporary filters at the end of that period.

D. Clean all diffusers, grilles and registers just prior to project final completion.

E. Cover all ductwork terminations during construction to prevent accumulation of dust and debris.

END OF SECTION

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SECTION 23-4000
HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide Air Cleaning Devices as specified herein and as shown on the Drawings.

B. Materials characteristics and size shall be as indicated on the Drawings.

C. Related Work: The requirements of Section 23 0500, Common HVAC Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Air Equipment Rating: In accordance with ASHRAE 52.2-2007.

1.03 SUBMITTALS

A. Submit catalog data, construction details and performance characteristics for all manufactured materials.

B. Submit operating and maintenance data.

PART 2 PRODUCTS

2.01 AIR FILTERS

A. Disposable Media, MERV 8 Rated:
1. Disposable, preformed 100% synthetic non-woven media, pleated 2” thick cartridge type with carrier board frames with diagonal and horizontal supports. Average ASHRAE test efficiency of MERV 8 per ASHRAE 52.2-2007 App J with initial pressure drop across the clean filter bank not exceeding 0.2" W.C. when operating at 500 FPM. The filter media shall have an Underwriters Laboratories UL 900 Class 2 listing.
2. Provide specified filters for temporary heat and testing during construction and replace filters with new clean, specified filters prior to acceptance of project by Owner (two complete sets of media are required).
3. Flanders or equal Farr.

B. Disposable Media, MERV 13 Rated:
1. Disposable, preformed 100% synthetic non-woven media, pleated 4” thick cartridge type with carrier board frames with diagonal and horizontal supports. Average ASHRAE test efficiency of MERV 13 per ASHRAE 52.2-2007 App J with initial pressure drop across the clean filter bank not exceeding 0.4" W.C. when operating at 500 FPM. The filter media shall have an Underwriters Laboratories UL 900 Class 2 listing.
2. Flanders or equal Farr.

2.02 AIR FILTER HOUSINGS

A. Single-Stage V-Bank Filter Housing:
1. Construction: 16-gauge galvanized steel with pre-drilled standing flanges and dual access doors.
2. UV-resistant door knobs, door and filter sealing gasketing.
3. Filters: 4" deep MERV 13 filter.
4. Camfil Vee-bank series or approved.

B. Dual-Stage V-Bank Filter Housing:
1. Construction: 16-gauge galvanized steel with pre-drilled standing flanges and dual access doors.
2. UV-resistant door knobs, door and filter sealing gasketing.
3. Filters: 2” MERV 8 filter and 4” MERV 13 filter.

4. Camfil Vee-bank series or approved.

2.03 AIR FILTER SYSTEM ACCESSORIES

A. Filter Gauge Filter Gauges: Dwyer 2000-AF Series or accepted substitute, across each filter bank or combination of filter banks when located in the same AHU or filter frame. Mount gauge securely at a point free of vibration.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

A. Air Handling Equipment Installation and Arrangement: Install and arrange as shown on Drawings. Comply with the manufacturer's recommendations for installation, connection, and start-up.

B. Equipment Access Panels: Locate free of all obstructions such as ceiling bars, electrical conduit, lights, ductwork, etc.

C. Filters: Install specified filters or accepted substitute temporary construction filters in supply units and systems prior to start-up or use for drying and/or temporary heat. Provide 1 additional set of filters and replace those installed during Balancing and Commissioning process.

D. Install and arrange equipment as shown on the Drawings and as recommended by the equipment manufacturer.

END OF SECTION

SECTION 23-8000
TERMINAL HVAC EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide Heating, Cooling, and Ventilating Equipment as specified herein and shown on the Drawings.

B. Equipment capacity and size shall be as indicated on the Drawings.

C. Related Work: The requirements of Section 23 0500, Common HVAC Materials and Methods, also apply to this section.

1.02 QUALITY ASSURANCE

A. Air Handling Equipment: Rated in accordance with AMCA certified rating procedures and AMCA labeled.

B. Air Conditioning and Refrigeration Equipment Rating: Rated in accordance with ARI certified rating procedures and ARI labeled.

C. See Commissioning specification for additional requirements.

1.03 SUBMITTALS

A. Submit catalog data, construction details and performance characteristics for each HVAC unit.

B. Submit operating and maintenance data.

PART 2 PRODUCTS

2.01 INDOOR HEAT RECOVERY UNIT

A. Product Specification
1. Heat Recovery Ventilator (HRV) shall be a packaged unit and shall transfer both sensible and latent energy using static plate core technology.

B. Quality Assurance
1. The energy recovery cores used in these products shall be third party Certified by AHRI under its Standard 1060 for Energy Recovery Ventilators. AHRI published certifications shall confirm manufacturer's published performance for airflow, static pressure, temperature and total effectiveness,
purge air (OACF) and exhaust air leakage (EATR). Products that are not currently AHRI certified will not be accepted. OACF shall be no more than 1.02 and EATR shall be at 0% against balanced airflow.
2. Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50 thereby meeting NFPA90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.
3. Unit shall be Listed under UL/ETL 1812 Standard for Ducted Air to Air Heat Exchangers and comply with CSA Standard 22.2.
4. The ERV core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten (10) years from the date of purchase. The balance-of-unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of two (2) years from the date of installation.

C. Energy Transfer: The ERV shall be capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.

D. Passive Frost Control: The ERV core shall perform without condensing or frosting under normal operating conditions.

E. Positive Airstream Separation: Water vapor transfer shall be through molecular transport by hydroscopic resin and shall not be accomplished by “porous plate” mechanisms. Exhaust and fresh airstreams shall travel at all times in separate passages, and airstreams shall not mix. No metal separators or metal core material shall be acceptable.

F. Laminar Flow: Airflow through the ERV core shall be laminar over the products entire operating airflow range, avoiding deposition of particulates on the interior of the energy exchange plate material.

G. Construction
1. The energy recovery component shall be of fixed-plate cross-flow construction, with no moving parts.
2. No condensate drain pans or drains shall be allowed and unit shall be capable of operating both winter and summer conditions without generating condensate.
3. The unit case shall be constructed of G90 galvanized, 20-gauge steel, with lapped corners and zinc-plated screw fasteners.
4. Access doors shall provide easy access to blowers, ERV cores, and filters. Doors shall have an airtight compression seal using closed cell foam gaskets. Pressure taps, with captive plugs, shall be provided allowing cross-core pressure measurement allowing for accurate airflow measurement.
5. Case walls and doors shall be insulated with 1 inch, 4 pound density, foil-scrim faced, high-density fiberglass board insulation, providing a cleanable surface and eliminating the possibility of exposing the fresh air to glass fibers, and with minimum R-value of 4.3 (hr· ft· ºF/BTU).
6. Provide MERV 8 filters at inlet to both sides of energy recovery Media.
   a. Flanders or equal Farr.
7. Unit shall have single-point power connection and a single-point 24 VAC contactor control connection. Start/Stop signal from time clock controller.
8. Blower motors shall be EC type.
9. Provide backdraft dampers at exhaust outlet and OSA intake connections to the unit.
10. The unit electrical box shall include a factory installed, non-fused disconnect switch and a 24 V contacts to receive signal from time clock controller enable unit. Contractor to provide 24V relay and wiring.

H. Renew Aire, American Aldes, or approved.

2.02 ELECTRIC DUCT HEATERS

A. UL approved assembly for zero clearance duct mounting. Heating elements shall be open coil, Grade "A" (20% chromium and 80% nickel) resistance wire supported with ceramic bushings. Element assembly mounted in heavy steel flanged frame members. Accessories shall include low voltage control contactors with terminal blocks, UL listed automatic resetting and manual resetting high limits, and pressure differential air flow switch with power interlock.

B. Provide completely prewired unit for single field power circuit connection. For operation on voltage shown on Electrical Drawings. Unit shall include SCR operation with 0-10v input signal.

C. Renew Aire, Indeeco, Heatrix, Redd-I, King, Valley, or approved substitute.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install and arrange equipment as shown on the Drawings and as recommended by the equipment manufacturer.

B. Piping: Refer to applicable sections for piping, ductwork, insulation, painting, etc.

C. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, to include electrical and piping connections. Report results to A/E in writing. Inspection must include a complete startup checklist to include (as a minimum) the following: Completed Start-Up Checklists as found in manufacturer's IOM.

D. Engage a factory authorized service representative to perform startup service. Clean entire unit, comb coil fins as necessary and clean filters. Measure and record electrical values for voltage and amperage. Refer to Division 23 "Testing, Adjusting and Balancing" and comply with provisions therein.

E. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate and maintain the unit. Refer to Division 01 Section Closeout Procedures and Demonstration and Training.

3.02 AIR HANDLING INSTALLATION

A. Installation and Arrangement: Air handling equipment shall be installed and arranged as shown on the Drawings. Comply with the manufacturer's recommendations for installation connection and start-up.

B. Lubrication: All moving and rotating parts shall be lubricated in accordance with the manufacturer's recommendations prior to start-up.

C. Filters: Specified filters or approved temporary construction filters shall be installed in supply units prior to start-up or used for drying and/or temporary heat.

3.03 CONTROLS

A. Wiring: All wiring shall be in accordance with the National Electrical Code and local electrical codes.

END OF SECTION

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SECTION 26 0500
BASIC ELECTRICAL MATERIALS & METHODS

PART 1 - GENERAL

1.01 Description

A. Furnish labor, supervision, permits, materials and equipment to complete the work required in Division 26 and by the contract documents.

B. It is the intention of this Section of the Specifications and the accompanying drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide a complete electrical system, together with such other miscellaneous installations and equipment hereinafter specified and/or shown on the Plans.

1.02 Contract Documents

A. The Contract Documents are complimentary, and what one affecting this Division requires shall be binding as if repeated herein.

B. Separation of this Division from other Contract Documents shall not be construed as complete segregation of the work.

C. Electrical work shall include both this Division as well as other Divisions as applicable, such as:

1. Division 27, Communications

2. Division 28, Safety & Security

3. Division 33, Utilities.

1.03 Codes

A. Meet requirements of State of Oregon Electrical Specialty Code, Oregon Administrative Rules Chapter 437, American Society of Testing and Materials (ASTM) Federal Specifications, American National Standards Institute (ANSI), National Electrical Manufacturers Association (NEMA), National Fire Protection Association (NFPA), Underwriters Laboratory (UL), National Electrical Code, National Electrical Safety Code, all rules and regulations of the local serving utility, National Board of Fire Underwriters and Oregon Structural Specialty Code. All Codes, rules, and regulations shall be the current or latest edition adopted by authorities having jurisdiction at time of permit.

B. Code requirements shall be considered a minimum guide for the work. Where contract documents require work materials in excess of Code minimum, install work as called for in contract documents.

1.04 Permits, Licenses And Taxes

A. The Contractor shall obtain and pay for all licenses, permits and inspections required by laws, ordinances and rules governing work specified herein. The Contractor shall arrange for inspection of work by the inspectors and shall give the inspectors all necessary assistance in their work of inspection. Division 26 Contractor shall make all necessary arrangements for installation of electrical services indicated on plans.

B. Utility installation fees will be paid by the Owner.

1.05 Layout And Coordination

A. See General Conditions.

B. Before starting work, carefully examine Architectural, Civil, Landscape, Structural, Plumbing, Heating, Ventilating and Air Conditioning Drawings to become thoroughly familiar with conditions governing work on this project. Verify elevations, measurements, rough-in requirements of equipment and its installation location before proceeding with the work. Install equipment with access as required by NEC.

C. Composite Interference Drawings. Before any sleeves or inserts are set or any electrical equipment or foundations are installed, prepare and submit for approval, by the Engineer, in accordance with the

General Provisions, composite coordination drawings for all equipment rooms, spaces and other areas in which the probability of interference exists. Drawings shall show the work of all trades covered, shall be drawn to a scale not smaller than 1/2" = 1'-0", and shall show clearly in both plan and elevation that all work can be installed without interference.

D. Prior Installation. Any electrical work installed prior to approval of coordination drawings shall be at the Contractor's risk. Subsequent relocations required to avoid interferences shall be made without additional expense to the Owner. In case interference develops, the Engineer will decide which work shall be relocated, regardless of which was installed first.

E. The existence of any wires, conduits, pipes, ducts or other service facilities is shown in a general way only. The Contractor is responsible for making the exact determination of the location and condition of these facilities.

F. The Drawings indicate outlet and equipment locations, directions and locations of branch circuit wiring and homeruns. Verify all locations with actual field conditions.

G. The horsepower of motors and apparatus wattages indicated on the plans and in the panel schedules are estimated requirements of equipment furnished under other Divisions of this contract and bid shall be based on these sizes. Overload elements, contactors, circuit breakers, fuses, conductors, etc., shall be furnished to suit actual equipment installed. Advise Engineer of any equipment changes affecting electrical circuits.

H. The location of utilities indicated on the plans is taken from existing public records. The Contractor must determine the exact location and elevation of public utilities. The Contractor shall ascertain whether any additional facilities other than those shown on the Drawings may be present.

I. The general directions and location of homeruns are indicated on Drawings and are to be extended to panels as though routes were completely shown. No homeruns or branch circuits are to be combined. Items which are installed other than as shown on Drawings and without receiving prior written approval will be ordered removed and installed as shown without additional cost to Owner.

J. Owner shall not be responsible for any loss of unanticipated costs that may be suffered by the successful bidder as a result of such bidder’s failure to fully inform himself in advance in regard to all conditions pertaining to the work and character of the work.

K. Coordinate work with other crafts employed on the project. Should rearrangement or relocation of equipment be necessary, provide for approval the simplest layout possible for that particular portion of the work. Under no condition are beams, girders, footing or columns to be cut for electrical items unless so shown on Plans or written approval is obtained from the Architect or Engineer.

L. Special attention shall be given for the following items and all conflicts shall be reported to the Engineer before installation for decision and correction:

1. Door swings; switches shall be located on the "strike" side of the door.
2. Location of radiators, grilles, pipes, ducts and other mechanical equipment so that all electrical outlets, lighting fixtures and other electrical outlets and equipment are clear from and in proper relation to these items.
3. Location of cabinets and counters so that electrical outlets and equipment are clear from and in proper relation to these items.
4. Within the limits indicated on the drawings, the maximum practicable space for operation, repair, removal and testing of equipment shall be provided.
5. Contractor shall coordinate with HVAC installer (if separate from the Contractor) to wire the HVAC system when the installer is ready for power.

M. Contractor shall consult the Architectural drawings for the exact height and/or location of all outlets, switches, lights, etc. specified herein or on the drawings.

N. Outlet locations shown on the drawings are approximate. Contractor shall study the building drawings in relation to spaces and equipment surrounding each outlet so that the lighting fixtures are symmetri-

cally located according to ceiling tile and room layout. When necessary, with the Engineer's approval, outlet shall be relocated to avoid interference with structural features of the building.

O. Call to the attention of the Architect any error, conflict or discrepancy in Plans and/or Specifications. Do not proceed with any questionable items of work until clarification of same has been made.

P. Supplementary Details and Plans may be supplied as required and they will become a part of the Contract Documents. The Architect or Engineer reserves the right to make minor changes prior to installation of specific electrical systems in the location of the conduits, outlets, etc., from those shown on the plans without extra charge to the Owner.

Q. Arrange work to reduce interruption of any existing service to minimum. When interruptions are unavoidable, consult Owner or Utility involved and agree in writing, with copy to the Architect, upon a mutually satisfactory time and duration.

1.06 Substitution Requests

A. Substitution of Equipment. (Prior To Bid).

1. Bids shall be based only upon the materials, construction and equipment specifically identified in the bidding documents, except as hereinafter provided.

2. If Contractors wish to use items of equipment other than those named in their base bid, Contractor shall apply in writing to the Engineer for approval of substitution at least 10 days prior to opening of bids, submitting with his request for approval complete descriptive and technical data on the items he proposes to furnish.

3. Equipment and materials proposed for substitution shall be similar in design and equal in quality and function to those specified.

4. Submittal shall be in triplicate with identification of the item to be substituted and clearly marked with all pertinent data depicting proper characteristics of proposed item.

5. Contractor's description of his proposed substitution shall specifically note all differences between the item specified and the proposed substitution.

6. If the Engineer approves any proposed substitution, such approval will be set forth in an Addendum or in writing to the person submitting equipment for approval.

7. Where a substitution alters the design or space requirements indicated, Contractor shall include all items of cost for the revised design and construction including cost of all allied trades.

8. Unless requests for changes in base bid specifications are received and approved prior to the opening of bids, as defined above, the successful Contractor will be held to furnish specified items under his base bid. After Contract is awarded, changes in specifications will be made only as defined under Substitution of Equipment. (After bid).

B. Substitution of Equipment or Materials. (After Bid).

1. After execution of the Contract, substitution of equipment or makes other than those specifically named in the Contract Documents will be approved by the Engineer for the following reasons only:

2. That the equipment proposed for substitution is equal to and/or superior to equipment named, in construction, efficiency and utility, and further that the equipment named in the specifications cannot be delivered to the job in time to complete the work in proper sequence to work of other Contractors, due to conditions beyond the control of the Contractor.

3. To receive consideration, requests for substitutions must be accompanied by documentary proof of equality or difference in price and delivery, if any, in the form of certified quotations from suppliers of both specified and proposed equipment.

4. In case of a difference in price, the Owner shall receive all benefit of the difference in cost involved in any substitution and the Contract altered by Change Order to credit Owner with any savings so obtained.

1.07 Submittals: Shop Drawings And Material Lists

A. In addition to the requirements of General Conditions of Division 01, submit manufacturers data and Shop Drawings and Material Lists as required by individual sections of Division 26 (and otherwise associated Divisions).

B. Before commencing work and within 30 days after award of contract, furnish six (6) copies of complete Shop Drawings and Material Lists to the Architect or Engineer.

C. Include only information on exact equipment installed; not complete "line" of manufacturer. Where sheets show proposed equipment as well as other equipment, identify proposed equipment with black arrow, underlining or circling. Contractor is not to use red. Diagrams for systems to be complete Drawings for specific system installed. "Typical" line diagrams not acceptable unless properly marked to indicate exact system for this project.

D. Single Submission. Data and shop drawings shall be supported and included in a single submission. Multiple submissions are not acceptable except where prior approval has been obtained from the Engineer. In such cases, a list of data to be submitted later shall be included with the first submission.

E. Shop Drawings. Shop drawings shall include complete construction details, dimensions, material descriptions, diagrams or pictures showing physical characteristics, performance and test data, description of operation, installation methods, wiring diagrams and any other data or information necessary for a complete evaluation. (Note: do not re-draw the contract drawings. The drawings to be submitted under this subsection are all the supplemental drawings and manufacturers' specification drawings which are not included in the contract drawings.) Shop drawings are in addition and supplemental to the contract drawings.

F. Identification. In addition to the requirements of Special Provisions, submittals shall be identified by the name of the system and applicable specification paragraph number.

G. Delivery Prior to Approval. No item of material or equipment shall be delivered to the site or installed, until approved. After the proposed materials have been approved, no substitution will be permitted except where approved by the Engineer.

H. Compliance. Should the Contractor fail to comply with the requirements of these provisions, the Engineer reserves the right to select any or all items of materials and systems. Selection shall be final and binding upon the Contractor. Materials so selected or approved shall be used in the work at no additional cost to the Owner.

I. Departures. If departures from the contract drawings are deemed necessary by the Contractor, details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with the drawings. Where such departures require raceways or equipment to be supported otherwise than as shown, the details submitted shall include loadings and type and kind of frames, brackets, stanchions, or other supports necessary. Approved departures shall be made at no additional cost to the Owner.

J. Electrical Diagrams. A complete electrical connection diagram for each item of equipment furnished under Division 26, which has electrically controlled components having more than one automatic or manual control device, shall be submitted for approval. Wiring diagrams shall identify each component, and one diagram shall show all interconnected or interlocked components. It is understood that the contract electrical drawings do not have to be submitted or copied for inclusion in this submittal.

K. Contractor agrees that submittals processed by the Engineer are not change orders; that the purpose of submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.

L. Late submittals will not be considered an excuse for time extension for the project.

M. Data not in conformity with these requirements will be returned for resubmittal.

N. Organization:

1. Assemble Shop Drawings and submittal data in hard cover loose-leaf ring binder. Provide cover with permanently attached typewritten or printed label with name of project, job number and heading reading "ELECTRICAL SUBMITTAL DATA".

2. Organize data in each set in basic categories listed in index for Division 26 (and otherwise associated Divisions). Provide submittal data with typewritten index having same sequence, numbering and wording as index for Division 26 (and otherwise associated Divisions). In addition, provide divider sheets between each section with identifying tabs having same designations as index. Organize material in each section in same order and identify with same number and wording as paragraphs of specification section.

3. Submit neat, clean copies of data, 8-1/2 inch by 11-inch size. Accordion fold required drawings to 8-1/2 inch by 11-inch size and include in submittal binder.

1.08 Electrical Equipment Operation and Maintenance Manuals

A. In addition to the requirements of the General Conditions of Division 01, submit manuals as required by individual Sections of Division 26 (and otherwise associated Divisions).

B. Provide all electrical equipment and control information. The purpose of this manual is to provide one comprehensive document that illustrates and describes all the electrical equipment and instrumentation installed in the plant.

C. For final acceptance of Division 26 work, provide to the Architect or Engineer six (6) copies of complete electrical operating and maintenance manuals for servicing of all equipment installed.

D. Information included must be exact equipment installed, not complete "line" of manufacturer. Where sheets show equipment installed as well as other equipment, identify installed equipment with black arrow, underlining or circling. Contractor is not to use red. Diagrams for each system to be complete Drawings for specific system installed. "Typical" line diagrams not acceptable unless properly marked to indicate exact system for this project.

E. Information shall include all revisions noted in shop drawings. Copies of stamped drawings are not acceptable.

F. Provide General Contractor’s name, contact person, telephone/fax numbers, include similar information for the sub-contractors.

G. Include all electrical devices provided under all Divisions. Coordinate with other Division Contractors. The Contractor shall coordinate with the Division 17 contractor and the Software Integrator to include pertinent documentation from their responsibilities in this submittal.

H. Manuals and documentation shall include calibration curves of every sensing device and a programming documentation sheet for every programmable device. The programming documentation sheet shall show the final operational value of every programmable parameter of every device. The purpose of this sheet is to provide maintenance personnel with a convenient source of information for programming the parameters of a replacement device should the old device fail.

I. Organization:

1. Assemble Shop Drawings and submittal data in hard cover loose-leaf ring binder. Contractor shall insert printed spine and cover title sheets to match font style and size of the rest of the plant O&M manual set. Coordinate with the General Contractor.

2. Organize data in each set in basic categories listed in index for Division 26. Provide submittal data with typewritten index having same sequence, numbering and wording as index for Division 26. In addition, provide divider sheets between each section with identifying tabs having same designations as index. Organize material in each section in same order and identify with same number and wording as paragraphs of specification section.

3. Submit neat, clean copies of data, 8-1/2 inch by 11-inch size. Accordion fold required drawings to 8-1/2 inch by 11-inch size and include in submittal binder.

1.09 Project Record Drawings

A. Maintain at the site one complete set of full-sized original prints for recording installed conditions (As-Builts). Keep record Drawings clean, undamaged and up to date as work progresses. Accurately indicate electrical work as actually installed with indications of all deviations, additions and omissions in red ink. Locate all buried exterior raceways or cables by actual dimensions from walls, center-lines or fixed points of reference.

B. The purpose of these Record drawings is to provide the Engineer with an easy to read, complete record of the installation so that at the end of the project the Engineer can revise the original contract drawings to represent the actual installation. Color-coded and highlighted notes shall be used if these would make the Record Drawings easier to read.

C. At the completion of the work, Contractor shall furnish the Engineer this original set of marked-up drawings. Final payment to the Contractor will not be authorized until these drawings have been submitted to and accepted by the Engineer.

1.10 Certificates

A. For final acceptance of Division 26 work (and that of otherwise associated Divisions), provide certificate of approval from the applicable regulatory and permitting agencies certifying that the electrical work has been inspected and that the work conforms with the minimum requirements of the State Electrical Codes.

1.11 Warranty

A. See Division 01.

PART 2 - PRODUCTS

2.01 Materials

A. Unless otherwise specified, all material to be new of recent manufacture, carrying full factory warranty, UL approved or approved by local inspection authority.

B. All like materials shall be by the same manufacturer throughout the project.

C. All material shall be new and bear manufacturer's name, model number, electrical characteristics and other identification and shall be the standard product of manufacturer regularly engaged in production of similar material.

D. Access Panels:

1. Provide access panels of adequate size for equipment requiring service and installed above plaster or gypsum board ceilings, behind walls or in furring.

2. Furnish complete with correct frame for type of building construction involved. Size, number and location of access panels is not necessarily shown on Drawings.

3. Use no panel smaller than 12 inches by 12 inches for simple manual access, nor smaller than 16 inches by 20 inches where personal must pass through.

4. Access panels shall maintain ceiling fire rating.

5. Acceptable Manufacturers: Milcor A, K, L, or M panels or equivalent Bilco or Potter - Roemer as required by construction.

PART 3 - EXECUTION

3.01 Excavation/Trenching

A. Provide trenching, backfilling, compaction, repaving or other site restoration as required by the work done in this Division.

B. Determine location of all existing underground gas, water, sewer, telephone and electric lines. Locate accurately on ground surface and for depth of same before excavation. Uncover by hand digging. Contractor shall be responsible for any damage or interruptions to these utilities, caused by himself, and other costs incurred by these interruptions.

C. Do not undermine footings or bearing walls.

D. Use power-digging equipment only in direction away from existing facilities.

E. Exercise standard safety precautions in excavation near power cables by using insulated handles, rubber gloves and footwear, etc.

F. Do not place backfill until installation to be covered has been tested, inspected and approved.

G. Minimum conduit burial depth shall be 24 inches, unless otherwise noted.

H. Install a detectable six inch wide yellow vinyl tape with letter “Caution: Buried Electrical Line Below” 18 inches above all buried services conduit and wire not under structures.

I. Backfill:

1. Backfill material for all trenches under paved areas shall be coarse sand or crushed rock, installed in layers not to exceed six inches and compacted to 95% of maximum density at optimum moisture content to preclude subsequent settlement.

2. The top 18 inches of trenches in landscaped or grassed areas shall be backfilled with native soil and tamped.

J. Conduits piercing a building waterproof membrane shall be provided with flanges, using two neoprene washers, one washer on each side of membrane, between each flange and membrane.

K. All underground conduits which enter the building penetrating poured-in-place slabs:

1. Shall be sloped to drain away from the building and shall be water sealed to prevent moisture from passing through the conduit into the building. All joints to be threaded and taped or glued to prevent entry of water into the conduits.

2. Shall be poured-in-place, or provide with watertight conduit sleeves and rubber seals, Linkseal system by Thunderline Corporation or equivalent.

3. Shall be rigid galvanized steel a minimum of 12-inches under the slab and 6-inches above the slab.

3.02 Cutting

A. Perform or arrange and pay for required cutting of concrete, masonry, wood, structural framing, etc.

B. Cutting or channeling of underpinning or structural members is not permitted without prior permission of the Engineer.

C. No weakening of structural parts is permitted and the Contractor will correct any work impaired.

3.03 Patching

A. Where trenching is done through existing paving, walks, curbs, etc., the Contractor is responsible to patch and repair these structures to original condition.

B. Patch all openings in and through concrete and masonry with dry pack.

C. In new work, patch and refinish all finished surfaces damaged by this contractor to match adjacent surface.

D. Where new electrical work is installed in the existing building, patch and refinish surfaces damaged to match existing. Refinishing to be as directed by the Architect or Engineer.

3.04 Framing And Blocking

A. Structural framing will be done by the Contractor.

B. Blocking required for sole use of electrical work such as fastening and support of outlet boxes, fixtures, panels, conduit, etc., will be by the Electrical Contractor.

3.05 Protection

A. Cap or plug all raceway openings during construction.

B. Protect all completed work against dirt, water or chemical damage, mechanical accident or injury.

C. Equipment found damaged or in other than new condition will be rejected as defective.

3.06 Sleeves

A. Where conduit passes through masonry or concrete, install sleeves during construction of same.

B. Where conduit must by necessity pass through beams or columns, install sleeves located as directed by Engineer.

3.07 Identification

A. Label complete electrical system to indicated use of each item of equipment or load served.

B. Identification of Disconnecting Means: Provide identification of disconnects in accordance with Section 110-22 and Section 240-83 of the National Electrical Code.

C. Provide black laminated white core engraved nameplates with lettering not less than 3/16 inch high attached to the outside of junction boxes larger than 4-11/16 inch; surface mounted cabinets, panelboards, time switches; disconnect switches, starters, contactor, relays; subdistribution and branch circuit panelboards, dry transformers and other items indicating equipment or load served. At flush mounted cabinets, panelboards, time switches and similar items mount nameplate on inside of door at finished areas and on outside of door at mechanical, storage rooms and other non-public spaces. Attach nameplates with epoxy glue.

D. Flush mounted devices with stainless steel or plastic finish plates requiring identification to be engraved with lettering not less than 1/8 inch high with black color filling.

E. Provide typewritten circuit schedules for panelboards, cross-connect panels and terminal cabinets. Schedules shall be covered with minimum of 0.018 inch thick clear rigid plastic installed in permanently attached metal frame holder located on inside face of door. Schedules to use final assigned room names/numbers, loads not plan designations.

F. When making modifications to existing equipment or panelboards, provide labels as indicated in this section. Provide new typewritten circuit schedules for all modified panelboards.

G. At Main Distribution Panels provide black laminated white core engrave nameplates attached to panel exterior with epoxy glue. Size of nameplate and lettering as directed. Label distribution breakers, main breakers, sub-breakers and panel sections to identify all components and voltage and phase of system. In addition, provide master nameplate indicating project name, date, Architect (when applicable), Electrical Engineer, and Electrical Contractor. Lettering minimum of 1/4 inch high. Provide half-sized electrical one-line diagram (s) framed and mounted on wall near main distribution panel (s).

H. At buildings having multiple services provide additional engraved nameplate at each service indicating location of additional services.

3.08 Installation

A. Wiring Requirements: Install wiring complete to every outlet with all devices shown and/or required. All wiring to be in raceways and concealed throughout finished areas unless specifically noted otherwise. For the purpose of electrical specifications, all areas, with the exception of boiler rooms, mechanical rooms and mechanical spaces, are to be considered as finished areas.

B. Provide raceway connections between outlets, outlets and panels and equipment and panels as shown on Drawings. Size raceways according to governing codes unless otherwise noted.

C. Locations:

1. Verify all locations with actual field conditions, and plans to avert possible installation conflicts.

2. Coordinate work with that of other trades to assure symmetrical placing of fixtures in respect to ceiling tile, grilles, etc.

3. Cabinets: Where electrical outlets occur in face, decks or base of cabinets or in walls above counters, carefully coordinate with details and arrangements of same.

4. Any work, which is incorrectly installed without prior verification with General Contractor, Architect, Engineer and Drawings, will be ordered removed and relocated and any damage to other work shall be repaired at no cost to the Owner.

5. In general, locate outlets as indicated in symbol schedule on Drawings.

D. All mounting heights shown on drawings are from finish floor to centerline unless otherwise shown. Mounting heights at non-typical locations shown with (+) sign and height required noted adjacent to outlet. Outlets located in concrete block, brick or tile walls are to be adjusted in height to coordinate with modular joints of the materials.

3.09 Painting

A. Painting in general will be covered under another Division of this specification, except items furnished under this Division that are scratched or marred in shipment or installation and/or require custom painting.

B. Install equipment with manufacturer's standard finish and color unless otherwise specified. Refinish any marred or oxidized items restored to manufacturer's factory finish.

C. Required surfaces or equipment with no standard finish; clean off grease and scale. Restore to smooth finish. Give one coat of primer, two coats finish.

D. Paint and color as selected by Architect or Engineer.

E. All exposed conduits on painted walls shall be painted to match wall and trim colors. Conduit labels shall be neatly affixed and shall not be painted over.

F. All electrical equipment and conduit exposed in finished areas and on exterior walls shall be painted to match surrounding surfaces.

G. Contractor shall coordinate the timing of painting requirements.

H. Refer to architectural specifications for methods and materials.

3.10 Future Provisions

A. Provide pull line in each empty conduit provided for future installation of wiring.

B. At all systems such as fire alarm, clock and program, intercom, etc., where future stations are to be fed from adjacent outlets or terminal cabinets, all conductors required for complete installation of additional units are to be provided to nearest outlet or terminal cabinet as required. In general, all wiring installed so it will not be necessary to remove existing conductors and repull additional wiring to install additional units. All spare conductors properly labeled and terminated in outlet boxes or at terminals in terminal cabinets.

3.11 Noise Control

A. To minimize noise transmission between occupied spaces, outlet boxes at opposite sides of partitions are not to be placed back to back and installation of straight-through boxes is not permitted.

B. 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 Plans. Where equipment is mounted on wall common to occupied spaces, provide shock mounting or noise isolators to effectively prevent transmission to occupied spaces.

C. Ballasts, contactors, starters and like equipment found noticeably noisier than similar equipment of same type are to be removed and replaced as directed by Engineer at no cost to Owner.

3.12 Fire-Stopping

A. Where raceways penetrate floors, ceilings, ducts, chases and fire walls, provide fire stopping to maintain integrity of the fire assembly. The code authority having jurisdiction shall approve fire-stopping method.

B. Where electrical boxes exceeding 16 square inches are located in fire resistive walls, fire stopping shall be provided to maintain integrity of the fire assembly.

3.13 Continuity Of Service

A. Keep outages to occupied areas to a minimum and prearrange all outages with Owner, Engineer and utilities involved. Requests for outages shall state the specific dates and hours and the maximum durations, with the outages kept to these specified times. When power interruptions will last longer than 5 minutes and cover more than 10% of the building, or affect public areas, they shall be performed on the weekend between 1 and 5 AM.

B. Contractor shall coordinate with Owner or Engineer so that work can be scheduled not to interrupt operations, normal activities, building access, etc. Coordinate work with other crafts for proper scheduling.

C. No circuits shall be turned off without prior approval from Owner or Engineer. Coordinate with the operations, normal activities, building access, etc. Coordinate work with other crafts for proper scheduling.

D. This contractor shall be liable for any damages resulting from unscheduled outages or for those not confined to the preapproved times. Include all costs for overtime labor as necessary to maintain electrical services in the initial bid proposal. Temporary wiring and facilities, if used, shall be removed and the site left clean before final acceptance. Requests for outages must be submitted at least (5) days prior to intended shutdown time.

E. When applicable, include in bid cost of minimum temporary power to Fire Alarm System, Security, Telephone/Data equipment and any other equipment designated by Owner, during time when primary building power has been interrupted.

3.14 Demolition And Salvage At Existing Structures

A. Contractor shall make all necessary adjustments to the electrical system required to meet code, accommodate installation of the new work, and for demolition and removal at existing structures.

B. Remove all existing fixtures, controls, clocks, switches, receptacles, and other electrical equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless specifically shown as retained or relocated on the drawings. If existing walls, ceiling, floors, etc. are moved, extend existing devices, fixtures, and circuiting to the new location.

C. Disconnect all existing mechanical equipment scheduled for removal or relocation as described in specifications and shown on the Plans. Remove abandoned raceways and cables. Re-label panels and motor controls centers to reflect changes.

D. If existing junctions boxes will be made inaccessible, or it abandoned outlets serve as feed through boxes for other existing electrical equipment that is being retained, new conduit and wire shall be provided to bypass the abandoned outlets. If existing conduits pass through partitions or ceilings which are being removed or remodeled, new conduit and wire shall be provided to route around the ceiling or wall and maintain service to the existing load.

E. Extend circuiting and devices in all existing walls to be furred out.

F. Locations of items shown on the drawings as existing are partially based on as-built and other drawings which may contain errors. The Contractor shall verify the correctness of the information shown prior to bidding and provide such labor and material as is necessary to accomplish the intent of the contract documents. The plans may shown some demolition conditions, but are not intended to shown all of them.

G. All materials accumulated during the demolition process are the Owners property and shall be removed from the job site as directed by the Owner.

3.15 Work At Existing Structure

A. Connect to and extend all existing electrical systems as required. Verify location of existing raceways stubbed out. If raceways indicated are not of proper size or in proper location, provide new as required for completion of project.

B. At areas where new ceilings are being installed, remove existing light fixtures and provide box extensions and reinstall existing fixtures. See Architectural Drawings for areas involved.

3.16 Safety

A. The Drawings and the specifications do not include design or construction details or instructions relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the Contractor to perform his work.

B. The Contractor shall provide necessary shoring, railing, barricades, protective devices, safety instructions and procedures to perform the work safely and to comply with State Safety Requirements and OSHA requirements.

3.17 Cleanup

A. Contractor shall continually remove debris, cuttings, crates, cartons, etc., created by his work. Such clean up shall be done at sufficient frequency to eliminate hazard to the public, other workmen, the building or the Owner's employees. Before acceptance of the installation, Contractor shall carefully clean cabinets, panels, wiring devices, cover plates, light fixtures, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.

3.18 Asbestos Bearing Materials

A. If during the course of his work, the Contractor observes the existence of asbestos or asbestos bearing materials, the Contractor shall immediately terminate further work on the project and notify the Owner of the condition. The Owner will, after consultation with the Architect, determine a further course of action.

3.19 Polychlorinated Biphenyls (PCB's)

A. If during the course of his work, the Contractor observes the existence of polychlorinated biphenyls (PCB's), the Contractor shall immediately terminate further work on the project and notify the Owner of the condition. The Owner will, after consultation with the Architect, determine a further course of action.

3.20 Testing.

A. Test the entire electrical installation to assure compliance with code and proper system operation.

1. Circuit Tests. The Contractor shall test all wiring and connections for continuity and ground before any fixtures or other loads are connected. Tests shall be made with a 500 volt DC "Megger" type tester. If tests indicate faulty insulation (less than 2 megohms) such defects shall be corrected and tested again. Contractor shall provide all apparatus and material required to make tests and shall bear all expense of required testing.

2. Load Balancing. Checks shall be made for proper load balance between phase conductors and make adjustments as necessary to bring unbalanced phases to within 15% of average load.

3. Ground Testing. Measure the OHMIC value of the Electric Service Entrance metallic "System Ground" with references to "Earth Ground" using the "Multiple Ground Rod" method and suitable instruments. Maximum resistance to ground shall be less than 10 ohms. If this resistance cannot be obtained with the ground system shown, notify the Engineer immediately for further instruction. Certify in writing to the Engineer that the grounding test has been made and that the requirements of this portion have been met for the "System Ground".

4. Motor Tests. Check all motors for proper rotation and for actual load current. Submit tabulation of motor circuits.

B. Materials and instrumentation shall be provided by the Contractor.

C. The Contractor shall notify the Engineer ten (10) working days prior to performance of any test.

D. The Contractor shall certify in writing that the above tests have been completed and shall provide documentation of test data.

3.21 Instruction Of Owner Employees

A. Instruct operation and maintenance personnel selected by Owner's representative at a single designated time in operation and maintenance of the entire electrical system and its components.

B. Electrical Contractor shall provide one 8-hour working day of instruction to Owner designated personnel. Software Integrator shall provide one 8-hour working day of instruction to Owner designated personnel after all equipment is fully operational and functional. The time for this instruction shall be scheduled shortly after start-up and at mutually agreed times. Contact Engineer for coordination.

C. Specific sections elsewhere in this Division may require additional training.

D. On completion of instructions, obtain from Owner certification in writing that demonstration had been given and instructions had been understood.

3.22 Payment for Work.

A. Payment for work under this Division shall be covered and included as part of the Basic Bid on the project, or as outlined under any schedules.

END OF SECTION

SECTION 26 0510
RACEWAYS, BOXES & CONDUCTORS

PART 1 - GENERAL

1.01 Description

A. Provide conductors, cables, connectors, lugs, cable ties and terminations for all systems.

B. Provide all raceways, fittings, outlet boxes, junction boxes, pull boxes and special boxes required for complete project. Install all systems in raceways unless specifically noted otherwise.

C. Not all conduits are shown. Where not specifically indicated, Contractor shall be responsible for sizing conduit per applicable codes for number of conductors.

D. Provide all seismic bracing (as required for the applicable seismic zone as determined by the Geotechnical Engineer or Architect) of equipment, feeders and other electrical items in accordance with prevailing codes. Produce and submit the required designs, calculations, certifications and stamped drawings to the authority having jurisdiction and obtain their approval prior to installation or fabrication. Comply with latest edition of the SMACNA Seismic Restraint Manual.

E. Related work in other sections includes.

1. Providing conductors, Section 26 0519, Conductors and Cables.

2. Providing boxes, Section 26 2726, Wiring Devices and Floor Boxes.

3. Providing supporting devices, Section 26 0529, Hangers and Supports.

1.02 Quality Assurance

A. UL listed.

1.03 Product Delivery, Storage And Handling

A. Deliver raceways with UL label and bearing manufacturer's name on each length.

B. Store and handle raceways and boxes so as not to subject them to corrosion or mechanical damage and in a manner to prevent damage from environment and construction operation.

C. Cap raceway ends until used.

D. Deliver fittings in manufacturer's original unopened and undamaged packages with labels legible and intact.

PART 2 - PRODUCTS

2.01 Conductors

A. Secondary service entrance conductors: Copper 600 volt type "THW", "THHN", or “XHHN” stranded, unless otherwise noted. Sizes as shown on Drawings.

B. Feeder conductors:

1. Copper, 600 volt, type “THW”, “THHN” or “XHHW” unless otherwise noted, sizes as shown on drawings.

2. Aluminum conductors are acceptable as panelboard feeders as shown on drawings for copper sizes #2/0 AWG and above only.

3. Drawings are based on copper conductors, contractor to provide a list of conductor and conduit sizes to the Engineer for review for all aluminum conductors to be used. List to be provided prior to ordering material.

C. Branch circuit conductors:

1. Copper, minimum size No. 12 AWG. Conductors No. 12 and No. 10 AWG shall be soft drawn, solid copper. Conductors larger than No. 10 AWG to be stranded, soft-drawn copper. Use type "THW", “THWN”, or "THHN". Special conductor types where noted or required by code.

D. Low-Voltage: Provide low-voltage conductors as per individual manufacturer’s recommendations.

2.02 Metal Clad Cable:

A. Cable shall be steel or aluminum jacketed interlocking armor with internal fully insulated green grounding conductor. Cable shall contain multi-conductor thermoplastic insulated type THHN color-coded solid or stranded copper conductors and shall be UL approved for the intended application.

B. Connections, terminations and fasteners shall be UL approved for the application, and designed specifically for use with the cable used, and shall have insulated throats to protect the wire.

C. Approved Manufacturers: MC Cable: AFC/A Nortek Company, Type Mc-Lite, HC-90; Alflex, Armorlite.

D. Tools: Use only tools approved by cable manufacturer. Cutting tool should be controlled depth rotary cutter.

E. See Installation for specific restrictions on use of MC Cable.

2.03 Rigid galvanized steel and IMC conduit:

A. Rigid galvanized conduit: Rigid steel zinc coated, manufactured in accordance with UL-6, ANSI, and Federal Specifications WW-C-540 standards.

B. Intermediate Metal Conduit (IMC): Zinc coated galvanized steel to comply with UL-1242, Type J and ANSI Standards.

C. Application:

1. Employed for runs embedded in concrete, concrete block, underground, wet or damp locations, where subject to mechanical injury, and where exposed within eight feet of floor.

2. Make threads watertight with bituminous sealer (solvent type cut back) before assembly where installed underground, in moist locations or where exposed to weather.

D. Fittings: Threaded iron or steel only, Thomas & Betts or O-Z/Gedney in sizes up to 1-1/2 inch plastic insulating type O-Z/Gedney type "A", or "T&B" 220 Series; sizes above 1-1/2 inch insulated metallic bussings O-Z/Gedney type "B" and "T&B" 1220 Series.

2.04 Rigid Stainless Steel conduit: Solid stainless steel.

A. Application: Required in most outdoor marine or corrosive environments or as specified.

B. Fittings: Threaded stainless steel. Erickson couplings, watertight split couplings (OZ or equivalent) permitted so long as all components are of the same stainless steel alloy and are waterproof.

2.05 Electrical metallic tubing (EMT): Steel zinc coated, to comply with ULI-797 and ANSI Standards.

A. Application:

1. Dry locations only. May be used in framed construction, furred ceilings and above suspended ceilings.

2. May be exposed in unfinished areas where not subject to damage.

B. Fittings: Connectors and couplings to be case steel. Preinsulated connectors and couplings up to one (1) inch trade size may be compression, indenter or setscrew type. Fittings above one (1) inch trade size shall be compression type. All connectors shall have insulated throats. Thomas & Betts, Steel City or approved.

2.06 Liquidtight flexible metal conduit: Zinc steel core with smooth gray abrasion resistant, liquidtight, polyvinyl chloride cover (with integral ground wire wound in steel core), to comply with UL 360 and ANSI Standards. Anaconda Sealtite type U.A. Electro Flex L4, Alflex Ultratite UL or EF or approved.

A. Application: For connection to equipment. Minimum size 3/4-inch for motor connections. Use 3/8-inch only for fixture and control wiring. Provide sufficient length of flexible conduit to avoid transmission of vibration.

B. Fittings: “Thomas & Betts" Supertite or approved.

2.07 Flexible metal conduit, to comply with UL360, ANSI Standards, and Federal Specification WW-6-566.

A. Application:

1. Permitted only in dry locations where flexibility is required in length not over 18 inches.

2. Minimum size required 1/2 inch, unless noted otherwise.

3. Where flexibility is not required, flexible metal conduit is not to be used without written permission of the Architect or Engineer.

B. Fittings: Screw-in-type factory preinsulated "Thomas & Betts".

2.08 Non-metallic conduit: Polyvinyl chloride schedule 40 heavy wall UL listed for underground and exposed applications in accordance with National Electrical Code to comply with NEMA TC2. Carlon Electrical Products, PWC or approved.

A. Application:

1. Permitted for runs embedded in concrete or underground in wet or damp locations.

2. All conduit offsets and bends made with factory fittings.

3. All 90 degree ells and conduit entrances into buildings to be with rigid galvanized or fiberglass conduit.

4. PVC conduit installed under roadways or areas subject to heavy traffic shall be provided with a minimum of 36" cover.

5. Fiberglass or galvanized rigid elbows shall be used for angles larger than 30 degrees where the conduit size is greater than one inch.

6. Provide a ground wire sized per code in all PVC conduits. Conductor quantities indicated in conduits do not include ground wires unless otherwise noted.

2.09 Wireways: All steel with screw covers. Parts coated with rust inhibitor and finished in color to match adjacent distribution equipment. Where located separate from distribution and control equipment, finish standard industrial gray enamel.

2.10 Surface raceways:

A. Allowed only upon prior approval by Architect or Engineer.

B. Surface mounted "Raceway” type, size and with number, spacing and type of outlets shown on Drawings. Provide raceways with all connectors, end fittings and miscellaneous items required for complete installation. Finish standard gray or beige as selected. Wiremold Co., Mono System or approved.

C. Install parallel to building surfaces.

2.11 Seals and Fittings:

A. Conduit plugs: Ideal "Conduloc" sizes 1/2 inch through one inch and T&B, Push Penny Plugs Series 1470 for 1-1/4 inch and larger, or approved for sealing conduits during construction. Steel City PL-200 series screwdriver slot threaded meter plugs or Killark Cat. No. CUP-O through CUP-9 for permanent plugs.

B. Floor and wall entrance fittings: O-Z/Gedney Electrical Mfg. Co. Type "FSK" entrance seal.

C. Expansion fittings: O-Z/Gedney Electrical Mfg. Co. Type ‘E’ expansion coupling with bonding jumper for up to four inch of movement.

D. Conduit seals: Vertical or horizontal type Crouse Hinds type "EYS" or approved.

E. Lead Roof Flashing Assembly: Open top caulk, six inch diameter skirt, Stoneman Engineering & Manufacturing Company No. S1000-4 for 1/2 inch diameter through eight inch diameter. Caulking compound G.E. Silicon Construction Sealant SCS-1200 or Dow Corning 781. Refer to Architectural.

F. Wall and floor fire and smoke barriers: Concrete floor type O-Z/Gedney Gedney Co. "Fire Seals" or approved. UL labeled fire barrier material installed in accordance with manufacturer's recommendations. 3M Branch Fire Barrier System; Chase Technology Corp. No. CTC PR-855; Fire Stopping Products SpecSeal, Putty, Sealant, Collars, and Mortar; or approved.

2.12 Pull lines: Polyline as manufactured by "Greenlee" or approved.

2.13 Underground Marking Tape:

A. Power: 6” wide, yellow, low density polyethylene, 4-mil thickness. Imprinted with “CAUTION – STOP DIGGING – BURIED ELECTRIC LINE BELOW” and current date. Somerset “Protect-A-Line” or approved.

B. Telephone/Data: Similar to Power tape except green.

2.14 Boxes

A. Outlet boxes: Steel City, National, or approved, steel boxes as best suited for purpose intended and as follows:

1. Lighting outlets: Four-inch octagon with 3/8-inch fixture studs.

2. Switch and receptacle outlets: Four inch square with proper device cover.

3. Telephone/Data: Four inch square by minimum 2-1/8 inch deep. See Telephone/Data specification for additional requirements.

4. Gang boxes: One piece pressed steel minimum 1-1/2 inch deep by four inches high by length required with proper device covers.

5. Masonry outlets: Standard boxes as specified above with square cornered tile wall covers with raise of depth required for specific conditions encountered. Steel City 52-C-49 and 72-C-49 series or approved.

6. Utility boxes: Allowed only with special permission of Engineer.

7. Special outlet boxes: See other section of specification for special outlet boxes.

B. Device covers for outlet boxes: Raised pattern, 3/4 inch minimum raise at plaster work, all other covers with raise equal to total wall material thickness. Surface boxes with 1/2 inch raise and rounded edges. Steel City, Raco or approved.

C. Extension rings: 1-1/2 deep. Steel City, Raco or approved.

D. Pullboxes

1. Pullboxes: Galvanized steel (indoors) or cast metal (exterior or damp locations) construction, conforming to National Electrical Code, with screw-on cover.

2. Flush Mounted Pullboxes: Provide overlapping covers with flush-head retaining screws, finished in light grey enamel.

3. Box volumes shall meet NEC for size and number of entering conduits.

4. In-Ground Pullboxes: In-ground pullboxes shall be suitable for specific application and as required by respective utility provider. See plans for typical types and locations.

E. Junction boxes: Minimum four inch square by 1-1/2 inch deep. In finished areas provide with two gang device cover and matching blank finish plate.

F. Floor boxes: See Section 16140 – Wiring Devices and Floor Boxes.

G. Weatherproof Outlet Boxes:

1. Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal face plate with spring-hinged waterproof cap suitably configured for each application, including face plate gasket and corrosion proof fasteners.

2. Weatherproof boxes to be constructed to have smooth sides, gray finish.

3. Boxes used in contact with soil shall be cast iron alloy with gasketed screw cover and water-tight hubs.

4. Weatherproof Plates: Cast metal, gasketed, for switches and receptacles provide spring-loaded doors.

H. Weatherproof Junction and Pullboxes:

1. Provide galvanized sheet steel junction and pullboxes, with screw-on covers; of the type, shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

I. Knockout Closures: Provide three (3) piece punched-steel knockout closures.

2.15 Fasteners

A. Provide approved fasteners for each specific application. Hammer-driven and trigger-fired anchors may be used only after obtaining specific written authorization from Architect.

1. Wood: Wood screws or screw-type nails.

2. Hollow masonry block: Toggle bolt.

3. Concrete or Brick: Expansion bolts. For new concrete work use cast-in-place inserts.

4. Steel: Machine screws, welded threaded studs, heat-treated or spring steel tension clamps.

2.16 Outlet box supports:

A. Wood stud walls: Adjustable bar hangers with "C" channel cross section Steel City 6010 series, or approved, or mounted on solid blocking. Four inch square boxes adjacent to wood studs may be side nailed and back braced with Steel City No. 50 box brace.

B. Metal studs: Caddy Bar Hanger Assembly BHA or Caddy MSG or MSF metal stud clips.

C. Concrete or masonry walls where boxes are not cast in place: Flush anchors, power actuated anchors, hammer driven trigger fired anchors, or concrete inserts.

D. Flush ceiling outlets: Steel City 6010 series or equal bar hangers.

2.17 Conduit supports:

A. One hole malleable straps, Steel City, Appleton, T&B, Diamond, Raco, or approved.

B. Conduit clips: Caddy, Raco or approved.

C. Nail-up straps: 1/2 inch thru one inch Raco 2252, 2253, 2254, or approved.

D. Adjustable hangers 1-1/2 inch conduits and larger: Steel City C-149 with threaded steel rod of proper size.

E. Adjustable trapeze hangers to support groups of parallel conduits: Steel City B-905 steel channel, H-119 square washer, C-105 strap threaded rod. Components of Unistrut, Globe Strut, Harvey Alstrut, or approved.

F. Drive ring spacing supports for open wiring, Diamond 800 series, or approved. Size as required by number of conductors installed.

2.18 Hanger rod attachments: Side Beam Connector, Kindorf E-244; 90 degree fitting, Kindorf B-916; clamp type anchor clips Kindorf Type "C", Unistrut P2675 or approved; spot type concrete insert Kindorf B-255 with "Galv-Krom" finish.

2.19 Support channels: Kindorf B-905 with Galv-Krom finish, and C-105 single bolt channel pipe straps.

PART 3 - EXECUTION

3.01 Conductors

A. Circuiting. Install branch circuiting exactly as shown. Conduit may be routed at Contractor's best judgment unless directed otherwise. Home runs are diagrammatic for clarity, and may be grouped as desired. Size conduits accordingly with capacity for 25% future fill.

B. Feeder conductors: Wires shall be factory color-coded by integral pigmentation. Colored plastic tape permitted on No. 6 and larger where integral pigmentation impractical. Apply tape in spiral half-lap over exposed portions in manholes, boxes, panels, switchboards and other enclosures.

C. All circuit conductors shall be identified with circuit number at all terminals, intermediate outlets, disconnect switches, circuit breakers, motor control centers, etc. Both ends of a given conductor shall be identified alike.

D. Install wire in conduit runs after concrete and masonry work is complete and after moisture is swabbed from conduits. Leave six-inch single wire pigtails for connection of fixture leads and devices to branch circuits.

E. Neatly bundle and tie with cable ties conductors in panel gutters, wire gutters, motor control centers, dimmers, etc. where multiple conductors run in accessible wireways. Spacing as required to neatly group and support conductors.

F. Quantity of conductors shown in any one raceway is not to be increased without specific permission of Engineer.

G. Install control conductors in separate raceways unless otherwise noted.

H. Clock and Program, Alarm and Detection System: Color code conductors as directed by equipment manufacturer. Where sufficient number of colors are not available to provide separate color for each item, provide W.H. Brady wire markers (or approved equal) on conductors marked similarly at all terminals and connections.

I. Raceway for low voltage NEC Class II wiring will be required only in walls, air plenums, inaccessible ceiling, and areas where conductors might be exposed to physical damage. Cables approved for use in air plenums and non-combustible ceilings will be accepted in lieu of conduits in plenums or non-combustible ceilings. Cables installed in cable tray shall be approved for such use. All low voltage cable must be suitable for the conditions in which it will be used. Prior to purchasing or installing any cable, confirm with the Mechanical Contractor which areas, if any, require plenum rated cable.

3.02 Raceways

A. General Installation:

1. In general, install raceways concealed in construction except where shown otherwise on the Drawings or unless specifically approved by Architect or Engineer.

2. Unless otherwise noted, size raceways in accordance with Table in Appendix C of NEC for type "THW" conductors regardless of type of conductor specified.

3. Two or more conduits using the same routing: Mount on channel support system. Unistrut or approved.

4. Provide pull line and cap off watertight each empty conduit provided for future installation of wiring.

5. Conduit stubbed from a concrete slab or wall to serve an outlet under a table or to supply a machine shall have a rigid conduit coupling flush with the surface of the slab. Provide plug where conduit is to be used in future.

6. Allow minimum of 6 inches clearance at flues, steam pipes, and heat sources. Do not run conduits beneath boilers or heating units.

7. Dissimilar Metals: Avoid contact with pipe runs of other systems.

B. Lengths and Bends:

1. Maximum number of bends in any run shall be the equivalent of three (3) 90 degree bends (270 degrees total). Maximum length of any run shall be 100 feet, except as allowed in underground installations.

2. Junction and pull boxes shall be provided to maintain these limits. Do not locate pull boxes or junction boxes in finished areas unless specifically shown or special permission is obtained from Architect or Engineer.

C. Exposed raceways:

1. In finished areas run parallel with or at right angles to building structural lines and closely follow surfaces wired over. Conduits offset at panels, outlets, junction boxes, etc. Conduit 1-1/2 inch and larger suspended at locations as directed by Architect or Engineer.

2. In accessible void and furred spaces, conduit may be run in a direct line between outlets with long sweep bends and offsets closely following surfaces wired over. Suspend conduit 1-1/4 inch and larger to be run to allow maximum access to space and located as directed by Architect or Engineer.

3. For exposed runs, attach surface mounted conduit with clamps. Where conduit runs along the inside of exterior walls, mount to channel-type strut at required spacing.

D. Concealed raceways:

1. At inaccessible areas, raceways may be run in a direct line with long sweep bends and offsets. In cavity walls, run conduit in hollow spaces and do not chase interior or exterior masonry.

2. At accessible areas above lift-out or accessible ceiling areas, run conduit on top or bottom of lower cords or trusses or on underside of roof. Vertical extensions for wiring to ceiling outlets and fixtures kept to minimum length.

E. Raceways in Concrete Slabs:

1. Do NOT install conduit larger than one inch maximum in concrete slabs unless specifically shown or approved.

2. Conduits in above grade slabs shall be located in the middle of the slab. Conduit installed in any concrete slab shall have a minimum two (2) inch cover. The maximum size, spacing, and location of conduits in post-tensioned slabs shall be subject to approval by the structural engineer. Conduits larger than one inch shall not be run in slabs.

3. Space no less than 8” on center and as far apart as possible where converging at panelboard locations.

4. Do not interfere with placement of re-bar. Place raceway under rebar layer. Spacing not less than eight (8) inches on center, or as required and as wide as possible where converging at panels, etc. Adequately secure raceway, boxes, inserts, etc. by mechanical means or suitable adhesive prior to pour.

5. Cap and securely support conduits prior to concrete pour.

6. Stub-Ups:

a. Install rigid galvanized conduit, Schedule 80 PVC or Fiberglass conduit with threaded coupling set flush with finished floor. Seal with flush, threaded pipe plug.

b. Where stub-up extends above floor, install conduit at such depth that no curved section of the elbow is exposed.

F. Expansion Joints:

1. All conduits crossing expansion joints where cast in concrete shall be provided with expansion-deflection fittings, equivalent to OZ/Gedney AXDX, installed per manufacturers recommendations.

2. All conduits three inches and larger where not cast in concrete shall be rigidly secured to the building structure on opposite sides of a building expansion joint with an expansion-deflection fitting across the joint, equivalent to OZ/Gedney AXDX, installed per manufacturer's recommendations.

3. All conduits less than three inches where not cast in concrete shall be provided with junction boxes securely fastened on both sides of the expansion joint, connected together with 15 inches of slack (a minimum of 15 inches longer than the straight line length) flexible conduit with copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits three inch and larger, may be installed.

G. Seismic Joints:

1. No conduits cast in concrete shall be allowed to cross a seismic joint.

2. All conduits shall be provided with junction boxes securely fastened on both sides of the expansion joint, connected together with 15 inches of slack (a minimum of 15 inches longer than the straight line length) flexible conduit with copper green ground bonding jumper. Prior to installation, verify with Architect that the 15 inches is adequate for the designed movement, and if not, increase this length as required.

H. Underground raceways:

1. Use galvanized rigid steel, fiberglass or Schedule 40 (or 80) PVC with galvanized rigid steel or fiberglass elbows and risers.

2. Maximum length of any run shall be 300 feet, less 50 feet for each equivalent 90-degree bend.

3. Install underground marking tape buried 6-8 inches below grade, directly above conduit.

4. Run in a direct line with long sweep bends.

5. Raceways inside of building run below slab in gravel fill.

6. Burial Depth – Secondary Service:

a. Rigid Galvanized: Minimum 24-inches below finish grade, unless noted otherwise.

b. PVC: Where installed under roadways or areas subject to heavy traffic provide a minimum of 36-inches of cover. All other locations, minimum 30-inches below finish grade, unless noted otherwise.

7. Burial Depth – Primary Service: Minimum 48-inches below finish grade or as required by serving utility.

8. All underground raceways to be made water-tight with sealed threads or couplings.

9. Rigid Galvanized conduit shall be coated entire length with coal-tar material (Koppers Bitumastic 515) or with PVC jacket (15 mil. Minimum).

I. Penetrations, Seals & Plugs

1. All 90 degree ells and conduit entrances into buildings to be with rigid galvanized conduit. Coat with coal-tar material (Koppers Bitumastic 515)

2. Provide conduit seals at exits and entrances from hazardous locations (i.e. Chlorine storage or distribution rooms), freezer rooms and other locations as required by NEC Article 500.

3. Conduit penetrations of the electrical room walls and floor must “float” via backer rod or fiberglass and caulked air tights.

4. Provide conduit plugs at all raceway openings during roughing-in to prevent entrance of foreign matter.

5. Provide floor or wall entrance fittings at all points where raceways enter or exit below finish grade at tunnels, basements or trenches.

6. Any conduit leaving the building envelope (e.g., site lighting, roof mounted HVAC equipment, etc.) to be 3/4-inch minimum and must slope downward. Seal conduits at interior side of building. Pack non-hardening duct sealing mastic around wires in the raceway.

7. Provide wall or floor fire and smoke barriers to cut off all concealed draft openings (both vertical and horizontal) where raceways perforate fire walls.

8. Roof Penetrations:

   a. Provide roof-flashing assembly at locations where conduit pierces the roof.

   b. Locate conduit minimum six inches from roof curbs or flashing.

   c. Provide caulking compound between counter flashing and conduit for watertight seal.

J. Multi-outlet surface raceways:

1. In general, raceways to extend full length of wall or cabinet at locations indicated.

2. See Architectural elevations and Electrical Drawings for locations and installation requirements.

3.03 Metal Clad Cable:

A. Permitted metal Clad Cable Uses:

1. Metal Clad cable shall only be used for concealed branch circuit interior wiring and may be exposed only in unfinished crawl spaces or attics. It shall not be used in inaccessible ceiling areas.

2. Metal Clad cable shall not be used for branch circuit home runs. Home runs shall be installed using conduit and conductor method from the circuit breaker panel to a junction box in the nearest accessible ceiling to the point of usage. From the junction box, Metal Clad cable may be used to each device or light. Metal Clad cable shall not be allowed from device to device.

B. Support horizontal and vertical cable six feet on center (maximum) and within six inches of boxes with approved cable clamps. Cables shall not rest on accessible ceiling tiles. Attach cables with metal clips or plastic cable ties to support wires from structure. Cable shall not be supported from, or come in contact with, mechanical ducts, water, sprinkler or gas piping; maintain six inch separation minimum.

C. Cable shall be cut with manufacturer-approved devices.

D. Junction Boxes: Splice conductors only in accessible junction boxes. Provide junction box at all cable penetrations of wall, ceiling or floor surfaces for equipment connections; cable shall not be run directly through finished surfaces. Provide junction box at transition from concealed to exposed wiring. Provide junction box at transition from interior to exterior wiring.

E. Voltage Drop: Conductors over 75 feet for 120 volt, and over 200 feet for 277 volt, for branch or individual circuit home runs from equipment connection, receptacle or lighting fixture shall be No. 10 AWG minimum.

F. Where cable penetrates fire-rated walls or floors, provide mechanical fire stop fitting with UL listed fire rating equal to wall or floor rating.

3.04 Boxes

A. Verify location of all outlet boxes with actual field conditions and plans to avert possible installation conflicts. Architect or Engineer reserves the right to make minor changes prior to installation without cost to the Owner. Coordinate work with that of other trades.

B. Toe Spaces: Boxes for receptacle outlets in toe spaces to be mounted horizontally.

C. Above Counter: Boxes for devices above counter should be typically mounted vertically, however, due to unforeseen field modification in casework and backsplashes, please coordinate with the architect.

D. Extension rings: Do not add more than one to any box with maximum depth of box and extension ring not to exceed three inch unless specifically indicated otherwise.

E. Boxes and pendants for surface-mounted fixtures on suspended ceilings shall be supported independently of the ceiling supports.

F. In open overhead spaces, cast metal boxes threaded to raceways need not be separately supported except where used for fixture support. Cast metal boxes having threadless connectors and sheet metal boxes shall be supported directly from the building structure or by bar hangers.

G. Where bar hangers are used, the bar shall be attached to raceways on opposite sides of the box and the raceway shall be supported with an approved fastener not more than 24 inches from the box.

3.05 Hangers and Support

A. Provide independent support to building structural members for all electrical fixtures, materials, or equipment installed in or on ceilings, walls, void spaces, and over furred or suspended ceilings. Supports shall be designed for a minimum of four times the weight of equipment including hangers.

B. Other crafts' fastening devices shall not be used for the supporting means of electrical equipment, materials or fixtures. Supports and/or fasteners shall not be used to support more than one particular item.

C. Vertical support members for equipment and fixtures shall be straight and parallel to building walls.

D. Hammer driven trigger fired and power actuated anchors may not be used in the following locations at concrete construction: In slabs or walls less than four inch thick; in joist or beams, including concrete waffle slabs which are less than eight inch wide; within three inches of any edge or opening; in prestressed concrete without prior approval of the Engineer unless specifically indicated otherwise.

E. Exact location and spacing between supports per manufacturer's recommendations and NEC requirements as minimum.

F. Fiber anchors, lag shields, perforated tape or wire not permitted unless otherwise indicated.

G. Raceways

1. Support conduits within 18 inches of outlets, boxes, panels, cabinets, couplings, elbows, and deflections. The maximum distance between supports shall not exceed ten foot spacing.

2. Conduit up to and including 1-inch EMT may be supported from ceiling fixture wires by conduit clips or other approved devices only with written approval of the installer of the ceiling support system. All other conduit runs shall be secured to the structure by two-hole straps or supported on Kindorf or Unistrut hangers. Wire will not be permitted for supporting conduit. All visible conduit runs will be parallel to the building structural lines.

3. Anchor conduit install in poured concrete to the steel reinforcing with No. 14 black iron wire.

4. In partitions of light steel construction, sheet metal screws may be used, and bar hangers may be attached with saddle-suspended ceiling construction only. Lighting system branch circuit raceways shall be fastened to the ceiling supports.

5. Support suspended feeder conduits by metal ring or trapeze hangers with threaded steel rods. Wire ties to prevent displacement, using not less than No. 14 iron wire, may be used only for concealed runs in concrete for conduit up to 1 ¼ inch.

6. Support all conduit within 18 inches of each box, coupling, elbow and panel at spacing of not more than ten feet along runs.

7. At Main Distribution, Subdistribution and surface mounted branch panels and cabinets where conduit exit from the top, provide support channels on wall 24-inch above panel and at six feet intervals from thereon for support of conduits.

8. Layout to maintain headroom, neat mechanical appearance, and to support equipment loads required.

9. Conduit shall be installed in such a manner as to prevent the collection of trapped condensation. All runs of conduit shall be arranged to avoid of traps wherever possible.

3.06 Cleaning

A. Complete raceways system before pulling-in conductors.

B. Remove all foreign matter from raceways and blow out or vacuum smaller conduits and pull mandrel through larger conduits prior to installing conductors.

3.07 Painting

A. All exposed conduits on painted walls to be painted to match wall and trim colors.

END OF SECTION

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SECTION 26 2400
SERVICE ENTRANCE, DISTRIBUTION AND GROUNDING & BONDING

PART 1 GENERAL

1.01 Description

A. This section shall include the furnishing and installing of all necessary equipment for a new electrical service and distribution complete as shown on the Plans and specified. The work in this section includes cable plowing and installation of conduit (i.e. trenching, laying pipe, backfilling, pulling of service line, and making the necessary connections).

B. Provide service rated 400-amp meter base with (2) 200-amp service entrance rated panels. All exterior components shall be in stainless steel enclosures and meet the requirements of the City of Bandon Power Utility.

C. Switchboards to include necessary interconnections, instrumentation and control wiring for a complete and satisfactory operating system.

D. All panelboards and breakers to be fully-rated, Series rated panel boards and breakers are not acceptable.

1.02 Grounding and Bonding

A. Provide a complete grounding system for all electrical equipment in accordance with NEC Article 250 and established safety practices.

B. Provide grounding grid at pad-mounted transformers.

C. Provide a main grounding electrode consisting of a bare No. 4 copper grounding electrode conductor connected to a concrete-encased electrode. Concrete-encased electrode provided by others. See detail on Architectural Drawings.

D. Provide a complete grounding electrode system. All building electrodes must be tied into this system per 250.50 of the NEC. These building electrodes are: the main concrete-encased electrode, any metal underground water pipe that is in direct earth contact for at least ten feet, and the metal frame of the building where effectively grounded.

E. The grounding electrode system is to include, but is not limited to: grounding conductors, fitting connectors and all other devices and material as required rendering the system complete.

1.03 Related work in other sections includes:

A. Providing identification, Section 26 500, Basic Electrical Materials and Methods.

B. Providing cable ties and lugs, Section 26 0519, Conductors and Cables.

C. Providing grounding, Section 26 0526, Grounding and Bonding.

1.04 Quality Assurance

A. American National Standards Institute (ANSI).

1. 67 Panelboards (ANSI/UL 67).

2. ANSI Z55.12 gray finishes for industrial apparatus and equipment.

B. Institute of Electrical and Electronics Engineers (IEEE).

1. Std. 241-74 Electric Systems for Commercial Buildings.

C. National Fire Protection Agency (NFPA).

1. NFPA 70 National Electrical Code.

D. Underwriters' Laboratory (UL).

1. UL 50: Cabinets and Boxes.

2. UL 67 Panelboards.

3. UL 869: Service Disconnects.

E. National Electrical Manufacturers Association (NEMA)

1. NEMA AB-1: Molded Case Circuit Breakers.

2. NEMA KS-1: Enclosed Switches.

3. Standards for Panelboards.

1.05 Submittals

A. Shop Drawings

1. Submit complete shop drawings with dimensions, components and internal connections in accordance with Division 01 or Section 26 0500, Basic Electrical Materials and Methods (when included).

B. Submit operation and maintenance data in accordance with Division 01 or Section 26 0500, Basic Electrical Materials and Methods (when included).

1.06 Product Delivery, Storage And Handling

A. Deliver with UL label and bearing manufacturer's name. Provide all equipment and each section with appropriate UL labels located in conspicuous places. Provide readily accessible nameplates.

B. Provide starters in manufacturers original cartons with labels intact.

C. Panelboard exterior trim separately packed to prevent damage during delivery and storage on site.

D. Upon receipt-open shipping carton and inspect for physical damage. Open switchgear and check interior condition. Prepare a written report of any damaged or unacceptable conditions.

E. Store and handle panelboards so as not to subject panels to corrosion or mechanical damage and in a manner to prevent damage from environment and construction operation. Keep switchboards wrapped or otherwise protected with plastic and stored on wood pallet on floor.

PART 2 PRODUCTS

2.01 Branch Circuit Panelboards:

A. Type:

1. NQOB for 120/240-volt panelboards with bolted breakers having minimum interrupting capacity of 22,000 amperes RMS symmetrical, unless noted otherwise at the bottom of the panel schedules. Breaker trip sizes and number of poles as indicated on the Drawings.

B. Bussing:

1. Copper or aluminum.

2. All bolts used to connect current-carrying parts together shall be accessible for tightening from the front of the panel.

3. Wiring terminals: Compression or set screw type for copper conductors; bolted to bus.

C. Construction: Flush or surface mounted as indicated with following:

1. Door with lock all keyed alike. National No. 68-226 flush panel.

2. Flush mounted panels: Concealed mounting hardware for exterior trim and door. No exposed fastenings or holes permitted. Flush mounted panel located side by side are to be of same length unless otherwise indicated. Flush panels of depth greater than available wall thickness provided with box type exterior trims with edges returned to wall. Depth of return as required making up difference in depth between panel and available wall depth. Panelboards 400 amp or less shall not exceed 6” depth.

2.02 Circuit Breakers

A. Multiple breakers common trip.

B. Combination breaker and ground fault interrupter: 10,000 amps or 20,000 IC rated, bolted connection.

C. Breakers for panel switched lighting to be labeled "SWD" for multiple operations.

D. Location of circuit breakers in panels: Install circuit breakers in panels at locations as indicated in the panel schedules.

E. Main breaker, when so equipped, shall be individually mounted separate from branch breakers. Where used as service disconnect, breaker and panelboard shall be listed for use as service entrance equipment.

F. Branch circuit breakers shall be bolt-on.

G. Provide circuit breaker handle guards to prevent accidental shut-off of equipment for breakers supplying obviously constant circuits for clocks, time switches, refrigeration, freezers, sound systems, fire alarm and other like systems as directed.

2.03 Identification:

A. Panelboards: In accordance with Section 26 0500. Locate nameplates attached to top center of interior trim. Nameplate to indicate panel, voltage and phase characteristics such as Panel 2AA, 120/208 volt, three phase. Panel labeling to correspond to distribution system labeling.

B. Circuit breakers: Number circuit breakers as indicated in panel schedules. Numbers engraved and filled in interior trim or permanently attached metal numbers equal to Wilson Heard markers or plastic numbers. Adhesive backed printed numbers not approved. Other methods of numbering as approved by Engineer.

C. Provide typewritten circuit schedules for panelboards, cross-connect panels and terminal cabinets. Schedules shall be covered with minimum of 0.018-inch thick clear rigid plastic installed in permanently attached metal frame holder located on inside face of door. Schedules to use final assigned room names/numbers, loads not plan designations.

D. When making modifications to existing equipment or panelboards, provide labels as indicated in this section. Provide new typewritten circuit schedules for all modified panelboards.

2.04 Panel finish:

A. All panels shall be provided with a rust-inhibiting phosphatized primer coating approved by the paint manufacturer.

B. At all finished areas factory finish to match adjacent surfaces. Rodda Baking Enamel.

C. In unfinished or utility areas standard factory industrial gray.

D. Paint sides, top and front of surface mounted panels.

2.05 Lugs:

A. In accordance with Section 26 0519, Conductors and Cables.

B. Compression or set-screw type, bolted to bus or CB output.

C. Provide double or feed thru lugs at panels where feeders are extended to additional panels.

D. Provide double capacity neutral lugs for all panelboards having an isolated bus.

E. Provide oversized lugs as required for aluminum panel feeders to accommodate sizes shown in feeder schedule on drawings.

2.06 Weatherproof Enclosures: All exterior mounted panelboards shall be provided with a minimum rated NEMA 3R enclosure and stainless steel.

2.07 Grounding and Bonding

A. Ground connectors: Bronze clamp type. All clamp accessories such as bolts, nuts and washers shall also be bronze to assure a permanent corrosion resistant assembly. Bolts used to fasten lugs to enclosures must be case hardened and sized for lug hole and hole drilled into enclosure. O-Z Gedney, Burndy, Ilsco or approved.

B. Ground rod clamps: Exothermic welding type or one piece cast bronze with safety set screw. Cadweld "G" series, Copperweld 6500 series, or approved.

C. Ground rods: Copper or steel core copper covered, minimum 5/8 inch by 10'-0". Copperweld 9400 series, or approved.

D. All ground cable splices and joints to be made with an exothermic welding process that shall provide a weld with current-carrying capacity not less than that of the conductors welded. Soldered connections not to be used.

2.08 Acceptable Manufacturers: Square-D, GE, Cutler-Hammer, or approved. For electronic grade panelboard suppression/filter system: GE, Current Technologies, Liebert, or approved.

PART 3 EXECUTION

3.01 Inspection

A. Coordinate NEC clearance requirements space provided to assure adequate clearances are maintained. Notify Engineer if space provided is inadequate for specified equipment and/or for maintaining required code clearances. Do not order equipment until any space inadequacies are resolved.

3.02 Installation

A. Prior to installation layout the electrical rooms and obtain approval of the layout from the code authority having jurisdiction.

B. Install panelboard in accordance with manufacturer's written instructions.

C. Furnish and install three spare one-inch conduits from the top of each recessed panel, to an accessible point above the ceiling.

D. Conduit shall be securely fastened to all panelboards and sheet metal outlet, junction, and pull boxes with galvanized locknuts, and one bushing installed in accordance with standard practice. The full number of threads shall project through to permit the bushing to be drawn tight against the end of the conduit, after which the locknut shall be made up sufficiently tight to draw each into firm electrical contact with the box.

E. Do not install exterior trims until finish painting is completed. Clean interior of panel (construction dust, paint over-spray, etc…) prior to installation of exterior trim.

F. Keys: Collect all panel keys. Combine all keys on one key ring and submit at time of substantial completion.

G. No low voltage wiring (less than 120 volt) to be installed in panel enclosures.

H. Breaker handle guards shall be provided on each circuit supplying obviously constant loads to prevent accidental shutting off. Such loads are refrigeration, contactor controlled circuits, freeze protection, etc.

I. Care shall be taken to terminate ground conductors from isolated ground receptacles only on the isolated ground bus in a panel. Do not terminate bonding conductors on an isolated ground bus.

J. Bolt panelboards to wall structure as required for appropriate seismic zone. Provide adequate backing as required.

K. All nameplates, labels, screws, bolts, or other hardware shall be in place prior to acceptance.

3.03 Power One-Line Diagram

A. Mount one-line diagram from Plans at main distribution assembly. Use a clean copy and mount under clear plastic cover, set in a metal frame.

3.04 Field Test

A. Prior to energizing distribution equipment, perform following test and adjustments according to manufacturer's recommendations and instructions.

B. Continuity check.

C. Insulation level (megger) tests.

D. Short circuit test.

3.05 Adjustment And Cleaning

A. Tighten bus connections and mechanical fasteners. Check bus-to-bus and breaker-to-bus connection for correct torque tightening.

B. Tighten feeder and circuit breaker connections as recommended by the manufacturer.

C. Clean all foreign matter from interior and exterior of equipment and touch-up scratched or marred surfaces to match original finish.

D. Adjust interior trim to fit tight against exterior trims.

E. Check all moving mechanical parts for proper operation.

3.06 Grounding and Bonding

A. Install in accordance with NEC Article 250.

B. Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of electrical equipment to be bonded together to limit any difference of potential voltage. Metallic raceway systems may be considered the equipment grounding system where specifically noted or where approved in the NEC. Equipment grounding conductors must be installed in all non-metallic conduit systems. All load side equipment to have the neutral system isolated from the equipment grounding system. The equipment grounding system must provide a low impedance path from the equipment back to the source equipment-grounding bar. This equipment-grounding bar to be connected to the system neutral at the source by a main bonding jumper sized per NEC 250.28. 250.102, and 250.168. The equipment grounding conductors to be sized at least as large as required by NEC 250.122.

C. The grounding electrode system to connect to the service neutral, if required, or to the system grounded conductor if a neutral is not required. The electrode system may terminate on the equipment-grounding bar at the main service where a properly sized main bonding jumper has been installed. Water system bonding must utilize the proper size water pipe bond clamp to match the size of the water pipe.

D. Electrical Equipment Grounding (Safety Ground):

1. Ground non-current carrying metal parts of electrical equipment enclosures, frames, manholes, conductor raceways or cable trays to provide a low impedance path for line-to ground fault current and to bond all non-current carrying metal parts together.

2. Equipment grounding conductor to be electrically and mechanically continuous from the electrical circuit source to the equipment to be grounded. Size ground conductors per NEC 250.122 unless larger conductors are shown on drawings.

3. Grounding conductors to be identified with green insulation. Where green insulation is not available, on larger sizes, black insulation to be used and suitably identified with green tape at each junction box or device.

4. Install metal raceway couplings, fittings and terminations secure and tight to ensure good ground continuity. Provide grounding bushing and bonding jumper where metal raceway is not directly attached to equipment metal enclosure, at concentric knock-outs, or at concentric or eccentric knockouts for circuits of over 250v to ground.

5. Lighting fixtures to be securely connected to equipment grounding conductors. Outdoor lighting standards to have a factory installed ground lug for terminating the ground wire.

6. Motors to be connected to equipment grounding conductors with a conduit ground bushing and with a bolted solderless lug connection on the metal frame. A separate equipment-grounding conductor to be run with each motor branch circuit.

7. Bonding to be provided to assure electrical continuity and the capacity to conduct safely any fault current likely to be imposed.

8. All plug-in receptacles to be bonded to the boxes, raceways and grounding conductor.

9. Equipment grounding conductors to be provided for all lengths of flexible metallic conduit. All equipment provided with two conductor cords to be rewired to provide a three-conductor type "S" cord and grounding attachment plug caps.

E. Neutrals throughout the system to be solidly grounded to one point at the system source.

F. Lighting and power panelboard to be grounded by connecting a conductor to the grounding stud and to the incoming and outgoing feeder conduits grounding bushings. Each grounding-type bushing to have the maximum ground wire accommodation available in standard manufacturer for the particular conduit size. Connection to the bushing to be with wire of this maximum size.

G. The grounding stud of each secondary voltage dry type, three phase transformer to be connected separately to the grounding lug on the panelboard serving the transformer. Connection to be by means of an insulated conductor run in conduit, sized as shown on the drawings.

H. Provide a No. 6 green coded insulated conductor from each telephone terminal board to the closest effectively grounded water pipe or structural steel.

I. When included as part of the project, the central equipment for the fire detection and alarm system is to have its grounding terminal connected to the ground lug on the panelboard serving the system by means of a No. 6 green coded insulated conductor, run in 3/4 inch metal conduit, utilizing a ground clamp.

3.07 Testing

A. Grounding Electrode Conductor (GEC):

1. Measure resistance between service equipment ground bus and each grounding electrode, using a Megger and a single length of additional wire, if necessary. Measure resistance between both ends of the additional wire used. Isolate and correct any poor connections as indicated.

B. System Ground Continuity:

1. At panels and selected outlets, measure the ground loop resistance between the neutral conductor and raceway using a megger or equivalent. Or, at selected outlets, measure the ground loop impedance using a ground loop impedance tester.

2. Ground loop impedance shall not exceed a value in ohms that is the voltage to ground divided by five (5) times the rated current.

3. Isolate and correct the cause of the poor connection. If the source of the high reading cannot be practically corrected, pull a separate ground conductor into the raceway and re-test.

4. Report findings to Engineer.

END OF SECTION

SECTION 26 2730
WIRING DEVICES, FLOOR BOXES & CONTROLS

PART 1 - GENERAL

1.01 Description

A. Provide all wiring devices and finish plates as required unless specifically indicated otherwise.

B. Related work in other sections includes:

1. Providing identification, Section 26 0500, Basic Electrical Materials and Methods.

2. Providing conductors, Section 26 0519, Conductors and Cables.

3. Providing boxes, Section 26 0533, Raceways and Boxes.

1.02 Quality Assurance

A. American National Standards Institute (ANSI): 467 Grounding and Bonding Equipment (ANSI/UL467). 498 Attachment Plugs and Receptacles (ANSI/UL498). C73 Series Dimensions of Attachment Plugs and Receptacles.

B. Federal Specification (FS): Electrical Power Connector, Plug, Receptacle and Cable Outlet. W-C-596D, E and F. Switches, Toggle (toggle and lock), Flush Mounted WS 896-E.

C. National Electrical Manufacturer's Association (NEMA): WD 1-79 General Purpose Wiring Devices.

D. National Fire Protection Association (NFPA): NFPA 70 National Electrical Code.

E. Underwriters' Laboratory (UL): UL-20 Standard for Snap Switches.

1.03 Submittals

A. Submit product data sheets per Division 01 or Section 26 0500, Basic Electrical Materials and Methods (when included).

B. Occupancy sensor system submittals shall include:

1. Floor plans, same scale as the electrical drawings, showing device locations, sensor coverage pattern, and sensor type.

2. Wiring diagrams.

3. Mounting details.

4. Complete material list with catalog sheets showing all components to be used in the system.

C. Submit operation and maintenance data per Division 01 or Section 26 0500, Basic Electrical Materials and Methods (when included).

1.04 Product Delivery, Storage And Handling

A. Deliver with UL label and bearing manufacturer's name in manufacturer's original unopened and undamaged cartons with labels legible and intact.

B. Store and handle material so as not to subject them to corrosion or mechanical damage and in a manner to prevent damage from environment and construction operation.

PART 2 - PRODUCTS

2.01 Acceptable manufacturers: Arrow-Hart, General Electric, Hubbell, Leviton, Pass & Seymour or approved.

2.02 Switches: Specification Grade, Quiet Type, Minimum rating 120/277 volt, 20 amp unless otherwise noted. Finish as selected by Architect.

A. Toggle and lock switches: Federal Specifications as listed in Quality Assurance.

1. Single Pole Switch: Arrow-Hart 1991 or approved.

2. Double Pole Switch: Arrow-Hart 1992 or approved.

3. Three-way Switch: Arrow-Hart 1993 or approved.

4. Four-way Switch: Arrow-Hart 1994 or approved.

5. Lock Switch: Corbin Type, Arrow-Hart 1191N or approved.

B. Pilot light switches: Illuminated red handle lit when switch is "on" voltage as required, 20 amp. Arrow-Hart 1991 PL, or approved.

C. Momentary contact switch: Three position, two circuit with center "off", 20 amp, 120/277 volt. Arrow Hart 1995; or approved.

D. Occupancy Sensors:

1. Private Offices: Wall mount, passive infrared, 180n degree, 900 square foot coverage with off override and adjustable from 30 seconds to 30 minutes. Watt-Stopper WS-120 or WS-277, Sensor Switch WS-120 or WS-277 or approved.

2. Ceiling mounted in restrooms and open office areas: Ultrasonic, 360 degrees, 1000 square foot coverage adjustable from 15 seconds to 15 minutes, with power pack and isolated relay (for HVAC control). Watt Stopper W-1000A (with A120-E or A277-E), Novitas 01-100-071-072 one-way, Sensor Switch (Ultrasonic) or approved.

3. Wall/ceiling mounted in classrooms: Dual technology (passive infrared and ultrasonic) with integral isolated relay (for HVAC control) 1500 square foot coverage adjustable from 15 seconds to 15 minutes, with power pack and ceiling mount attachment. Watt Stopper DT-100L (with A120-E or A277-E and CM-100), Novitas 01-074-184 (dual technology), Sensor Switch (dual technology) or approved.

4. Provide occupancy sensors ahead of light switches and tied into Manufactured Wiring System Junction Module (JM) where applicable. Any inter-tie to DDC energy management control system will be by mechanical contractor.

5. Provide 12” x 12” metal access panels at locations where power packs are installed above inaccessible ceilings.

6. All occupancy sensor products shall be the same manufacturer.

E. Time Switches

1. Multi-Circuit Lighting Control

a. The electronic time switch shall be a solid-state digital type capable of distributing set points on independent daily schedules throughout a 7-day time period. The time switch shall provide for 5-weekday programming, 2-weekend day programming or all 7-day programming to simplify program entry for typical 5/2-day load control. The time and set points shall be programmable to the nearest minute with a minimum ON duration of 1 minute and a maximum of 6 days, 23 hours and 59 minutes.

b. The time switch shall have a digital LED readout and prompt LEDs for each function to further simplify program entry.

c. Each load control shall include an ON/OFF pushbutton, an ENABLE/DISABLE switch and an LED load status indicator.

d. The time switch shall provide an operating temperature range of -40° F (-40°C) to 122° F (50° C).

e. Astronomic: The time switch shall provide astronomic programming and momentary or interval programming for any or all circuits independently. Astronomic control shall automatically calculate “center of time zone” times for both sunrise and sunset, and allow user-selectable offset of actual times.

f. The time switch shall provide full year control by providing automatic leap year and daylight saving time adjustment. A user selectable override shall be provided for

states not observing daylight saving time. The time switch shall also provide holiday or special day control requirements by providing up to 99 holiday schedules. Each of the holiday schedules shall be programmable for a single day or any duration as required. Each holiday schedule shall provide automatic no load activity and shall be independently programmable for a unique load schedule if required.

g. A non-volatile memory shall maintain all program data for the life of the time switch without the need for battery backup. The time switch shall include a factory installed lithium battery backup, which shall maintain clock time and calendar data for 8 years minimum. The single coin cell backup shall be user replaceable without removing the field wiring.

h. The time switch logic control circuitry shall be isolated and shielded to prevent EMI and RFI interference, for reliable operation in electrically noisy environments. The power board circuitry shall provide protection for transients up to 6,000 volts.

i. The time switch shall provide user-selectable 12 hour AM/PM or 24-hour clock formats.

j. Enclosure: Verify time switch location and provide appropriate enclosure. The time switch shall be enclosed in a lockable steel enclosure.

k. The time switch shall be powered by a user selectable 120, 208, 240 or 277 VAC 50 or 60 Hz source.

l. Acceptable Manufacturer: Intermatic ET70000 series or approved.

F. Photocells

1. Flush mounted photo control with stainless steel finish plate and neoprene gasket, 1800 watt tungsten, 120 volt, Intermatic K-4021, 2000 watt tungsten, 208 volt, Intermatic K4024, 3000 watt tungsten, 277 volt, Intermatic K4033, 3000 watt tungsten 480V, Intermatic K4035.

2. Conduit mounting, heavy duty, relay type, photo control, 1800 watt tungsten, 120 volt. Intermatic K-4121 or approved.

2.03 Receptacles: Specification Grade. Conform to Federal Specifications as listed in Quality Assurance. Finish as selected by Architect.

A. Duplex, double parallel slot 20 ampere, 120 volt, typical locations, Arrow-Hart 5362 or approved.

B. Ground fault circuit interrupter receptacle: 20 ampere, duplex, double parallel slot, Arrow-Hart GF5362 or approved.

C. Flush floor receptacles to be duplex and to have brass, hinged flap lids. Provide carpet flanges in carpeted floors. See also Recessed Floor Boxes.

2.04 Flush Floor boxes (non-carpeted areas):

A. Single gang boxes, flush mounted, fully adjustable, concrete tight formed steel, with rectangular forged brass cover and flange. Shallow type three inch maximum depth with conduit entrances for 1/2 inch and 3/4 inch conduits, Hubbell, or approved. Cat. No. B2429. Deep type four inch maximum depth with conduit entrances for one inch and 1-1/4 inch conduits, Hubbell, or approved, Cat. No. B2427.

B. Two gang boxes, flush mounted fully adjustable, watertight cast iron, corrosion-resistant, with rectangular forged brass two gang cover and flange, removable partition between gangs, conduit entrances for 3/4 inch and 1 inch conduits, depth 3-7/16 inch, Hubbell, or approved, Cat. No. B4233. Three gang boxes same as two gang, Hubbell Cat. No. B4333, or approved.

C. Covers for rectangular boxes: Brass with requirements as follows:

1. At 120 volt duplex receptacle locations Hubbell Cat. No. 3625 with two plastic brass finish rings, Hubbell S-3072 (two required at each single gang box).

2. At microphone, visual education, etc., flush floor boxes cover to have single opening 2-1/8 inch diameter Hubbell S-2825, with one Hubbell S-3086 brass finish cast aluminum split nozzle.

D. Mounting brackets: As required for device installed at each gang.

E. Combination power and telephone pedestal floor outlets to consist of two single rectangular flush floor boxes as specified above with Hubbell S-2625 one inch diameter threaded covers. One floor box for 120 volt power and the other for telephone. Pedestal satin aluminum, single kickproof housing with isolated 120 volt and communication compartments. Pedestal with special base without conduit access holes for field modification for connection to flush floor boxes. Telephone compartment with split rubber grommet to allow telephone connectors and cable to be readily installed and to provide space for three amphenol connectors. Square D G-6, Walker 1400 with special base, or approved.

2.05 Flush Floor boxes (carpeted areas):

A. Single gang boxes, flush mounted, fully adjustable, concrete tight formed steel, with round forged brass cover and flange, and round brass customized adjustable duplex type carpet flange Hubbell S-3082 as required for floor covering thickness installed. Shallow type box three-inch minimum depth with conduit entrances for ½-inch and 3/4-inch conduits, Hubbell B-2529, or approved. Deep type four-inch maximum depth with conduit entrances for ½-inch thru 1-1/2-inch Hubbell Cat. No. B2527, or approved.

B. Multi-gang box locations: Provide single gang boxes grouped as shown on Drawings. Separate as directed to allow for proper installation of carpet.

C. Covers for round single gang boxes brass as follows:

1. At 120 volt duplex receptacle locations Hubbell Cat. #S-3725 with two plastic brass finish rings, Hubbell S-3072 (two required at each location).

2. At microphone, visual education, etc., flush floor boxes to have single opening 2-1/8 inch diameter Hubbell S-2925 with one Hubbell S-3086 brass finish cast aluminum split nozzle.

D. Combination power and telephone pedestal floor outlets same as for non-carpeted areas above.

E. Carpet flange: Hubbell S-3079 round Lexan.

2.06 Recessed Floor Boxes

A. Provide recessed floor box with full-access hinged lid. Box shall be welded steel approximately 10” x 12” x 4” deep.

B. Accessories:

1. Provide concrete pour pan for slab-on-grade applications. Floor box shall be supplied with leveling feet.

2. Provide power, data and blank cover plates from floorbox manufacturer. Contractor shall provide blank coverplates to finish unused sections of floor box.

3. Provide all data/low-voltage terminations.

C. Floor box shall be provided with the minimum number of device outlets as indicated on the drawings.

D. Hinged Lid: Contractor shall determine proper lid configuration for carpeted and non-carpeted floors. Verify solid lid color (non-carpeted areas) or carpet depth (carpeted areas) with Architect.

2.07 Finish plates:

A. At surface wiring, raised galvanized industrial type. National Association of Electrical Distributors 12000 Series.

2.08 At all typical location: Thermoplastic. Finish as selected by Architect. Arrow-Hart or approved.

A. Engraved plates: See Execution for requirements.

B. Wet locations (exterior) receptacle finish plate: UL listed to be weatherproof while in use. Cover base to be constructed of heavy duty noryl and cover to be constructed of lexan. Thomas & Betts. Perfect Line Weatherproof cover or approved.

C. Telephone and Data: Blank coverplate, finish to match receptacle.

D. Plate Securing Screws: Metal with heads finished to match finish plate.

PART 3 - EXECUTION

3.01 Inspection

A. Determine outlet boxes, raceways and conductors are properly installed and outlet boxes are cleaned of all foreign matter before installing devices and finish plates.

B. Inspect each wiring device for defects.

3.02 Installation

A. Install wiring devices in accordance with NECA “Standard of Installation”.

B. Do not install devices or finish plates until final painting is complete.

C. Switches:

1. Install switches with the OFF position down.

2. Do not group or gang switches in outlet boxes unless they can be so arranged that voltage between adjacent switches does not exceed 300 volts, or installed in boxes equipped with permanently installed barriers between adjacent switches.

D. Verify mounting location of photo controls to insure proper operation from outside lighting. In general, photo control mounting exposed to north.

E. Receptacles:

1. Install receptacles with the ground pole on top.

2. Install a separate green or bare wire between the receptacle strap grounding (green) screw and a screw into the outlet box. Self-grounding strap not approved as grounding means.

F. Floor boxes:

1. Do not install interiors of floorboxes until they are no longer subject to corrosion, water, construction debris, etc. Floorboxes shall be clean and new condition upon acceptance by Owner. Contractor shall replace oxidized, corroded, or otherwise damaged interior components.

2. Boxes set plumb and true and adjusted after installation to be flush with finish floor. At carpeted areas provide carpet flange and coordinate work with carpet installer.

3. At locations requiring more than three gangs, make up installation of combinations of single and two gang floor boxes spaced as directed by Engineer.

4. Deliver cover rings and split nozzles to Owner and at flush fittings leave outlets closed with threaded plugs.

5. Verify location of all outlets prior to installation.

G. Finish Plates:

1. Install devices and finish plates plumb with building lines.

2. Use jumbo size plates for outlets installed on masonry walls.

3. Do not install finish plates until final painting is complete.

H. Wall Box Dimmers:

1. Install dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

2. Do not share the neutral conductor on load side of dimmers.

I. Occupancy Sensors:

1. Manufacturer to design complete occupancy sensor system for all areas where occupancy sensors are called out on the drawings.

2. It shall be the contractor's responsibility with the suppliers assistance to locate and aim all occupancy sensors in the correct location required for complete and proper volumetric coverage within the range of coverage of controlled areas.

3. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room.

4. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms that are to be provided with sensors.

5. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

6. Proper judgment must be exercised in executing the work to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

7. Final location of ceiling mounted ultrasonic occupancy sensors shall be a minimum of 48 inches away from any HVAC diffuser.

3.03 Identification

1. Switches: Where 2 or more switches are ganged and where indicated, identify each switch with approved legend engraved on wall plate.

2. Receptacles: Identify the panelboards and circuit number from which served. For nylon faceplates, engrave panel and circuit number on face and highlighted in contrasting color. For stainless steel plates use machine printed, pressure sensitive, abrasion resistant label tape on face of plate and durable wire markers or tags within outlet box.

3.04 Testing

A. Operate each wall switch with circuit energized and verify proper operation.

B. Verify that each receptacle devices is energized.

C. Test each receptacle for proper polarity.

D. Test each drive for ground continuity.

E. Test each ground fault circuit interrupter operation with both local and remote fault simulations according to manufacturers recommendations.

3.05 Cleaning

A. Internally clean device, device outlet box and enclosure.

B. Replace stained or improperly painted finish plates or devices.

END OF SECTION

SECTION 26 5100
LIGHTING FIXTURES

PART 1 - GENERAL

1.01 Description

A. Provide lighting fixtures of type and wattages indicated on Drawings by letter and number shown adjacent to lighting outlet symbol. A fixture typical for location is to be installed at every lighting outlet unless otherwise indicated.

B. Provide fixtures complete with lamps, ballasts, reflectors, diffusers, lenses, shielding, hangers, poles and accessories, concrete pole bases and fittings.

C. Related work in other sections includes:

1. Providing concrete bases for poles, Division 03.

2. Providing conductors and connectors, Section 26 0519, Conductors and Cables.

3. Providing raceways and fittings, Section 26 0533, Raceways and Boxes.

4. Providing fire rated enclosures at light fixtures.

1.02 Quality Assurance

A. UL listed or CSA certified for application.

B. NEMA SSL 1: Electronic Drivers for LED Devices, Arrays, or Systems.

1.03 Coordination

A. Confirm compatibility between final luminaire and lighting control selections.

B. Confirm compatibility and interface of other materials with luminaire and ceiling system. Report discrepancies to the Engineer/Architect and defer ordering until clarified.

C. Supply plaster frames, trim rings and backboxes to other trades.

D. Coordinate with Division 23 to avoid conflicts between luminaires, supports, fittings, and mechanical equipment.

1.04 Submittals

A. Submit a complete list of fixtures, lamps and ballasts with catalog numbers, manufacturer's drawings, photographs or catalog sheets for approval prior to ordering fixtures. Submittal to be in accordance with Division 01 or 26 0500, Shop Drawings and Materials Lists (when included).

B. Submit operation and maintenance data in accordance with Division 01 or 26 0500, Electrical Equipment Maintenance Manuals (when included).

1.05 Product Delivery, Storage And Handling

A. Deliver fixture in manufacturer's original unopened packages with labels legible and intact.

B. Deliver with UL label and bearing manufacturer's name.

C. Deliver poles wrapped and protected from damage.

D. Store and handle so as not to subject materials to corrosion or mechanical damage and in manner to prevent damage from environment and construction operation.

PART 2 - - PRODUCTS

2.01 General:

A. Fixture types: See light fixture schedule on drawings for fixture types and acceptable manufacturers.

B. Provide fixtures with ACL, damp or wet label if required for the applications indicated.

C. All recessed fixtures shall be free of light leaks.

2.02 Approved Manufacturers:

A. See Light Fixture Schedule on drawings for approved manufacturers and specifically approved products (models).

B. Listing of a manufacturer on the Light Fixture Schedule (or other Contract Documents) does not constitute the approval of a specific fixture model not otherwise specifically identified on the Light Fixture Schedule.

C. The supplier/contractor is responsible to provide approved light fixtures that meet the requirements as specified herein and on the drawings (Light Fixture Schedule, general and keyed notes, etc.).

D. Other manufacturer's products submitted for approval must meet the aesthetic appearance and quality standards of the specific model listed as the basis of design. The contractor shall, at the discretion of the Engineer and/or Architect and at no cost to the Owner, replace any product deemed inferior to the specifically specified light fixture model.

2.03 Recessed Luminaires

A. Supply recessed luminaire complete with trim type required for ceiling system installed. Before ordering, confirm ceiling construction details and architectural finish for each area.

B. Confirm recessed luminaires are suitable for installation where encountering sloped ceilings.

2.04 Pendants & Cable Hangers

A. Swivel sockets permitting normal fixture motion and self-adjustment. Adjustable to provide fixture height alignment.

B. One-piece, white finish, with matching canopies.

C. Fixtures shall be factory counter-weighted and balanced to provide level hanging. Weights shall not be visible.

D. Cable hangers shall be adjustable for a minimum of 24 inches.

E. Provide any sloped ceiling adaptors as required for pendant installation.

2.05 Lamps:

A. All lamps of each type and color shall be by the same manufacturer.

2.06 LED (Light Emitting Diode):

A. LED manufacturer will include, but not be limited to, light source, luminaire, power supply and control interface with added components as needed for complete and functioning system.

B. Warranty: LED systems and complete luminaires must have a manufacturer's warranty of 3 year from date of substantial completion.

C. Compliance

1. LED light fixtures shall be in accordance with IES, NFPA, UL as shown on the Drawings and as specified.

2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS) compliant.

3. Comply with ANSI chromaticity standard for classifications of color temperature. See luminaire schedule for specified LED lamp color and color temperature. UL or ETL listed and labeled.

4. Luminaire testing per IESNA LM-79 and LM-80 procedures.

D. LED drivers shall include the following features unless otherwise indicated:

a. Minimum Efficiency: 85% at full load.

b. Minimum Operating Ambient Temperature: -20°C (-4°F).

c. Input Voltage: 120-277V (±10%) at 60 Hz.

d. Integral short circuit, open circuit, and overload protection.

e. Power Factor: ≥ 0.95.

f. Total Harmonic Distortion: ≤ 20%.

g. 4-wire (0-10VDC voltage controlled) dimming driver. Capable of dimming from 100% to 5% light output, unless otherwise noted, and step to 0%. Driver shall respond similarly when raising from 0% to 100%.

h. Driver shall be free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10).

E. Lamp life

1. White LEDs: 50,000 plus hours with lamp failure occurring when LED produces 70 percent of initial rated lumens (IES L70).

2. Color LEDs: 30,000 plus hours with lamp failure occurring when LED produces 50 percent of its initial rated lumens.

F. Provide shop drawings, with LED systems based on lumen output at 70 percent lumen depreciation for white LEDs and 50 percent lumen depreciation for color LEDs. Initial lumens for all colors of LEDs must be listed individually.

G. LED Downlights: Housing, LED driver, and LED module shall be products of the same manufacturer.

H. LED Troffers:

1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.

2. Housing, LED driver, and LED module shall be products of the same manufacturer.

I. Provide extra replacement LED driver for each fixture type in project. Quantity: 10%. Where a fraction occurs, round up to next larger integer.

J. LED light source manufacturers: Nichia, Cree, Osram/Sylvania, GE Lumination or approved.

2.07 Fixture lengths: Furnish fixtures of lengths shown on Drawings. At continuous runs furnish joiner plates, end plates and all required fittings.

2.08 Recessed Lighting Fixtures – Residential:

A. Recessed lighting fixtures shall be IC-Rated.

2.09 Fixture mounting:

A. General: Provide all blocking and supports as required. Fixtures may be supported from ceiling system unless specifically indicated otherwise.

B. Surface mounted fixtures: Provide UL approved fixtures at low-density cellulose fiber ceilings. 1-1/2 inch spacers not permitted unless specified fixture is unavailable with low-density rating.

C. Recessed fixture: Provide fixtures with plaster frames, ceiling flanges and hangers as required for specific ceiling conditions. Verify ceiling types prior to ordering fixtures. Provide thermal protection for all High Intensity Discharge and Incandescent fixtures mounted in a recessed application (non lay-in ceiling).

D. Stem suspended fixtures: Provide stems with aligned canopies. Stems of length specified or required for proper mounting of fixture.

E. Positively attach all lighting fixtures to suspended ceiling systems. Attachment device to have capacity of 100 percent of lighting fixture weight acting in any direction.

F. Lighting fixtures weighing more than 20 pounds but less than 56 pounds shall have in addition to the requirements outlined above, two No. 12 gauge hangers connected from fixture housing to structure

above. These wires may be slack. Fixtures weighing more than 56 pounds are to be suspended from the structure and not from suspended ceilings.

PART 3 - EXECUTION

3.01 Inspection

A. Verify location, ceiling types and mounting requirements for each fixture prior to ordering fixtures.

B. Verify voltage at each fixture outlet prior to installation.

C. Examine fixtures for damage or broken parts and replace prior to installation.

3.02 Installation

A. See architectural reflected ceiling plan for exact location of fixtures and ceiling types.

B. Coordinate installation of fixtures with other subcontractors, and verify methods of hanging and supporting required.

C. All fixtures to be illuminated at time of acceptance.

D. Fixtures located in mechanical and store rooms to be coordinated with ductwork, piping and structural members. Adjust stems as required for proper illumination of the area.

E. All recessed fixtures to be flex connected to branch circuit outlet box unless fixture is provided with code approved junction box. Connection to conform to Article 410-67 of NEC.

F. Fixtures recessed into fire rated ceilings shall be provided with an approved fire-rated enclosure or have an enclosure built around them that will not violate the fire rating of the ceiling.

G. All light outlets shall be supplied with a fixture. Outlet symbols on the drawings without a type designation shall have a fixture the same as those used in similar or like locations.

H. Fixtures of a given description may be used in more than one type of ceiling. The fixture list and electrical drawings do not indicate what type of ceiling a recessed fixture is intended for. Consult the Architectural Reflected Ceiling plan to obtain this information. The contractor shall confirm that the specified fixtures are compatible with the ceiling system and is responsible to provide all mounting apparatus required for proper installation.

I. Where fixtures are mounted under cabinets, in soffits, coves, or other physically restricting spaces, the contractor shall verify that the fixtures will fit the space prior to ordering.

J. Under cabinet and similar fixtures are to be hard wired. Flexible cords similar to SO cord are not acceptable.

3.03 Adjustment And Cleaning

A. Fixture supports shall provide proper alignment and leveling of fixtures.

B. Aim adjustable fixtures as directed by Architect or Engineer. Exterior fixtures should be adjusted for proper illumination of areas.

C. Clean all foreign matter from interior and exterior of fixtures and from exterior of poles, touch-up scratched or marred surfaces to match original finish.

3.04 Testing

A. Operate the complete exterior lighting system for seven (7) consecutive days. When the lighting performance is satisfactory to the Engineer, the system will be accepted.

END OF SECTION

SECTION 27 2500
TELEPHONE AND COMPUTER DATA

PART 1 - GENERAL

1.01 Description

A. Provide complete telephone system infrastructure for installation of utility and owner furnished equipment. Provide Telephone Terminal Board and all required grounding.

B. Provide service entrance conduits for underground telephone, cable TV, and/or data service from serving utility pole to telephone terminal location in building as indicated.

C. Provide complete data/telephone distribution system including CAT 5e conductors, devices with cover plates, boxes, terminal cabinets, etc., as indicated on Drawings.

1.02 Network Overview

A. The network of voice/data cabling is designed and will be constructed in a star, with the hub located in the Utility Room.

B. A horizontal CAT 5e cabling system connects the hub to the individual telephone/data jacks throughout the building.

C. All voice and data cabling, jacks, and patch panels will be CAT 5e. All cables are to terminate on contractor-furnished patch panels in the data rack. The layout of the data rack is to be verified with the owner prior to work.

1.03 Quality Assurance

A. Conform to requirements of serving utility.

B. UL Listed.

C. National Electrical Code with state and local amendments.

D. ANSI/TIA/EIA-568-A – Commercial Building Telecommunications Wiring Standard

E. EIA/TIA 569 – Commercial Building Standard for Telecommunications Pathways and Spaces.

F. EIA/TIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications.

G. IEEE 802.3y – Physical layer specifications for 100Mb/s.

1.04 Submittals

A. Submit equipment data sheets and shop drawings in accordance with 26 0500, Shop Drawings and Materials Lists, Basic Electrical Materials and Methods.

B. Submit operation and maintenance data in accordance with 26 0500, Electrical Equipment Maintenance Manuals, Basic Electrical Materials and Methods.

PART 2 - PRODUCTS

2.01 Rough-in Materials

A. Outlet Boxes: 4” square, 2-1/8” deep minimum with 1-gang device ring.

B. Conduits: 1” minimum size with larger sizes as indicated on the Drawings.

C. Pull Boxes: Sheet metal, primed and painted, screw cover.

D. Telephone terminal backboards shall be 4’x8’x3/4” plywood with a grade of “AB” or higher. Plywood shall be fire-rated or painted with fire retardant paint as requested by utility. Mount with best side out. Backboards shall be smooth finished, sanded surface without significant blemishes. If the plywood is to be painted, prime and paint with two coats of white fire retardant paint, Benjamin Moore IronClad Retardo, or approved alternate.

2.02 Conductors

A. Unshielded twisted pair cable CAT 5e, 4-pair, 24 gauge copper unshielded twisted pair, PVC coated cable listed as complying with UL Type CM, C(UL) Type CM, ANSI/TIA/EIA-568-B.2 CAT 5e. Belden Data Twist 5e+.

B. Paired, 25 pairs, 24 AWG, solid BC – bare copper conductors, S-R PVC – Semi-rigid polyvinyl chloride insulation, unshielded, PVC jacket, jacket sequentially marked at 2 foot intervals.

2.03 Jacks

A. Panduit mini-com mini jack CAT5e with universal 568A or 568B pin-out. Verify color with Architect prior to order.

2.04 Face Plates

A. Panduit mini-com executive series vertical 2-port faceplates. Verify color with Architect prior to order. A blank of the same color is required for any ports not utilized during the installation of the network.

2.05 Patch Panels

A. Panduit DP5e 48 port with universal 568A or 568B pin out for data.

2.06 Wire Managers

A. Panduit Slotted Duct Horizontal Management System, 2-sided cable manager utilizing 2-rack spaces. The front manager shall measure 3”x3” and the rear manager shall measure 2”x4”. One above and below each patch panel that is installed.

2.07 Equipment Racks

A. Provided by Owner. The ground for the rack shall be installed by contractor.

PART 3 - EXECUTION

3.01 Inspection

A. Verify location of all telephone and data outlets with architectural Drawings prior to roughing-in. Where outlets occur at built-in counters, desks, and bookshelves coordinate with other trades.

B. Examine area to receive terminals and equipment to assure adequate clearance.

3.02 General Installation

A. Verify installation requirement with serving utility. Stub conduit up nominally six inch above floor or below ceiling at terminal facilities provided by Telephone Company and lock into metal template with locknuts and insulating bushings.

B. Underground Service: Provide conduit down pole, elbow at bottom of pole and conduit from pole to terminal location inside building. Conduit to continue up exterior of building and terminate inside building at designated location. Other exterior raceways as indicated on Drawings.

C. Conduit bends to be large radius field bends or factory ells. At wall outlets at frame or metal studs telephone connector place telephone connector inside wall cavity and not in surface mounted box located over telephone outlet. Thru wall box and conduits at these locations to be properly supported.

D. Provide pull-in line in all empty raceways

E. Anchor plywood terminal board to the building structure. Use of toggle bolts to attach to the sheetrock is not an acceptable means of support.

F. Provide ¾” raceway and #6 solid copper wire to main electrical ground bus for Telco ground. The demarcation point must be within 20 feet of the main electrical ground. Verify exact requirements with Utility.

G. Provide conduit from outlet box into accessible ceiling space. Conduit to include bushings and pull-in line.

3.03 Cabling Installation

A. Strict adherence shall be made to Manufacturer's installation instructions and requirements. Where conflicts arise between the requirements of this specification and the manufacturer's installation instructions, the Architect shall be consulted for resolution.

B. All wiring systems shall be installed according to related standards as listed within TIA/EIA-569. All installed cables shall be kept free from nicks, abrasions, and cuts during storage and installation. Defective wiring will be replaced at the Contractor's expense in a manner that will not delay the progress of the project.

C. Installation shall provide minimal signal impairment by closely following manufacturer's installation guidelines, and by preserving wire twists as closely as possible to the point of termination.

D. Installation shall be neat, well organized, and of professional quality, with wire management and termination practices in accordance with manufacturer's guidelines. Cabling will be supported in the ceiling according to industry standard and manufacturer recommendations to minimize cross talk, EMI, and damage. Cabling is to be dressed and secured with Velcro Cable Ties from the point it enters the data room space to the point it enters the cable managers or is terminated.

E. All cables will be home run. Splicing of cables will not be accepted. All CAT 5e cables will be run to the data rack and terminated on the patch panel.

F. Leave 18" of coiled cable at each outlet, and 12" loosely coiled cable in the Horizontal Cable Manager in the data room in a way that does not kink the cable. Cable is to be installed in the data rack so the rack is not impaired, and can open to the fullest extent without cable interference.

G. Provide CAT 3, 25 pair cable from the TTB (demarc) to the data rack. Verify termination type with owner prior to installation. Provide a minimum of 10 feet of slack at each end of the cable (verify with owner).

3.04 Labeling

A. All cables shall be identified, by the Contractor, at both ends of the wiring run. Identification shall be made by legible, indelible marking on cable tags. Cable tags shall be affixed to the ends of each cable comprising the run. All tags are to be made for the purpose of labeling cables. The labels are to be done with a mechanical printing device such as a P-Touch or similar label maker. Hand written tags or labels are not acceptable.

B. Each cable shall be labeled at each end in the format given by the owner. The number shall be preprinted on a cable tag, with the tag secured to the cable sheath no more than 4-inches from its termination. Verify labeling scheme to be used with the Owner or Architect

3.05 Testing

A. The Contractor shall perform all of the following tests, and provide all tools and instruments used to test the installed system. Test instruments used by the Contractor shall be suitable for the intended procedure and of industry-recognized standards.

B. The Contractor shall use a Fluke or equal twisted pair cable tester for the testing of all CAT 5e copper cabling installed in this contract. Provide test data in electronic format that does not require proprietary software to view and hard copy. The test results are to be placed into a 3-ring binder utilizing plastic sleeves with the test results in numeric or alphabetic order depending on labeling scheme used.

1. All cables shall be tested bi-directional for the following parameters: Wire map/continuity, length, attenuation, NEXT (near end cross talk), ELFEXT (equal level far end cross talk), delay and delay skew, return loss, and PSELFEXT (power sum equal level far end cross talk).

2. All test results are to meet the current industry standard for length and dB loss.

END OF SECTION

SECTION 28-1000
ACCESS CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Access control system requirements.

B. Access control units and software.

C. Access control point peripherals, including readers and keypads.

1.02 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Card Reader:
   1. HID
   2. Or approved equivalent.

B. Door Position Switch/Contact:
   1. Sentrol
   2. Or approved equivalent

C. Request to Exit Device (REX):
   1. Bosch
   2. Or approved equivalent

2.02 ACCESS CONTROL SYSTEM REQUIREMENTS

A. Provide new access control system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.
   1. Access Control Units and Readers: Listed and labeled as complying with UL 294.

2.03 ACCESS CONTROL UNITS AND SOFTWARE

A. Provide access control units and software compatible with readers to be connected.

B. Unless otherwise indicated, provide software and licenses required for fully operational system.

2.04 ACCESS CONTROL POINT PERIPHERALS

A. Provide devices compatible with control units and software.

B. Provide devices suitable for operation under the service conditions at the installed location.

C. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 08-7100.

2.05 CARD READER

A. Furnish and install card readers at locations indicated on the Drawings. Mounting height to be 48-inches unless noted otherwise on the Drawings.

B. Furnish and install a single gnag size, wall mount proximity card reader or mullion mount card reader on store front applications.

C. Card Readers to be suitable for indoor or outdoor use.

D. Card Readers to be ADA compliant.

2.06 DOOR POSITION SWITCH/CONTACT

A. Furnish and install recessed door position switches designed to be compatible with and operate with the access control and intrusion system, in the locations indicated on the Drawings.

B. In situations where a recessed switch cannot be used, utilize a surface mount switch (roll-up door).

C. Coordinate switch type and installation with architectural door hardware schedule and requirements.

2.07 REQUEST TO EXIT DEVICE (REX)

A. Furnish and install a REX at each door indicated on the Drawings.

B. Coordinate with the door hardware schedule for type of device required.

C. If the REX is not built into the door hardware, install a surface mount passive infrared sensor (PIR) type device per architect's direction.

PART 3 EXECUTION

3.01 INSTALLATION

A. This specification is to be used in conjunction with the Drawings. There may be circumstances where a device listed here is not present or required on the project Drawings.

B. Install products in accordance with manufacturer's instructions.

C. Contractor to coordinate conduit installation with the electrical contractor.

END OF SECTION

SECTION 32-1123
AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Paving aggregates.

1.02 RELATED REQUIREMENTS

A. Section 32-1313 - Concrete Paving: Finish concrete surface course.

1.03 REFERENCE STANDARDS

A. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).

B. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.

C. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

1.04 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MATERIALS

A. "Select" Fill: 3/4-inch minus, clean (i.e., less than 5% passing the #200 U.S. Sieve), well-graded, crushed gravel or rock.

2.02 SOURCE QUALITY CONTROL

A. See Section 01-4000 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.

PART 3 EXECUTION

3.01 INSTALLATION

A. Under Portland Cement Concrete Paving:
   1. Compact to 95 percent of maximum dry density.

B. Place aggregate in maximum 4 inch layers and roller compact to specified density.

C. Level and contour surfaces to elevations and gradients indicated.

D. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.02 FIELD QUALITY CONTROL

A. See Section 01-4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

END OF SECTION

SECTION 32-1313
CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete walks, ramps, and stairs steps.

1.02 RELATED REQUIREMENTS

A. Section 03-1000 - Concrete Forming and Accessories.

B. Section 03-2000 - Concrete Reinforcing.

C. Section 03-3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

E. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.

F. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

G. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.

H. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).

I. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2013).

PART 2 PRODUCTS

2.01 PAVING ASSEMBLIES

A. Comply with applicable requirements of ACI 301.

B. Concrete Sidewalks and Median Barrier: 3,000 psi 28 day concrete, 4 inches thick, Portland cement, exposed aggregate finish.

2.02 FORM MATERIALS

A. Form Materials: As specified in Section 03-1000, conform to ACI 301.

B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
   1. Thickness: 1/2 inch.

2.03 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 80 (80,000 psi) yield strength; deformed billet steel bars; unfinished.

2.04 CONCRETE MATERIALS

A. Obtain cementitious materials from same source throughout.

B. Concrete Materials: As specified in Section 03-3000.

2.05 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.

D. Concrete Properties:
   1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; 3000 psi.
   2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
   3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
   4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
   5. Water-Cement Ratio: Maximum 40 percent by weight.
   6. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
   7. Maximum Slump: 4 inches.
   8. Maximum Aggregate Size: 1-1/2 inch.

2.06 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted granular base is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

A. See Section 32-1123 for construction of base course for work of this Section.

3.03 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Notify Architect minimum 24 hours prior to commencement of concreting operations.

3.04 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

A. Place reinforcement at midheight of slabs-on-grade.

3.06 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

3.07 EXTRUDED CURBS

A. The pavement shall be dry and cleansed of loose or deleterious materials prior to curb placement.

B. Extruded cement concrete curb shall be placed, shaped and compacted true to line and grade with an approved extrusion machine. The extrusion machine shall be capable of shaping and thoroughly compacting the concrete to the required cross section.

C. The cement concrete mixture shall be homogeneously mixed to conform with above when delivered to the hopper of the curb machine. Each hopper load of cement concrete shall be run through the curb laying machine, adjusted properly to form and compact the cement mix for the concrete curb.

D. Joints in the extruded cement concrete curb shall be spaced at 15-foot intervals or shall match existing transverse joints or cracks in existing pavement. Joints shall be cut vertically.

3.08 JOINTS

A. Place 3/8 inch wide expansion joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.

B. Provide scored joints.
   1. At 3 feet intervals, unless shown otherwise.

2. Between sidewalks and curbs.

3.09 FINISHING

A. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.

3.10 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

B. Maximum Variation From True Position: 1/4 inch.

3.11 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

END OF SECTION

SECTION 32-1713
PARKING BUMPERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Parking bumpers.

B. Adhesive.

C. Steel bars for installation.

1.02 REFERENCE STANDARDS

A. ODOT/APWA Oregon Standard Specifications for Construction, 2008 Edition.
   1. Epoxy - Section 02070.

1.03 SUBMITTALS

A. General: Refer to Section 01-3000 - Administrative Requirements: Submittals, Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Shop Drawings: Submit Shop Drawings for bumpers, including plan layout and installation details, for approval.

C. Product Data: Submit manufacturers' product data of precast bumpers and epoxy adhesive for approval.

1.04 QUALITY ASSURANCE

A. Precast parking bumpers shall be manufactured for the intended purpose by a company or firm specializing in the manufacture of precast concrete parking appurtenances.

PART 2 PRODUCTS

2.01 MATERIALS

A. Parking Bumpers:
   1. Provide precast concrete parking bumpers of half octagonal configuration and dimensions. Unless indicated otherwise, provide bumpers of 72"-inch length.
   2. Bumpers shall be manufactured of Class 4000 reinforced concrete - Portland Cement Concrete, to withstand constant use and rough service. Each bumper shall be reinforced with two No. 4 deformed steel reinforcing bars, minimum.
   3. Each bumper to be installed on at-grade asphalt pavement shall be manufactured with two holes to accommodate the installation rebar. Holes shall be positioned 6 inches in from each end.

B. Adhesive: Adhesive for anchoring bumpers or wheel stops to pavement shall be an epoxy adhesive manufactured for the purpose, from ODOT/APWA QPL.

C. Steel Bars for Installation: Rebar, No. 5 size, conforming to ASTM A615, Grade 60.

D. Adhesive: Epoxy type.

PART 3 EXECUTION

3.01 INSTALLATION

A. Precast concrete bumpers shall be secured in position on at-grade concrete pavements, as indicated, with an appropriate epoxy adhesive as specified in Article 2.01.B herein.

END OF SECTION

SECTION 32-1723
PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Painted pavement markings.

1.02 REFERENCE STANDARDS

A. ORS 447.233 - Oregon Transportation Commission Standards for Accessible Parking Spaces; 2018.

1.03 SUBMITTALS

A. See Section 01-3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in containers of at least 5 gallons accompanied by batch certificate.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.05 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MATERIALS

A. Line and Zone Marking Paint: MPI (APL) No. 97 Latex Traffic Marking Paint; color(s) as indicated.
   1. Parking: White, retroreflective.
   2. Handicapped Symbols: White, retroreflective.

B. Reflective Glass Beads: FS TT-B-1325, Type I (low index of refraction), Gradation A (coarse, drop-on); with silicone or other suitable waterproofing coating to ensure free flow.

C. Accessibility Signage: Conform to Oregon Transportation Commission Standards for Accessible Parking Spaces, 2018.
   1. ADA Parking R7-8.
      a. White, retroreflective sheeting (background).
      b. Green, retroreflective sheeting (legend).
      c. White on Blue, retroreflective sheeting (sign symbol).

d. Size: 12" x 18", handicap reserved parking.
e. Quantity: One (1).

2. Sign Posts: 2" x 2" square, perforated sign post.
   a. 2.25" x 2.25" x 0.015", 12 gauge, galvanized steel finish.
   b. Holes at 1-inch on center, on all four sides.
3. Accessories: Mounting hardware. See Drawings.
4. Location: As shown on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that pavement is dry and ready for installation.

3.02 PREPARATION

A. Clean surfaces prior to installation.
   1. Remove dust, dirt, and other debris.

3.03 INSTALLATION

A. General:
   1. Position pavement markings as indicated on drawings.

B. Painted Pavement Markings:
   1. Apply in accordance with manufacturer's instructions.
   2. Marking Paint: Apply uniformly, with sharp edges.
      a. Applications: One coat.
      b. Wet Film Thickness: 0.015 inch, minimum.
      c. Stencils: Lay flat against pavement, align with striping, remove after application.
      d. Glass Beads: Apply directly to paint, 10 second lag time, 6 lbs/gal of paint, uniform thickness and coverage.
      e. Width Tolerance: Plus or minus 1/8 inch.

3.04 PROTECTION

A. Prevent approaching traffic from crossing newly applied pavement markings.

END OF SECTION